Submission Data File

General Information	
Form Type*	20-F
Contact Name	EDGAR Advantage Service Team
Contact Phone	800-688-1933
Filer Accelerated Status*	Large Accelerated Filer
Filer File Number	
Filer CIK*	0001161611 (ALUMINUM CORP OF CHINA LTD)
Filer CCC*	**********
Filer is Shell Company*	N
Filer is Voluntary Filer*	N
Filer is Well Known Seasoned Issuer*	Y
Confirming Copy	No
Notify via Website only	No
Return Copy	No
SROS*	NYSE
Period*	12-31-2021
Emerging Growth Company	No
Elected not to use extended transition period	No
(End General Information)	

Document Information	
File Count*	54
Document Name 1*	ach-20211231x20f.htm
Document Type 1*	20-F
Document Description 1	Form 20-F
Document Name 2*	ach-20211231xex8d1.htm
Document Type 2*	EX-8.1
Document Description 2	Exhibit 8.1
Document Name 3*	ach-20211231xex12d1.htm
Document Type 3*	EX-12.1
Document Description 3	Exhibit 12.1
Document Name 4*	ach-20211231xex12d2.htm
Document Type 4*	EX-12.2
Document Description 4	Exhibit 12.2
Document Name 5*	ach-20211231xex13d1.htm
Document Type 5*	EX-13.1
Document Description 5	Exhibit 13.1
Document Name 6*	ach-20211231xex13d2.htm
Document Type 6*	EX-13.2
Document Description 6	Exhibit 13.2
Document Name 7*	ach-20211231xex96d1.htm
Document Type 7*	EX-96.1
Document Description 7	Exhibit 96.1
Document Name 8*	ach-20211231_cal.xml
Document Type 8*	EX-101.CAL
Document Description 8	XBRL TAXONOMY EXTENSION CALCULATION LINKBASE
Document Name 9*	ach-20211231_def.xml
Document Type 9*	EX-101.DEF
Document Description 9	XBRL TAXONOMY EXTENSION DEFINITION LINKBASE
Document Name 10*	ach-20211231_lab.xml
Document Type 10*	EX-101.LAB
Document Description 10	XBRL TAXONOMY EXTENSION LABEL LINKBASE
Document Name 11*	ach-20211231_pre.xml
Document Type 11*	EX-101.PRE
Document Description 11	XBRL TAXONOMY EXTENSION PRESENTATION LINKBASE
Document Name 12*	ach-20211231.xsd
Document Type 12*	EX-101.SCH
Document Description 12	XBRL TAXONOMY EXTENSION SCHEMA
(End Document Information)	

Notifications	
Notify via Website only	No
E-mail 1	hkcust@toppanmerrill.com
(End Notifications)	

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As filed with Securities and Exchange Commission on April 22, 2022

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 20-F

☐ **REGISTRATION STATEMENT PURSUANT TO SECTION 12(b) OR (g) OF THE SECURITIES EXCHANGE ACT OF 1934**

OR

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**
For the fiscal year ended December 31, 2021

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

OR

☐ **SHELL COMPANY REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**
Date of event requiring this shell company report _____________
For the transition period from __________ to __________

Commission file number 001-15264

中国铝业股份有限公司
(Exact name of Registrant as specified in its charter)

ALUMINUM CORPORATION OF CHINA LIMITED
(Translation of Registrant's name into English)

People's Republic of China
(Jurisdiction of incorporation or organization)

No. 62 North Xizhimen Street, Haidian District, Beijing
People's Republic of China (100082)
(Address of principal executive offices)

Zhu Runzhou
No. 62 North Xizhimen Street, Haidian District, Beijing
People's Republic of China (100082)
(86) 10 8229 8322
ir@chalco.com.cn
(Name, Telephone, Email and/or Facsimile number and Address of Company Contact Person)

Securities registered or to be registered pursuant to Section 12(b) of the Act.

Title of each class	Trading Symbol	Name of each exchange on which registered
American Depositary Shares* Class H Ordinary Shares**	ACH	New York Stock Exchange, Inc.

* Evidenced by American Depositary Receipts. Each American Depositary Share represents 25 H Shares.
** Not for trading, but only in connection with the listing of American Depositary Shares, pursuant to the requirements of the Securities and Exchange Commission.

Securities registered or to be registered pursuant to Section 12(g) of the Act.

None
(Title of Class)

Securities for which there is a reporting obligation pursuant to Section 15(d) of the Act.

None
(Title of Class)

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Indicate the number of outstanding shares of each of the issuer's classes of capital or common stock as of the close of the period covered by the annual report.

As of December 31, 2021:	
Domestic shares, par value RMB1.00 per share	13,078,706,983
H Shares, par value RMB1.00 per share	3,943,965,968

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ☑ No ☐

If this report is an annual or transition report, indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934. Yes ☐ No ☑

Note – Checking the box above will not relieve any registrant required to file reports pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 from their obligations under those Sections.

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☑ No ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☑ No ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or an emerging growth company. See definition of "large accelerated filer," "accelerated filer," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer ☑ Accelerated filer ☐ Non-accelerated filer ☐ Emerging growth company ☐

If an emerging growth company that prepares its financial statements in accordance with U.S. GAAP, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards† provided pursuant to Section 13(a) of the Exchange Act. ☐

†The term "new or revised financial accounting standard" refers to any update issued by the Financial Accounting Standards Board to its Accounting Standards Codification after April 5, 2012.

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report. Yes ☑ No ☐

Indicate by check mark which basis of accounting the registrant has used to prepare the financial statements included in this filing:

U.S. GAAP ☐
International Financial Reporting Standards as issued by the International Accounting Standards Board ☑
Other ☐

If "Other" has been checked in response to the previous question, indicate by check mark which financial statement item the registrant has elected to follow.

Item 17 ☐ Item 18 ☐

If this is an annual report, indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act).

Yes ☐ No ☑

(APPLICABLE ONLY TO ISSUERS INVOLVED IN BANKRUPTCY PROCEEDINGS DURING THE PAST FIVE YEARS)

Indicate by check mark whether the registrant has filed all documents and reports required to be filed by Sections 12, 13 or 15(d) of the Securities Exchange Act of 1934 subsequent to the distribution of securities under a plan confirmed by a court.

Yes ☐ No ☐

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Forward-Looking Statements

Certain information contained in this annual report, which does not relate to historical information, may be deemed to constitute forward-looking statements. The words or phrases "will likely result," "are expected to," "will continue," "is anticipated," "estimate," "project," "believe" or similar expressions are intended to identify "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. Such statements are subject to certain risks and uncertainties that could cause actual results to differ materially from historical results and those presently anticipated or projected. You should not place undue reliance on any such forward-looking statements, which speak only as of the date made. These forward-looking statements include, without limitation, statements relating to:

- future general economic conditions;
- future conditions in the international and China capital markets;
- future conditions in the financial and credit markets;
- future prices and demand for our products;
- future PRC tariff levels for alumina and primary aluminum;
- sales of our products;
- the extent and nature of, and potential for, future developments;
- production, consumption and demand forecasts of bauxite, coal, alumina and primary aluminum;
- expansion, consolidation or other trends in the primary aluminum industry;
- estimates of proven and probable reserves and measured, indicated and inferred resources with respect to our bauxite and coal mines;
- the effectiveness of our cost-saving measures;
- future expansion, investment and acquisition plans and capital expenditures;
- the severity, duration and spread of the COVID-19 pandemic, as well as the direct and indirect impacts of COVID-19 pandemic (as well as the efforts to contain it) on our operations and financial performance, the industry we are in, our suppliers and customers, the PRC economy and global economy;
- competition;
- changes in legislation, regulations and policies;
- the impact of the Holding Foreign Companies Accountable Act and any rules or regulations adopted by U.S. regulators to implement such legislation, including but not limited to the Interim Final Rule and the Final Rule with respect to the Holding Foreign Companies Accountable Act adopted by the SEC;
- the impact of the ongoing Russia-Ukraine conflict and the economic sanctions imposed on Russia, and their impact on the global economy;
- our research and development plans; and
- our dividend policy.

These statements are based on assumptions and analyses made by us in light of our experience and our perception of historical trends, current conditions and future developments, as well as other factors we believe are appropriate in particular circumstances. However, whether actual results and developments will meet our expectations and predictions depends on a number of risks and uncertainties, which could cause actual results to differ materially from our expectations. These risks are more fully described in the section headed "Item 3. Key Information - D. Risk Factors."

Consequently, all of the forward-looking statements made in this annual report are qualified by these cautionary statements. We cannot assure you that the actual results or developments anticipated by us will be realized or, even if substantially realized, that they will have the expected effect on us or our business or operations.

Certain Terms and Conventions

"**Chalco**," "**the Company**," "**the Group**," "**our Company**," "**our Group**," "**we**," "**our**" and "**us**" refer to Aluminum Corporation of China Limited and its subsidiaries and, where appropriate, to its predecessors;

"**A Share(s)**" and "**domestic share(s)**" refer to our domestic ordinary share(s), with a par value of RMB1.00 each, which are listed on the Shanghai Stock Exchange;

"**ADR(s)**" refers to the American Depositary Receipt(s);

"**ADS(s)**" refers to the American Depositary Share(s);

"**alumina-to-silica ratio**" refers to the ratio of alumina to silica in bauxite by weight;

"**aluminum fabrication**" refers to the process of converting primary aluminum or recycled aluminum materials into plates, strips, bars, tubes and other fabricated products;

"**Baotou Aluminum**" refers to Baotou Aluminum Co., Ltd., our wholly-owned subsidiary established under the PRC law;

"**bauxite**" refers to a mineral ore that is principally composed of aluminum;

"**Bayer process**" refers to a refining process that employs a strong solution of caustic soda at an elevated temperature to extract alumina from ground bauxite;

"**Bayer-sintering combined process**" and "**Bayer-sintering series process**" refer to the two methods of refining process developed in China which involve the combined application of the Bayer process and the sintering process to extract alumina from bauxite;

"**Board**" refers to our board of directors;

"**Boffa Project**" refers to the project to develop and operate a bauxite mine located in Boffa, Guinea, in accordance with a mining convention entered into by Chalco Hong Kong, Chalco Guinea Company S.A. and the Guinean government on June 8, 2018;

"**CBEX**" refers to China Beijing Equity Exchange, an approved equity exchange for the transfer of state-owned assets;

"**Chinalco Assets**" refers to Chinalco Assets Operation and Management Co., Ltd., a wholly-owned subsidiary of Chinalco;

"**Chalco Energy**" refers to Chalco Energy Co., Ltd., our wholly-owned subsidiary established under the PRC law;

"**Chalco Hong Kong**" refers to Chalco Hong Kong Ltd., our wholly-owned subsidiary established under Hong Kong Law;

"**Chalco Logistics**" refers to Chalco Aluminum Logistics Corporation Group Co., Ltd., our wholly-owned subsidiary established under the PRC law;

"**Chalco Materials**" refers to Chalco Materials Co., Ltd., our wholly-owned subsidiary established under the PRC law;

"**Chalco Mining**" refers to Chalco Mining Co., Ltd., our wholly-owned subsidiary established under the PRC law;

"**Chalco Ruimin**" refers to Chalco Ruimin Company Limited, our subsidiary until June 2013 when we disposed of 93.30% of its equity interest to Chinalco;

"**Chalco Shandong**" refers to Chalco Shandong Co., Ltd., our wholly-owned subsidiary established under the PRC law;

"**Chalco Shanghai**" refers to Chalco Shanghai Company Limited, our wholly-owned subsidiary established under the PRC law;

"**Chalco Southwest Aluminum**" refers to Chalco Southwest Aluminum Company Limited, our subsidiary until June 2013 when we disposed of 60% of its equity interest to Chinalco;

"**Chalco Southwest Aluminum Cold Rolling**" refers to Chalco Southwest Aluminum Cold Rolling Company Limited, our wholly-owned subsidiary until June 2013 when we disposed of its entire equity interest to Chinalco;

"**Chalco Trading**" refers to China Aluminum International Trading Co., Ltd., our wholly-owned subsidiary established under the PRC law;

"**Chalco Trading Group**" refers to China Aluminum International Trading Group Co., Ltd., our wholly-owned subsidiary established under the PRC law;

"**Chalco Xing County Alumina Project**" refers to the Bayer process production system and ancillary facilities at Xing County, Lvliang City of Shanxi Province with production capacity of 800,000 tonnes of metallurgical grade alumina per year;

"**China**" and the "**PRC"** refer to the People's Republic of China, excluding, for purposes of this annual report only, Hong Kong Special Administrative Region, Macao Special Administrative Region and Taiwan;

"**China Copper**" refers to China Copper Co., Ltd., a wholly-owned subsidiary of Chinalco;

"**China United Assets Appraisal**" refers to China United Assets Appraisal Group Co., Ltd., a PRC qualified valuer;

"**Chinalco**" refers to our controlling shareholder, Aluminum Corporation of China and its subsidiaries (other than Chalco and its subsidiaries) and, where appropriate, to its predecessors;

"**Chinalco Finance**" refers to Chinalco Finance Co., Ltd.;

"**CSRC**" refers to China Securities Regulatory Commission;

"**cut-off grade**" refers to the grade (i.e., the concentration of metal or mineral in rock) that determines the destination of the material during mining. For purposes of establishing "prospects of economic extraction," the cut-off grade is the grade that distinguishes material deemed to have no economic value (it will not be mined in underground mining or if mined in surface mining, its destination will be the waste dump) from material deemed to have economic value (its ultimate destination during mining will be a processing facility). "**Exchange Act**" refers to the U.S. Securities Exchange Act of 1934, as amended;

"**Euro**" refers to the lawful currency of the Eurozone;

"**Fushun Aluminum**" refers to Fushun Aluminum Company Limited, our wholly-owned subsidiary established under the PRC law;

"**Gansu Hualu**" refers to Gansu Hualu Aluminum Company Limited, 51% of the equity interest of which is owned by us;

"**Gansu Huayang**" refers to Gansu Huayang Mining Development Company Limited, 70% of the equity interest of which is owned by us;

"**GNF**" refers to Guinea franc, the lawful currency of the Republic of Guinea;

"**Guangxi Investment**" refers to Guangxi Investment (Group) Co., Ltd., formerly known as Guangxi Development and Investment Co., Ltd., a PRC state-owned enterprise;

"**Guizhou Development**" refers to Guizhou Provincial Materials Development and Investment Corporation, a PRC state-owned enterprise and one of our promoters and shareholders;

"**Guizhou Huajin**" refers to Guizhou Huajin Aluminum Co., Ltd., 60% of the equity interest of which is owned by us;

"**Guizhou Huaren**" refers to Guizhou Huaren New Material Co., Ltd., 40% of the equity interest of which is owned by us;

"**Guangxi Huasheng**" refers to Guangxi Huasheng New Material Co., Ltd., 51% of the equity interest of which is owned by us;

"**H Share(s)**" refers to overseas listed foreign share(s) with a par value of RMB1.00 each, which are listed on the Hong Kong Stock Exchange;

"**Henan Aluminum**" refers to Chalco Henan Aluminum Company Limited, our subsidiary until June 2013 when we disposed of 90.03% of its equity interest to Chinalco;

"**HK$**" and "**HK dollars**" refer to Hong Kong dollars, the lawful currency of the Hong Kong Special Administrative Region of the PRC;

"**Hong Kong Stock Exchange**" refers to The Stock Exchange of Hong Kong Limited;

"**Huaxi Aluminum**" refers to Huaxi Aluminum Company Limited, our subsidiary until June 2013 when we disposed of 56.86% of its equity interest to Chinalco;

"**Inner Mongolia Huayun**" refers to Inner Mongolia Huayun New Materials Co., Ltd., 50% of the equity interest of which is owned by Baotou Aluminum;

"**IRS**" refers to Internal Revenue Service of the United States federal government;

"**Japanese Yen**" refers to the lawful currency of Japan;

"**Jiaozuo Wanfang**" refers to Jiaozuo Wanfang Aluminum Manufacturing Co., Ltd.;

"**Ka**" refers to kiloamperes, a unit for measuring the strength of an electric current, with one kiloampere equaling 1,000 amperes;

"**kWh**" refers to kilowatt-hours, a unit of electrical power, meaning one kilowatt of power for one hour;

"**Lanzhou Aluminum**" refers to Lanzhou Aluminum Co., Ltd., our wholly-owned subsidiary since January 2019, which was previously our wholly-owned branch, Lanzhou branch;

"**Listing Rules**" and "**Hong Kong Listing Rules**" refer to the Rules Governing the Listing of Securities on the Hong Kong Stock Exchange, as amended;

"**LME**" refers to the London Metal Exchange Limited;

"**Logistics Zhongzhou**" refers to China Aluminum Logistics Group Zhongzhou Co., Ltd., our indirect subsidiary;

"**MIIT**" refers to Ministry of Industry and Information Technology of the PRC;

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"**MOF**" refers to Ministry of Finance of the PRC;

"**MW**" refers to megawatt, a unit of electrical power;

"**Nanchu**" refers to ENanchu (http://www.enanchu.com/), a nonferrous metal-related portal site in PRC;

"**NDRC**" refers to China National Development and Reform Commission;

"**Ningxia Energy**" refers to China Aluminum Ningxia Energy Group Co., Ltd., formerly known as Ningxia Electric Power Group Co., Ltd., before we acquired 70.82% of its equity interest in January 2013;

"**Northwest Aluminum**" refers to Northwest Aluminum Fabrication Branch, our wholly-owned branch until June 2013 when we disposed of all its assets to a subsidiary of Chinalco;

"**NYSE**" and **"New York Stock Exchange**" refer to the New York Stock Exchange Inc.;

"**ore-dressing Bayer process**" refers to a refining process we developed to increase the alumina-to-silica ratio of bauxite;

"**PBOC**" refers to People's Bank of China;

"**Qingdao Light Metal**" refers to Chalco Qingdao Light Metal Company Limited, our wholly-owned subsidiary until June 2013 when we disposed of its entire equity interest to Chinalco. In December 2017, we acquired 100% of the equity interest in Qingdao Light Metal through Chalco Shandong at a consideration of RMB300.4 million to further our prospective strategic layout on secondary aluminum;

"**qualified person**" refers to an individual who is a mineral industry professional with at least five years of relevant experience in the type of mineralization and type of deposit under consideration and in the specific type of activity that person is undertaking on behalf of the registrant; and an eligible member or licensee in good standing of a recognized professional organization at the time the technical report is prepared. "**refining**" refers to the chemical process used to produce alumina from bauxite;

"**RMB**" and "**Renminbi"** refer to the lawful currency of the PRC;

"**SAT**" refers to State Administration of Taxation of the PRC;

"**SAFE**" refers to State Administration of Foreign Exchange of the PRC;

"**SASAC**" refers to State-owned Assets Supervision and Administration Commission of the State Council of China;

"**SEC**" refers to the U.S. Securities and Exchange Commission;

"**Securities Act**" refers to the U.S. Securities Act of 1933, as amended;

"**Shandong Huayu**" refers to Shandong Huayu Alloy Material Co., Ltd., 55% of the equity interest of which is owned by us;

"**Shanxi Huasheng**" refers to Shanxi Huasheng Aluminum Company Limited, 51% of the equity interest of which is owned by us;

"**Shanxi Huaxing**" refers to Shanxi Huaxing Aluminum Co., Ltd., a wholly-owned subsidiary established under the PRC law.

"**Shanxi Huayu**" refers to Shanxi Huayu Energy Investment Co., Ltd., a wholly-owned subsidiary established under the PRC law.

"**Shanxi New Material**" or "**Shanxi Huaze**" refers to Chalco Shanxi New Material Co., Ltd., formerly known as Shanxi Huaze Aluminum and Power Co., Limited, 85.98% of the equity interest of which is owned by us;

"**Shanxi Other Mines**" refers to the nine mines to which we entrusted another party to conduct mining activities, including Changjialing mine, Guxian mine, Loufan mine, Nanpo mine, Xishan mine, Yangjiashan mine, Niucaogou mine, Xiwupu mine and Jiaokou Xisongzhuang mine in Shanxi Province;

"**Shanxi Zhongrun**" refers to Shanxi China Huarun Co., Ltd., 40% of the equity interest of which is owned by us;

"**SHFE**" refers to the Shanghai Futures Exchange;

"**sintering process**" refers to a refining process employed to extract alumina from bauxite by mixing ground bauxite with supplemental materials and burning the mixture in a coal-fired kiln;

"**smelting**" refers to the electrolytic process used to produce molten aluminum from alumina;

"**tonne**" refers to the metric ton, a unit of weight, that is equivalent to 1,000 kilograms or 2,204.6 pounds;

"**US$**," "**dollars**" and "**U.S. dollars**" refer to the lawful currency of the United States;

"**Xinghua Technology**" refers to Chinalco Shanxi Jiaokou Xinghua Technology Ltd., 66% of the equity interest of which is owned by us;

"**Yangtze**" refers to the Shanghai Changjiang Nonferrous Metals Spot Market;

"**Yixin Aluminum**" refers to Heqing Yixin Aluminum Co., Ltd., an indirect subsidiary of Chinalco;

"**Yunnan Aluminum**" refers to Yunnan Aluminum Co., Ltd., an indirect subsidiary of Chinalco;

"**Yunnan SASAC**" refers to the State-owned Assets Supervision and Administration Commission of Yunnan Provincial People's Government;

"**Zhangze Electric Power**" refers to Shanxi Zhangze Electric Power Co., Ltd., which owns 14.02% of equity interest in Shanxi New Material;

"**Zhengzhou Institute**" refers to Chalco Zhengzhou Research Institute of Non-ferrous Metal Co., Ltd., our wholly-owned subsidiary, which primarily provides research and development services;

"**Zhongzhou Aluminum**" refers to Chalco Zhongzhou Aluminum Co., Ltd., our wholly-owned subsidiary established under the PRC law;

"**Zhongzhou Aluminum Plant**" refers to Henan Zhongzhou Aluminum Plant Co., Ltd., a wholly-owned subsidiary of Chinalco;

"**Zhongzhou Logistics**" refers to Henan Zhongzhou Logistics Co., Ltd., which had been a wholly-owned subsidiary of Chinalco and was dissolved in September 2020;

"**Zunyi Alumina**" refers to Chalco Zunyi Alumina Co., Ltd., which was merged into Zunyi Aluminum in June 2018; and

"**Zunyi Aluminum**" refers to Zunyi Aluminum Co., Ltd., 67.45% of the equity interest of which is owned by us.

Translations of amounts in this annual report from Renminbi to U.S. dollars and vice versa have been made at the rate of RMB6.3726 to US$1.00, the exchange rate as set forth in the H.10 statistical release of the Federal Reserve Board for December 30, 2021. We make no representation that any Renminbi or U.S. dollar amounts could have been, or could be, converted into U.S. dollars or Renminbi, as the case may be, at any particular rate, the rates stated below, or at all.

Any discrepancies in any table between the amounts identified as total amounts and the sum of the amounts listed therein are due to rounding.

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PART I

Item 1. Identity of Directors, Senior Management and Advisors

Not applicable.

Item 2. Offer Statistics and Expected Timetable

Not applicable.

Item 3. Key Information

A. Selected Financial Data

Reserved.

B. Capitalization and Indebtedness

Not applicable.

C. Reasons for the Offer and Use of Proceeds

Not applicable.

D. Risk Factors

Our business and financial condition and results of operations are subject to various changing business, competitive, economic, political and social conditions in China and worldwide. In addition to the factors discussed elsewhere in this annual report, the following are some of the important factors that could cause our actual results to differ materially from those projected in any forward-looking statements.

Our business is vulnerable to downturns in the general economy and industries in which we operate or which we serve. A significant reduction in demand could materially and adversely affect our business, financial condition and results of operations.

Demand for our products depends on the general economy and level of activity and growth in the industries where we operate or serve. Adverse development in economic and market conditions, such as a significant economic downturn or a downturn in the commodity sector or the financial markets, could have a material adverse effect on our business, financial condition, results of operations and the price of our ordinary shares or ADSs. Development of the relevant industries is subject to various factors, including but not limited to market fluctuations of prices of commodities, general political or economic conditions, technology development, government regulations and investment plans and changes in domestic and global production capacity, many of which are beyond our control.

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We are unable to predict cycles of the global and domestic economies. Concerns over inflation, energy costs, geopolitical issues, trade tensions, the availability and cost of credit, unemployment, consumer confidence, declining asset values, capital market volatility and liquidity issues have created difficult operating conditions for us in the past and may continue to do so in the future. For example, since 2018, there were continuing trade tensions between the U.S. and China, resulting in increased tariffs and escalating tensions between the two countries. On January 15, 2020, the two parties signed the China-U.S. phase-one economic and trade agreement. Since then, the PRC government and the U.S. government have granted tariff exemptions on certain goods. However, it is still unclear when future phase negotiations between the two countries will begin and whether there will be further trade agreements following such negotiations. It is also unclear if future disputes will occur or the two countries will be able to negotiate the issues to restore a mutually beneficial economic and trade cooperation. Future actions or escalations by either the U.S. government or the PRC government could have a material adverse effect on the business environment in general, global, Chinese and/or U.S. economic conditions and the stability of global, Chinese and/or U.S. financial markets, which in turn, may adversely affect our business, financial condition and results of operations. In addition, on November 12, 2020, the President of the United States signed Executive Order 13959 (as subsequently amended on January 13, 2021 and June 3, 2021, the "Executive Order"), which prohibits certain transactions in securities of certain entities listed in the annex to the Executive Order (each, a "Restricted Entity"). Currently, neither we nor Chinalco are on the list of Restricted Entities. However, if the Executive Order is further amended, or the Office of Foreign Assets Control of the U.S. Department of Treasury exercised its power pursuant to the Executive Order, to include us or Chinalco as a Restricted Entity in the future, U.S. persons as defined under the Executive Order may be prohibited from purchasing our securities. As a result, the value and liquidity of our ADSs may be materially and adversely affected, which may lead to significant volatility in our ADS trading price. Furthermore, the PRC government has, from time to time, adjusted its monetary, fiscal and other policies and measures to manage the rate of growth of the economy or the overheating and overcapacity in certain industries or markets. In addition, the global outbreak of COVID-19 and the efforts to contain it have negatively impacted the global economy and financial markets. For further details of the impact of outbreak of COVID-19 on the general economy, please refer to "–Our business may be materially and adversely affected by the COVID-19 pandemic."

The global economy began to recover from the COVID-19-induced recession in 2021 and the commodities market had an unparalleled growth. Due to the recovery of demand for aluminum globally, in 2021, the average spot price of alumina on the Australian FOB increased by 21.8% to US$331 per tonne and the average international cash price for primary aluminum on the LME increased by 45.5% to US$2,480 per tonne. During the same period, the average spot price of alumina in the domestic market increased to RMB2,798 per tonne, representing an increase of 19.7% compared to 2020. Although the overall trend of the industries we are in was upward in 2021, there is no assurance that there will not be any further and significant fluctuations, which may materially and adversely affect our business, financial condition and results of operations. Recently, the Russia-Ukraine military conflict has caused, and continues to intensify, significant geopolitical tensions in Europe and across the world. The resulting economic sanctions imposed by the United States, the European Union, the UK and other countries may continue to significantly impact supply chains, lead to market disruptions including significant volatility in commodities' prices, and bring heightened near-term uncertainty to the global financial system. Escalation of the Russia-Ukraine conflict could lead to other additional impacts which may adversely affect our business, such as disruption of international trade flows, extreme market pricing volatility, with particular impact on the energy sector, industrial supply chains, shipping, and regulatory and contractual uncertainty, and increased geopolitical tensions around the world. These factors could disrupt the global markets in ways that are difficult to predict and estimate in advance as to their potential impact on our business, financial position, or operational results.

As a result of the foregoing, the global and domestic economic conditions or any particular industry in which we operate or which we serve may grow at a lower-than-expected rate or even experience a downturn. Uncertainty about future economic conditions makes it challenging for us to forecast our results of operations, make business decisions and identify risks that may affect our business. If we are not able to timely and appropriately adapt to changes resulting from the difficult macroeconomic environment, our business, financial condition and results of operations may be materially and adversely affected.

Volatility in the prices of alumina, primary aluminum, other non-ferrous metal and other commodities may adversely affect our business, financial condition and results of operations.

The prices of the products we produce and trade, including alumina, primary aluminum, other non-ferrous metal and coal products, have experienced significant fluctuation historically and are expected to continually fluctuate in response to general economic conditions, supply and demand, the level of inventories, interruption caused by unforeseen international or domestic events such as global outbreak of COVID-19, uncertainty of or changes in domestic or foreign laws or policies and many other factors, which are beyond our control.

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We price our alumina and primary aluminum products by reference to international and domestic market prices, and domestic supply and demand, each of which may fluctuate beyond our control. We may not be able to effectively respond to a sudden fluctuation in alumina or primary aluminum prices. For example, due to the recovery of demand for aluminum globally, in 2021, the average spot price of alumina on the Australian FOB increased by 21.8% to US$331 per tonne and the average international cash price for primary aluminum on the LME increased by 45.5% to US$2,480 per tonne. During the same period, the average spot price of alumina in the domestic market increased to RMB2,798 per tonne, representing an increase of 19.7% compared to 2020, and the average spot prices of primary aluminum at SHFE increased by 34.2% to RMB18,953 per tonne. In 2021, the average external selling prices for our self-produced alumina and primary aluminum, regardless whether the sales were recognized in our trading segment, were RMB2,785 per tonne and RMB19,099 per tonne, respectively, representing an increase by 13.4% and 34.8%, respectively, as compared to the prices in 2020. Nevertheless, the prices of alumina and primary aluminum may decline due to, among other things, decrease in market demand of those products and any slowdown of economic growth in China. Because our prices are affected by a variety of factors, most of which are beyond our control, we may not be able to respond promptly to the fluctuation in alumina or primary aluminum prices in international market or domestic market. There is no assurance that there will not be any further and significant fluctuations in prices of our key products, including alumina and primary aluminum, which may materially and adversely affect our business, financial condition and results of operations. In addition, since our profit margin for trading non-ferrous metal products and coal products is based on price fluctuations in the short term, we need to make the correct prediction of the price fluctuations of these commodities on the markets to maintain our profit margin. If market price fluctuations on the market do not match our prediction, we may incur substantial losses.

In addition, as we generate profit from the differences between the purchase and sales prices of the non-ferrous metal products and the coal products we deal in, significant fluctuations in these prices may cause the value of the outsourced products in transit or in inventory to decline, and if the carrying value of our existing inventories exceeds the market price in the future periods, we may need to make additional provisions for our inventories' value, which may have a material and adverse effect on our profit level and other financial performance. See Note 13 to our audited consolidated financial statements for information about our inventories. As a result, any significant fluctuation in market prices for these commodities could materially and adversely affect our business, financial condition and results of operations.

Our business requires substantial capital expenditures that we may not always be able to obtain at reasonable costs and on acceptable terms.

Our plans to upgrade and expand our production capacity will require substantial capital expenditures. For the years ended December 31, 2019, 2020 and 2021, our total capital expenditures were approximately RMB11.8 billion, RMB4.6 billion and RMB4.7 billion, respectively. We expect our estimated capital expenditures in 2022 to be a total of approximately RMB6.8 billion. See "Item 4. Information on the Company – D. Property, Plants and Equipment – Our Expansion" and "Item 5. Operating and Financial Review and Prospects – B. Liquidity and Capital Resources – Capital Expenditures and Capital Commitments" for details of our expansion and capital expenditures. We may also need additional funding for debt servicing, working capital, other investments, potential acquisitions and joint ventures and other corporate requirements.

We may need to seek external financing, such as bank and other loans as well as bond offerings, to satisfy our capital needs if cash generated from our operations is insufficient to fund our capital expenditures or if our actual capital expenditures and investments exceed our plans. Our ability to obtain external financing at reasonable costs and on acceptable terms is subject to a variety of factors, such as our credit ratings, financial market conditions and our past or projected financial performance. Although we have been profitable in recent years, we cannot guarantee that we will not incur losses in the future, in which case the rating agencies may downgrade our credit ratings. In addition, if financial markets experience significant volatility and disruption, it may result in a decrease in the availability of liquidity and credit for borrowers and increase in interest rate or other financing cost. Failure to obtain sufficient funding at reasonable costs and on acceptable terms for our development plans could delay, reduce the scope of, or eliminate future activities or growth initiatives and adversely affect our business and prospects.

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Our business may be materially and adversely affected by the COVID-19 pandemic.

Since the end of 2019, COVID-19, a disease caused by a novel strain of coronavirus, has spread in China and globally, and the World Health Organization declared the COVID-19 outbreak a pandemic in March 2020. The COVID-19 pandemic has led the governments and other authorities around the world, including China, to impose measures intended to control its spread, including quarantines, restrictions on travel and public gatherings, temporary closure of certain businesses and facilities. While still continuing, the COVID-19 pandemic, as well as efforts to contain it, has caused significant economic and financial disruptions around the world, including disruption on manufacturing operations, logistics and global supply chains and significant volatility and disruption of financial markets. We have taken measures to control and manage the impact of COVID-19, including measures to protect health and safety of our employees, maintain ventilation system and promote vaccinations among all employees. However, if the virus, in particular the Delta and Omicron variants thereof, further spreads worldwide, including China or other jurisdictions in which we, our suppliers or customers operate or have property or projects, or further control measures are adopted and continue to stay in place in these or other regions, we may face further disruptions on our normal operation, sales, project construction, supply chain and transportation channel, labor shortage and other limitations on our business activities due to restrictions on our employees' ability to travel, infection of management and employees, suspension or closure of facilities, additional costs arising from precautionary infection control and hygienic measures, and other impacts, which could be material and adverse to our business, financial condition and results of operations. For example, China has recently experienced upticks in cases that have prompted selective restrictions in affected regions such as Shanghai.

In addition, the market prices of primary aluminum and alumina have been volatile since the COVID-19 outbreak. Although, because of the recovery of the downstream business activities in China and globally, the market prices of primary aluminum and alumina have increased in 2021, there is no assurance that the demand for primary aluminum and alumina will not be weakened by the COVID-19 pandemic any more, and any volatility or decreases of the market prices of primary aluminum and alumina may result in reduction of our revenue and profit, increase of our inventory amount and other material and adverse impacts on our financial condition and results of operations.

If the global public health crisis caused by COVID-19 pandemic continues, it may have an adverse impact on the global and China's economies, which may, among other things, exacerbate turbulence in commodity market, discourage or disrupt investment and production, increase total inventories of primary aluminum or other products in the industry, bring more uncertainty to the consumption of aluminum-made products and the prices of primary aluminum and alumina, and cause other adverse impacts on the industry we are in. An economic downturn including financial market disruption, or a market perception that this situation may occur or develop, may also cause increase of financing costs, or reduce available sources of financing for operation or expansion. In addition, significant financial market volatility and uncertainty may adversely affect the market prices of our ordinary shares and ADSs. Credit risks of customers and suppliers and other counterparty risks may also increase. These factors may materially and adversely affect our business, financial condition and results of operations. We may also experience negative effects from other future health epidemics or outbreaks beyond our control. These events are impossible to forecast and difficult to prevent. Any of these events could have a material adverse effect on our results of operations and financial condition.

Our operations consume substantial amounts of electricity, and our profitability may decline if electricity costs rise or if our electricity supplies are interrupted.

Our operations consume substantial amounts of electricity. Although we generally expect to meet the electricity consumption requirements for our alumina refineries and primary aluminum smelters from a combination of internal and external sources, our results of operations may be materially and adversely affected by any significant increase in electricity costs or interruptions in electricity supply.

Cost of electricity is the principal production cost in our primary aluminum operations. Our average electricity cost per kWh (including tax) of our primary aluminum smelters increased by 27% from 2020 to 2021. There is no assurance that the electricity costs will not further increase in the future. For instance, in 2021, the PRC government issued certain policies related to electricity pricing that could increase our electricity cost. See "Item 4. Information on the Company – B. Business Overview – Regulatory Overview – Electricity Supply and Price" for further details. If we are unable to pass on increases in energy costs to our customers, our operating margin, financial condition and results of operations could be materially and adversely affected.

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With the implementation of the policy of "carbon dioxide peaking and carbon neutrality," a series of policies have been introduced to control both the total amount and intensity of energy consumption and restrict the energy-intensive and high-emission industries, resulting in drastic market fluctuations and a sharp increase in production costs. A series of stringent measures such as electricity consumption restriction and production restriction and restriction on approval of projects have been adopted in various regions, resulting in large-scale production reduction in the industry, which led to a shortage of supply and aggravated the uncertainty of new or resumed production capacity in the second half of 2021. We cannot assure you that our production capacity will not be further affected by such policies, the occurrence of which could have a material adverse impact on our business, financial condition and results of operations.

In addition, interruptions in the supply of electricity can result in costly production shutdowns, increased costs associated with restarting production and the waste of production in progress. A sudden loss of electricity, if prolonged, can cause damage to or the destruction of production equipment and facilities. In such an event, we may need to expend significant capital and resources to repair or replace the affected production equipment to restore our production capacity. In the past, various regions across China experienced shortages and disruptions in electricity supply, especially during peak demand summer season or under severe weather conditions. For instance, certain subsidiaries of our Company were affected by electricity shortage due to electricity consumption restriction in the second and third quarters of 2021 and the suspended production volume reached a maximum of 3% of our total production capacity in October and November 2021. We cannot assure you that our operations will not suffer from shortages or disruptions in electricity supply, the occurrence of which could have a material adverse impact on our business, financial condition and results of operations.

Our operations consume substantial amounts of coal, and our operations may be adversely affected if we are not able to procure sufficient coal or if coal prices rise significantly.

We rely heavily on coal as our energy and fuel source in our operations. As we increase our alumina refining capacity, our consumption of coal will increase accordingly. If we are not able to obtain the amount of coal needed for our production due to a shortage of coal, constraints on coal transportation or any other reason, we may be forced to reduce our production output or suspend our alumina refining operations, which could materially and adversely affect our financial condition and results of operations. Although we have acquired equity interest in a number of coal mines, we expect to continue to rely substantially on third-party coal suppliers for the supply of coal. Our average purchase price per unit tonne of thermal coal increased by approximately 52.4% in 2021 from the level in 2020. See "Item 5. Operating and Financial Review and Prospects – A. Operating Results – Overview – Factors Affecting Our Results of Operations – Manufacturing Costs." There is no assurance that the coal prices will not further increase or fluctuate. If we are unable to pass on increases or otherwise significant fluctuations in coal prices to our customers or offset price increases through productivity improvements, our operating margin, financial condition and results of operations could be adversely affected.

Our business and industry may be affected by the development of alternative energy sources and climate change.

Our operations consume substantial amounts of coal, the combustion of which generates significant greenhouse gas and other pollutants, and negatively contributes to climate change. A number of governments or governmental bodies have introduced or are contemplating legislative and regulatory changes in response to the potential impacts of climate change. These regulatory mechanisms may impact our operations directly or indirectly through our customers or supply chain. For example, the deepening of supply-side structural reform and the policy of "carbon dioxide peaking and carbon neutrality" have urged the industry in which we operate to optimize the energy consumption structure, reduce energy consumption, and develop deep-processing products with high added values. We may have to increase our capital expenditures in order to comply with such revised or new legislation or regulations, and changes to our profit or loss may occur due to increased or decreased demand for our products and indirectly due to changes in costs of goods sold, which may adversely affect our results of operations and financial condition.

In addition, we have invested in coal mining operations. Although revenues attributable to our energy segment accounted for only approximately 2.8% of our total revenues in 2021 (after elimination of inter-segment sales), we might still be affected by any change on the PRC thermal power industry, which have relied on coal as main source of fuel. The PRC thermal power industry may be affected by the development of alternative energy sources, climate change and global environmental factors. In particular, pursuant to the environmental protection goal set in China's 14th Five-Year Plan, the PRC government plans to continue to encourage the development of new energy sources from 2021 to 2025. As such, alternative energy industries may rapidly develop and gradually gain mainstream acceptance in the PRC and the rest of the world. If alternative energy technologies continue to develop and prove suitable for wide commercial application in the PRC and overseas, demand for conventional energy sources, such as coal, could be reduced. Such reduction in demand for coal could have a material adverse effect on the coal mining industry and, consequently, negatively affect our business, results of operations and financial condition.

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We may not be able to continue competing successfully in the markets in which we operate.

In 2021, we supplied approximately 43.8% of our total production of alumina to our own smelters and sold substantially all of the remaining self-produced alumina and all of our self-produced primary aluminum to our domestic customers. Our alumina (with chemical alumina products included) and primary aluminum production represented approximately 23.6% and 10.1%, respectively, of total domestic production in China in 2021. We face competition from both domestic and international alumina and primary aluminum producers. Our principal competitors are major domestic refineries and smelters. These producers compete with our alumina and primary aluminum operations on the basis of product cost, quality and pricing. In addition, we face increasing competition from international alumina and primary aluminum suppliers as a result of the elimination of tariffs on imports of primary aluminum and alumina into China. See “Item 4. Information on the Company – B. Business Overview – Competition” for further details.

Increasing competition in our product markets may reduce our selling prices or sales volumes, which will have a material adverse effect on our financial condition and results of operations. If we are unable to price our products competitively, maintain or increase our current share of China’s alumina and primary aluminum markets or otherwise maintain our competitiveness, our financial condition, results of operations and profitability could be materially and adversely affected.

Our overseas expansion exposes us to political and economic risks, commercial instability and events beyond our control in the countries in which we plan to operate.

We have overseas projects from time to time. For example, in 2020, we completed the construction of the Boffa Project, a project for the construction and development of a bauxite mine located in Boffa, Guinea. Although the Boffa Project has been completed and put into production, due to uncertainties involved in the overseas projects, we cannot assure you that all of our overseas expansion or investments will be successful or that we will not suffer foreign exchange losses in connection with our overseas investment.

In addition, operations in the overseas markets may also expose us to a number of risks including expropriation and nationalization of our assets in foreign countries, civil unrest, acts of terrorism, war, or other armed conflict; shortages of construction equipment and materials; severe weather conditions; social security, public health and safety, labors and construction safety and similar issues; epidemic diseases and infectious diseases; natural disasters; inflation; currency fluctuations, devaluations and conversion restrictions; confiscatory taxation or other adverse tax policies, governmental activities that limit or disrupt markets, restrict payments or limit the movement of funds, governmental activities that may result in the deprivation of contractual rights; lack of a well-developed legal system that makes it difficult to enforce our contractual rights; uncertainties in laws and policies; and governmental activities that may result in the inability to obtain or retain licenses required for operations. For example, in September 2021, President of Guinea was captured by the country’s armed forces in a coup. While our Boffa Project has not been materially impacted as of the date of this annual report, we cannot assure you that it will not be adversely affected given the fluid situation in Guinea.

Our profitability and operations could be adversely affected if we are unable to obtain a steady supply of raw materials at competitive prices.

Historically, the price for bauxite, our most important raw material for alumina production, has been volatile. We obtain bauxite for our operations from our mines and external suppliers. See “Item 4. Information on the Company – B. Business Overview – Raw Materials – Alumina – Supply.” The extents to which we procure bauxite from each of these sources affect the security of our supply or cost of bauxite. The supply of bauxite could be affected by various factors, including geographic conditions of bauxite mines, government policies, market prices and competition, many of which are beyond our control. We rely on overseas suppliers to obtain a portion of bauxite we use for production. Indonesia used to be a major source of our imported bauxite. As a result of the ban imposed by the Indonesia Government on the exportation of unprocessed bauxite and nickel, since January 2014, we have not been able to import bauxite from Indonesia for the use of our alumina refineries in China, and our operation of bauxite mining in Indonesia has been suspended since September 2014. See “Item 4. Information on the Company – B. Business Overview – Our Mines” for more details of our bauxite mines in Indonesia. If we exhaust our stockpiles or our procurement of bauxite from external suppliers is interrupted for any reasons, and cannot find an alternative source of bauxite at competitive prices, our financial condition, results of operations and profitability could be adversely affected.

In addition, our results of operations can be affected by increases in the cost of other raw materials and other key inputs such as energy. If we cannot obtain a steady supply of key raw materials at competitive prices, our financial condition and results of operations could be materially and adversely affected.

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Any transportation interruption or any material increase in our transportation costs could have a material adverse effect on our business, financial condition and results of operations.

Our operations require the reliable transportation of raw materials and supplies to our refining and smelting sites and finished products to our customers. Our alumina and primary aluminum products are mainly transported by rail and trucks. There is no assurance that we can always enjoy sufficient transportation capacity or we will not experience transportation interruption in the future. Furthermore, natural disasters, severe weather conditions and outbreak of epidemic diseases and infectious diseases may cause interruption to the transportation system, which could in turn affect the transportation of our products. Please refer to "– Our business may be materially and adversely affected by the COVID-19 pandemic" for further details of the impact of COVID-19 pandemic on the transportation system. In addition, any changes in fuel prices or fuel supply may be unpredictable and beyond our control. There is no assurance that shortage of fuel will not occur in the future. Any surge in fuel prices or shortage of fuel supply may lead to increases in our operation and transportation costs. If we are unable to make timely deliveries due to logistical and transportation disruptions, or transfer the increased costs to our customers, our production, reputation and results of operations may be adversely affected.

Estimates of mineral reserves and mineral resources are uncertain and the volume and grade of minerals actually extracted may vary from our estimates.

Our estimates of mineral reserves and mineral resources have been prepared in accordance with the disclosure requirements of Subpart 1300 of U.S. Securities and Exchange Commission Regulation S-K ("Regulation S-K 1300"). Compliance with Regulation S-K 1300 may be subject to varying interpretations in some cases due to their lack of specificity, which could result in continuing uncertainty regarding compliance matters and substantial costs associated with compliance.

There are numerous uncertainties inherent in mineral estimates. Such estimates are, to a large extent, based on assumed prices for the commodities we produce, primarily bauxite and coal, and interpretations of geologic data obtained from drill holes and other exploration techniques, which may not necessarily be indicative of future results. Our mineral estimates are based on the latest available geological and geotechnical studies. We conduct ongoing studies of our mining properties to optimize economic values and to manage risk. Valid estimates made at a given time may significantly change when new information becomes available.

Estimates of mineral reserves, or the cost at which we anticipate the mineral reserves will be recovered, are based on assumptions, such as prices of alumina, aluminum and coal and other economic inputs. Changes to such assumptions may require revisions to reserve estimates which could affect our asset carrying values and may also negatively impact our future financial condition and results. We revise our mine plans and estimates of recoverable proven and probable mineral reserves as required in accordance with the latest available studies. Until mineral reserves are actually mined and processed, the quantity of minerals and grades must be considered as an estimate only.

Additionally, the term "mineral resources" does not indicate recoverable proven and probable mineral reserves as defined by Regulation S-K 1300. Estimates of mineral resources are subject to further exploration and evaluation of development and operating costs, grades, recoveries and other material factors, and, therefore, are subject to considerable uncertainty. Certain mineral resources may not meet the threshold for mineral reserve modifying factors, such as engineering, legal and/or economic feasibility, that would allow for the conversion to mineral reserves. Accordingly, no assurance can be given that the estimated mineral resources not included in mineral reserves will become recoverable proven and probable mineral reserves.

The estimation of mineral resources and reserves is a subjective process that is partially dependent upon the judgment of the qualified person preparing such estimates. The process relies on the quantity and quality of available data and is based on knowledge, mining experience, statistical analysis of drilling results and industry practices. If the market prices for the commodities we produce decline from assumed levels, if production costs increase or recovery rates decrease, or if applicable laws and regulations are adversely changed, we can offer no assurance that the mineral reserves can be mined or processed profitably. If we determine that certain of our estimated recoverable proven and probable mineral reserves have become uneconomic, this may ultimately lead to a reduction in our aggregate reported mineral reserves, which could have a material adverse effect on our business, financial condition and results of operations.

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Our previous adjustments of our business segments and historical results may not be indicative of our future prospects.

In 2013, we entered into a new business segment, the energy segment, through acquisition of Ningxia Energy. In the past few years, we have streamlined our existing business to focus on the productions of alumina and primary aluminum. For instance, in December 2018, we acquired 50% equity interests in Shanxi Huaxing through the Shanghai United Assets and Equity Exchange at a price of approximately RMB2,665.2 million from Baotou Transportation Investment Group Co., Ltd. Upon completion of the acquisition, Shanxi Huaxing became a wholly-owned subsidiary of the Company. The acquisition is conducted for purposes of enhancing our profitability and is in line with our strategic layout of alumina and aluminum business, as the increase of our shareholding in Shanxi Huaxing, an alumina plant, is expected to enhance the synergy with our primary aluminum production in Shanxi, where we have newly added production capacity of primary aluminum.

There is no assurance that we will enter into a new business segment or continue to streamline our existing business as we have done so in the past. Moreover, we cannot assure you that the benefit of entering into a new business segment or streamlining our existing business will be fully realized as expected or at all.

While our revenue increased by 45.0% from RMB185,990.6 million in 2020 to RMB269,748.2 million in 2021, primarily due to the year-on-year increase in the prices of alumina and electrolytic aluminum, the financial performance was driven by a wide range of factors, many of which are out of our control or may not be sustainable or indicative of future growth or performance, such as the prices of our products and raw materials. As a result, our historical results may not be indicative of our future prospects and results of operations.

Our failure to successfully manage our business expansion, including our expansion into new areas of business, would have a material adverse effect on our results of operations and prospects.

We have made investments in business expansion in line with our development strategy through organic growth, acquisitions and joint ventures. In addition, we may, from time to time and when we deem appropriate, expand into new industries which we believe have synergies with our existing operations.

Our expansion has created, and will continue to place, substantial demand on our resources. Managing our growth and integrating the acquired businesses will require us to, among other things:

- comply with the laws, regulations and policies applicable to the acquired businesses, including obtaining timely approval for the construction or expansion of production and mining facilities as required under the relevant laws of PRC and foreign jurisdictions;
- maintain adequate control on our business expansion to prevent, among other things, project delays or cost overruns;
- accumulate expertise and experience in managing the new businesses;
- gain market acceptance for new products and services and establish relationships with new customers and suppliers;
- achieve sufficient utilization of new production facilities to recover costs;
- manage relationships with employees, customers and business partners during the course of our business expansion and integration of new businesses;
- attract, train and motivate members of our management and qualified workforce to support successful business expansion;
- access debt, equity or other capital resources to fund our business expansion, which may divert financial resources otherwise available for other purposes;
- divert significant management attention and resources from our other businesses; and
- strengthen our operational, financial and management controls, particularly those of our newly acquired subsidiaries, to maintain the reliability of our reporting processes.

Any significant difficulty in meeting the foregoing or similar requirements could delay or otherwise constrain our ability to implement our expansion plans, or result in failure to achieve the expected benefits of the combination or acquisition or write-offs of acquired assets or investments, which in turn would limit our ability to increase operational efficiency, reduce marginal manufacturing costs or otherwise strengthen our market position. Failure to obtain the intended economic benefits from the business expansion could adversely affect our business, financial condition, results of operations and prospects. In addition, we may also experience mixed results from our expansion plans in the short term.

Furthermore, there is no assurance that we will be able to identify attractive acquisition targets, obtain favorable deal terms in any acquisition, secure applicable governmental approvals for any proposed investments, accurately estimate the mineral resources and reserves of these acquisition targets or obtain the necessary funding to complete such acquisitions on commercially acceptable terms or at all. Acquisitions may result in the incurrence and inheritance of debts and other liabilities, assumption of potential legal liabilities in respect of the acquired businesses, and incurrence of impairment charges related to goodwill and other intangible assets, any of which could harm our business, financial condition and results of operations. In particular, if any of the acquired businesses fail to perform as we expect, we may be required to recognize a significant impairment charge, which may materially and adversely affect our business, financial condition and results of operations. As a result, there can be no assurance that we will be able to achieve the strategic purpose of any acquisition, the desired level of operational integration or our investment return target.

Our joint ventures and strategic investments may not be successful.

We may from time to time enter into joint ventures or make strategic investments to grow our business and operations. For example, we have participated in joint ventures and strategic investments in coal mining, in line with our development strategy to diversify our product offering and partially offset our future energy costs. In addition, we have acted as joint venture partner or strategic investor in certain projects which engage in primary aluminum and aluminum alloy manufacturing to diversify our product offering, strategically position ourselves along the industrial chain and facilitate our enterprise transformation and upgrade. If our joint ventures, strategic investments or other investments experience fluctuation in performance or incur losses, our business, financial condition and results of operations may be adversely affected. For further details of certain of our joint ventures and strategic investments, please see "Item 4. Information on the Company – A. History and Development of the Company" and "Item 4. Information on the Company – D. Property, Plants and Equipment – Our Expansion."

In addition, our joint ventures and subsidiaries which operate coal mines have been facing increasing uncertainties. While the coal price rose rapidly in the first three quarters of 2021 due to short supply, it then declined to a reasonable range in November 2021 due to the policy adjustment and increase of coal supply. If coal price further decreases in the future, the business, financial condition and results of operations of these joint ventures which operate coal mines may be adversely affected.

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Failure to maintain optimal utilization of our production facilities will adversely affect our gross and operating margins.

During the past few years, we expanded the production capacity by completing our construction, upgrading or remolding of some of our alumina and primary aluminum production facilities. If we are able to maintain satisfactory facility utilization rates and increase our production output, this increase in our production capacity would enable us to reduce our unit costs through economies of scale, as fixed costs will be spread over a higher volume of output units. Conversely, underutilization of our existing and newly acquired or constructed production facilities may increase our marginal production costs and prevent us from realizing the intended economic benefits of our expansion.

Since 2013, we have implemented flexible production arrangements from time to time for certain alumina and primary aluminum production facilities in response to prevailing market conditions and government policies. Although we did not implement flexible production arrangements in 2021, we cannot assure you that we will not do so in the future. We may also increase our external purchases of alumina and primary aluminum for trading purposes to capitalize on fluctuating market prices and to enhance resource planning to achieve cost savings in our production. The increase in our external purchases will reduce our utilization of certain production facilities, but may not result in a proportionate decrease in fixed costs such as leases and depreciation of plant, property and equipment.

If we fail to maintain optimal utilization rates and spread fixed costs over a high volume of output units, our gross and operating margins may be adversely affected.

We may be required to record impairment charges in the future.

If business conditions deteriorate, long-lived assets need to be reviewed for possible impairment. Impairment loss needs to be recognized to the extent that the carrying amount exceeds the recoverable amount. In 2019, 2020 and 2021, we recorded impairment loss of property, plant and equipment of RMB259.4 million, RMB416.8 million and RMB2,328.1 million, respectively. In addition, we made net credit impairment of receivables of RMB171.0 million, RMB979.2 million and RMB1,384.9 million in 2019, 2020 and 2021. We cannot guarantee that we will not incur any impairment loss or our impairment loss will not increase in the future due to various reasons including, but not limited to, strategic decisions made in response to changes in economic and competitive conditions, the impact of the economic environment on our customer base and material adverse changes in our relationship with significant customers. If we record significant impairment charges, our results of operations may be materially and adversely affected.

Our mining operations have limited mine lives and eventual closure of these operations will entail costs and risks regarding ongoing monitoring, rehabilitation and compliance with environmental standards.

Our existing mining operations in the PRC and overseas have limited mine lives and will eventually be depleted. We need to perform certain procedures to remedy and rehabilitate the environmental and social impact that our mining operations have had on local communities and the environment. Remediation, rehabilitation, closure and removal of our facilities will incur various costs and are subject to various risks. The key costs and risks for mine closures include, among others, (i) long-term management of permanent engineered structures and acid rock drainage; (ii) closure in accordance with local or international environmental standards; (iii) orderly retrenchment of employees and third-party contractors; and (iv) orderly transfer of the site, its associated permanent structures and community development infrastructure and programs to new owners. There is no assurance that such closure of mines will be successful and without delays or additional costs, in which case we may be subject to increased costs, penalties or other legal or administrative actions, damages to reputation, or even suspension and cancellation of mining permits, the occurrence of which would cause a material adverse effect on our business, financial condition and results of operations.

Failure to discover new reserves or resources, maintain or enhance existing reserves or resources, develop new mining operations or expand our current mining operations could negatively affect our business, financial condition and results of operations.

Mining exploration is unpredictable in nature. The success of any mining exploration program depends on various factors, many of which are beyond our control. Due to the unpredictable and speculative nature of the mining industry, there is no assurance that any exploration program that we are currently undertaking or may undertake in the future will result in the discovery of valuable reserves or resources. There is no assurance that reported resources can be converted into reserves. Furthermore, actual results upon production may differ from those anticipated at the time of discovery. To access additional reserves in explored areas, we will need to successfully complete development projects, including but not limited to extending existing mines and developing new mines. There are a number of uncertainties inherent in the development and construction of any new mine or an extension of an existing mine, including but not limited to (i) the availability and timing of necessary governmental approvals; (ii) the timing and cost necessary to construct mining and processing facilities; (iii) the availability and cost of labor, utilities, auxiliary materials and other supplies and the accessibility of transportation and other infrastructure; and (iv) the availability of funds to finance construction and production activities. There is no assurance that any future exploration activities or development projects will extend the life of our existing mining operations or result in any new economic mining operations and such failure may have a material adverse effect on our business, financial condition and results of operations.

Our indebtedness could adversely affect our business, financial condition and results of operations.

We have relied, and expect to continue to rely, on both short-term and long-term borrowings to fund a significant portion of our capital requirements. As of December 31, 2021, we had approximately RMB24,506.1 million in outstanding short-term bonds and short-term bank borrowings (including the current portion of long-term bank and other borrowings) and RMB64,095.9 million in outstanding long- and medium-term bonds and long-term bank and other borrowings (excluding the current portion of these borrowings). On March 22, 2022, subject to approval at our 2021 annual general meeting that is expected to be held in 2022, our Board approved to authorize the issuance of debt financing instruments and bonds in the PRC (including various issued domestic bonds) and overseas bonds with an aggregate outstanding balance of all bonds not exceeding RMB50 billion, the term of which authorizations will commence on the date of approval at our 2021 annual general meeting and close upon the conclusion of our 2022 annual general meeting. Although we have been managing our debt and assets with the goal of maintaining our debt at an appropriate level, there is no assurance that such efforts would be successful or the level of our debt will be further decreased. Please see Note 19 and Note 44 to our audited consolidated financial statements for more detailed information about our borrowings and recent issuance of bonds and notes in 2022. This level of debt could have significant consequences on our operations, including:

- making it more difficult for us to fulfill payment and other obligations under our outstanding debt, including repayment of our debt and credit facilities should we be unable to obtain extensions for any such debt or credit facilities before they mature. Please see “Item 5 – Operating and Financial Review and Prospects – B. Liquidity and Capital Resources” for maturities of our outstanding long-term borrowings;
- reducing the availability of cash flows to fund working capital, capital expenditures, acquisitions and other general corporate purposes;
- exposing us to interest rates fluctuations on our borrowings and the risk of being unable to rollover, extend or refinance our borrowings as necessary;
- potentially increasing the cost of additional financing and making it more difficult for us to conduct equity financings in the capital markets or obtain government approvals to seek additional financing; and
- putting pressure on our ADS price due to concerns of our ability to repay our debt.

Our ability to meet our payment and other obligations under our outstanding debt depends on our ability to generate cash flows in the future or to refinance such debt. In 2021, we carried out capital preservation and appreciation businesses by using daily reserve fund for investments such as structural deposits. However, we cannot assure you that such capital preservation and appreciation businesses will be successful or profitable, or our business in general will generate sufficient cash flows from operations, to satisfy our obligations under our outstanding debt and to fund other liquidity needs. If we are not able to generate sufficient cash flows to meet such obligations, we may need to refinance or restructure our debt, reduce or delay capital investments, or seek additional equity or debt financing. The sale of additional equity securities could result in dilution to our ADS holders. A shortage of financing could in turn impose limitations on our ability to plan for, or react effectively to, changing market conditions or to expand through organic and acquisitive growth, thereby reducing our competitiveness. We cannot assure you that future financing will be available in amounts or on terms acceptable to us, if at all.

The instruments governing our senior debt contain covenants that restrict our ability to take certain corporate actions and pay dividends.

We issue perpetual securities from time to time to meet our capital expenditure and working capital requirements. Please refer to "Item 4. Information on the Company – A. History and Development of the Company – Senior Perpetual Capital Securities Offering" for further details.

In November 2019 and December 2020, we issued RMB1,500 million perpetual medium-term notes with an initial distribution rate at 4.20% (the "2019 Perpetual Medium-term Notes") and RMB1,000 million perpetual medium-term notes with an initial distribution rate at 4.45% (the "2020 Perpetual Medium-term Notes"), respectively, in China. Pursuant to the terms of the 2019 Perpetual Medium-term Notes and the 2020 Perpetual Medium-term Notes, while any coupon distribution payments are unpaid or deferred, our Company cannot declare or pay dividends to shareholders or decrease the share capital, or make material fixed asset investments. Therefore, our ability to pay dividends in respect of our ordinary shares and the ADSs may be limited under certain circumstances.

In addition, if these perpetual securities are categorized as debt due to changes of accounting standard or other reasons, or if we choose to redeem these perpetual securities, our total equity may be reduced, which may be adverse to our financial condition or the price of our ordinary shares or ADSs.

The interests of our controlling shareholder who exerts significant influence over us may conflict with ours.

As of December 31, 2021, our largest shareholder, Chinalco, directly owned 29.67% of our issued share capital and indirectly owned an additional 2.49% of our issued share capital through its controlled entities. The interests of Chinalco may conflict or even compete with our interests and those of our public shareholders. Chinalco may take actions that are in the interest of its subsidiaries, associates and other related entities to our detriment. For example, Chinalco may seek to influence our decision as to the amount of dividends we declare and distribute. Any increase in our dividend payout would reduce funds otherwise available for reinvestment in our businesses and thus may adversely affect our future prospects and financial condition.

In addition, we enter into transactions with related parties, including Chinalco and its subsidiaries and associates, which provide a range of services to us, including engineering and construction services, social services, land and property leasing as well as the supply of raw and supplemental materials. See "Item 7. Major Shareholders and Related Party Transactions – B. Related Party Transactions" for detailed information. It would be difficult to find an alternative source for some services that we receive from Chinalco. Our cost of operations may increase if Chinalco, its subsidiaries and associates are unable to continue providing such services to us.

In January 2019, Yunnan SASAC transferred its 51% equity interest in Yunnan Metallurgical Group Co., Ltd. to China Copper, a wholly-owned subsidiary of Chinalco, with no consideration. As Yunnan Aluminum, an affiliated company of Yunnan Metallurgical Group Co., Ltd., competes with us in the business segments of alumina and primary aluminum, Chinalco, as the indirect controlling shareholder of Yunnan Aluminum and our direct controlling shareholder, issued a letter of undertakings on non-competition to us, according to which Chinalco undertook to start in 2019 planning the integration of the businesses in which Yunnan Aluminum and we compete with each other, and address such business competition within five years. For further details, please see "Item 4. Information on the Company – A. History and Development of the Company." While we intend to closely monitor Chinalco's planning and implementation of such business integration and make timely public disclosure about significant progress made, due to the uncertainties involved in such business integration, however, we cannot assure you that business competition between Yunnan Aluminum and us would be addressed without undue delays or at all, or the plan of such business integration or the implementation thereof would be viewed by you or other investors as most favorable to us or our shareholders.

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We are subject to, and incur costs to comply with, environmental laws and regulations.

As we produce air emissions, discharge waste water, and handle hazardous substances at our bauxite mines, alumina refineries and primary aluminum smelters, we are subject to, and incur costs to comply with, environmental laws and regulations.

Given the magnitude, complexity and continuous amendments to these laws and regulations, compliance therewith may be onerous or may involve substantial financial and other resources to establish efficient compliance and monitoring systems. The liabilities, costs, obligations and requirements associated with these laws and regulations may therefore be substantial and may delay the commencement of, or cause interruptions to, our operations. Non-compliance with the relevant laws and regulations applicable to our operations may even result in substantial penalties or fines, suspension or revocation of our relevant licenses or permits, termination of government contracts or suspension of our operations. For example, relevant supervision authorities released a public notification of the dust, noise, relocation and other issues of Baotou Aluminum in 2020. In response to this notification, the Company and Baotou Aluminum attached great importance to the issues involved, analyzed the issues, and communicated with local governments and local residents proactively. As of the end of 2020, a majority of the issues involved have been rectified, dust and noise pollution have been effectively controlled, and the relocation of residents has been progressing smoothly under the organization of the local government. In 2021, Baotou Aluminum completed the project of “transformation from shipment by truck to shipment by rail,” established relevant facilities to reduce the dust and noise and engaged expert to analyze status of environmental governance and protection. However, as the environmental protection standards and requirements may be further enhanced, we cannot assure you that the similar events would not occur in the future, if such incidents were to occur, it could impact our operating results, financial condition and reputation, all of which could adversely affect our profitability and ability to retain existing customers and to attract new customers.

In addition, the environmental laws and regulations in the PRC and other jurisdictions in which we operate continue to evolve. As a result, we may incur significant additional costs if relevant laws and regulations change or enforcement of existing laws and regulations becomes more rigorous. For instance, in April 2020, the Law on Prevention and Control of Environmental Pollution Caused by Solid Waste was amended to impose stricter liabilities on enterprises that produce solid waste. The National Catalogue of Hazardous Wastes was also amended and the new version became effective on January 1, 2021, which detailed and reclassified some hazardous wastes. As we generate solid waste during our production process, we may incur higher costs to comply with the requirements under the amended law. Since 2017, the PRC government has carried out regulations and comprehensive campaigns to control air pollution in response to the poor air quality in autumn and winter in Beijing, Tianjin, Hebei and their surrounding areas and the Fenhe and Weihe plain, pursuant to which we may reduce output of our relevant plants from time to time. Further, our overseas expansion projects are subject to foreign environmental laws and regulations. Failure to comply with environmental laws and regulations may trigger a variety of administrative, civil and criminal enforcement measures, including the assessment of monetary penalties, the imposition of remedial requirements and the issuance of orders enjoining future operations, all of which may materially and adversely affect our business operations.

We are subject to administrative policies and orders relating to China’s energy-saving and emission reduction requirements that could adversely affect our production.

We are subject to administrative energy-saving and emission reduction policies and orders carried out by the central and provincial governments. The MIIT issued the Standard Conditions for Aluminum Industry on July 18, 2013 and updated it on February 28, 2020, which set forth various standards for existing enterprises, including but not limited to standards for environmental protection, energy consumption, and utilization of resources. We cannot assure you that the relevant government authorities will not issue more stringent standards or rules, which may require us to incur additional costs or expenses to comply with these standards or rules, and our existing production may be delayed for facility upgrading or suspended before full compliance with these standards or rules. The occurrence of any of the foregoing could have an adverse effect on our business, results of operations and financial condition.

We are subject to accidents and natural disasters that may adversely affect our performance.

We may experience accidents and natural disasters in the course of our operations, which may cause significant property damage and personal injuries. Significant accidents and natural disasters may cause interruptions to our operations or result in property or environmental damage, increase in operating expenses or loss of revenues. The occurrence of accidents, natural disasters and the resulting consequences may not be covered adequately, or at all, by the insurance policies we carry. Losses or payments incurred by us as a result of major accidents or natural disasters may have a material adverse effect on our results of operations.

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We have not obtained valid titles or land use rights to certain properties or land parcels that we occupy.

We have not obtained valid ownership certificates to certain properties that we occupy. These properties are used primarily for production plants and daily operations management. As of December 31, 2021, the book value of our properties with defective titles is RMB6,609.2 million, which represents approximately 3.4% of our total asset value. In addition, we had not obtained land use rights to certain land parcels, which we use primarily for our production plants. As of December 31, 2021, the book value of these land parcels is RMB734.4 million, representing approximately 0.4% of our total asset value. We have applied to the appropriate authorities to obtain the relevant ownership certificates. We cannot give any assurance that ownership dispute will not occur or that third parties will not assert any claims against us for compensation in respect of any use of these properties or land parcels.

Our business involves inherent risks and occupational hazards, which could damage our reputation, subject us to liability claims and cause substantial costs to us.

Our business involves inherent risks and occupational hazards. Under our mining operations, we engage or may engage in certain inherently risky and hazardous activities, including, among others, operations at height or on dangerous terrains, underground excavation and construction, use of heavy machinery, mining and handling of flammable and explosive materials, and we are therefore subject to risks associated with these activities, including, among others, geological catastrophes, toxic gas and liquid leakages, equipment failures, industrial accidents, fire, explosions and underground water leakages. Although we conduct geological assessments on mining conditions and adapt our mining plans to the mining conditions at each mine, we cannot assure you that adverse mining conditions will not endanger our workforce, increase our production costs, reduce our bauxite or coal output or temporarily suspend our operations. The occurrence of any of the foregoing events or conditions could have a material adverse impact on our business and results of operations. Additionally, we are exposed to operational risks associated with industrial or engineering activities, such as maintenance problems or equipment failures. These risks and hazards may result in personal injury and fatal casualties, damage to or destruction of properties or production facilities, and pollution and other environmental damage. Any of these consequences, to the extent they are significant, could result in business interruption, possible legal liability and damage to our business reputation and corporate image.

Our mines and operating facilities may be damaged by water, gas, fire or cave-ins due to unstable geological structures. Any significant accident, business disruption or safety incident could result in substantial uninsured costs and the diversion of our resources, which could materially and adversely affect our business operations and financial condition.

We may be subject to product liability claims.

Some of the products we sell or manufacture may expose us to product liability claims relating to property damage or personal injury. The successful assertion of product liability claims against us could result in significant damage payments and harm to our reputation, which in turn could have a material adverse effect on our business, financial condition and results of operations.

We are subject to litigation risks.

In the ordinary course of business, claims involving project owners, customers, suppliers and subcontractors may be brought against us and by us in connection with our operations. If we were found to be liable on any of the claims, we would have to incur a charge against earnings to the extent a reserve had not been established for the matter in our accounts, or to the extent the claims were not sufficiently covered by our insurance coverage. Both claims brought against us and by us, if not resolved through negotiations, are often subject to lengthy and expensive litigation or arbitration proceedings, and claims against us may also result in freeze of or restrictions on our bank deposits or other assets during such lengthy legal proceedings. Charges associated with claims brought against us and write-downs associated with claims brought by us could have a material adverse impact on our business, financial condition, results of operations and cash flow. Moreover, legal proceedings resulting in judgments or findings against us may harm our reputation and damage our prospects for future contract or business awards.

We face counterparty risks.

While we generally sell goods and provide services to reputable customers and evaluate the customers' credit in accordance with our internal risk management criteria, such as their credit history and likelihood of default, we have limited access to information about our customers, and we may encounter difficulties in the collection of receivables in certain countries that we have less experience in our dealings. Therefore, we cannot guarantee that all of our customers will fully perform their obligations under their respective contracts with us, and the deterioration of any customers' credit or payment conditions may result in those customers defaulting on their contractual obligations, which could materially and adversely affect our business, financial condition and results of operations. In addition, disputes with governmental entities and other public organizations could potentially lead to contract termination if these remain unresolved or it may take a considerably longer period of time to resolve the disputes with counterparties in the private sector, and payments from these entities and organizations may be delayed as a result.

We face risks related to our derivative instruments.

From time to time, we may utilize derivative instruments to minimize our exposure to fluctuations in the price of primary aluminum and other products. We primarily use futures contracts and option contracts traded on the SHFE and LME to hedge against fluctuations in the price of primary aluminum. All of our future contracts and option contracts are held for hedging purpose. As of December 31, 2021, the fair value of the outstanding futures and option contracts recognized in financial assets and financial liabilities amounted to nil and RMB69 million, respectively. In the process of hedging with futures and options, we cannot assure you that we will not incur any loss, which may have an adverse effect on our financial condition and results of operations.

We may face challenges to our intellectual property rights which could adversely affect our reputation, business and financial position.

We own important intellectual property, including patents and trademarks. Our intellectual property plays an important role in maintaining our competitive position in a number of the markets that we serve. Our competitors may develop technologies that are similar or superior to our proprietary technologies or design around the patents we own or license. Developments or assertions by or against us relating to intellectual property rights, and any inability to protect or enforce these rights, could adversely affect our business and competitive position.

We may be exposed to claims in relation to the unsatisfactory performance of third-party service providers, and disputes with business partners may also adversely affect our business.

We rely on third-party service providers for certain services, including but not limited to mining infrastructure construction, logistics services or warehouse management. Therefore, we are exposed to the risk that our third-party service providers may fail to perform their obligations, which may adversely affect our business operations. In addition, from time to time, we cooperate with business partners to develop our business, including acquiring strategic mining resources or businesses that complement our own business line. Furthermore, we operate certain projects through joint venture arrangements and may enter into further joint ventures in the future along with the expansion of our operations. We may have disputes with these business partners or joint venture partners over various aspects, such as performance of each party's obligations, scope of each party's responsibilities, product quality and logistics services. If such disputes cannot be settled in a timely manner, our financial condition and business may be adversely affected.

Failure to hire and retain management executives and other qualified personnel could adversely affect our business and prospects.

The growth of our business operations depends on the continued services of our senior management team. The industry experience, expertise and contributions of our executives and other members of our senior management are essential to our continued success. We will require an increasing number of experienced and competent executives in the future to implement our growth plans. If we were to lose the services of any of our key management members and were unable to recruit and retain personnel with equivalent qualifications at any time, the management and growth of our business could be adversely affected.

Competition for qualified personnel in general is intense in the PRC and other markets where we operate. We cannot guarantee that we will be able to maintain an adequately skilled labor force necessary for us to execute our projects or to perform other corporate activities, nor can we guarantee that staff costs will not increase as a result of a shortage in the supply of skilled personnel. If we fail to attract and retain personnel with suitable managerial, technical or marketing expertise or maintain an adequate labor force on a continuous basis, our business operations could be adversely affected and our future growth and expansions may be inhibited.

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We may not be able to detect and prevent fraud or other misconduct committed by our employees, representatives, agents, customers, affiliates or other third parties.

We may be exposed to fraud or other misconduct committed by our employees, representatives, agents, customers, affiliates or other third parties that could subject us to litigation, financial losses and sanctions imposed by governmental authorities, as well as adversely affect our reputation, business, financial condition, results of operations and ADS trading prices. Such misconduct may include, among others:

- hiding unauthorized or unsuccessful activities, resulting in unknown and unmanaged risks or losses;
- intentionally concealing material facts, or failing to adequately perform necessary due diligence or risk analysis procedures designed to identify potential risks;
- improperly using or disclosing confidential information;
- engaging in improper activities or activities that might be subject to penalties, fines or sanctions;
- misappropriation of funds;
- conducting transactions that exceed authorized limits;
- engaging in misrepresentation or fraudulent, deceptive or otherwise improper or illegal activities;
- engaging in unauthorized or excessive transactions to the detriment of our customers; or
- otherwise not complying with applicable laws or our internal policies and procedures.

Our internal control procedures are designed to monitor our operations and ensure overall compliance. However, such internal control procedures may be unable to identify, detect or prevent all incidents of non-compliance or suspicious transactions in a timely manner, if at all. In addition, we do not have control over the activities conducted on their own by those of our customers, affiliates or other third parties.

There is no assurance that fraud or other misconduct by our employees, representatives, agents, customers, affiliates or other third parties will not occur in the future. If such fraud or other misconduct does occur and to the extent that our employees, representatives, agents, customers, affiliates or other third parties are penalized for any of their non-compliance activities or are otherwise subject to any sanctions laws of foreign jurisdictions, it may cause negative publicity of us as a result, and could have a material adverse effect on our business, financial condition, results of operations and our ADS trading prices.

Cyber attacks and security breaches may threaten the integrity of our intellectual property and other sensitive information and disrupt our business operations, which could adversely affect our reputation, business and financial position.

We face global cybersecurity threats, which may range from uncoordinated individual attempts to sophisticated and targeted measures directed at us. Cyber attacks and security breaches may include, but are not limited to, attempts to access information, computer viruses, denial of service and other electronic security breaches. Cyber attacks and security breaches may cause equipment failures, loss of information and limited access to systems. For manufacturing companies, cyber attacks and security breaches may result in the theft of sensitive data, including valuable technical and marketing information, disruptions to operations and breakdown of industrial control system. The economic costs to us to eliminate or alleviate cyber attacks and security breaches could be significant and may be difficult to estimate or calculate because the loss may differ based on the identity and motive of the programmer or hacker, which are often difficult to identify. Further, the perpetrators of cyber attacks and security breaches are not restricted to specific groups or persons. These attacks may be committed by company employees or external actors operating in any geography, including jurisdictions where law enforcement measures to address such attacks are unavailable or ineffective, and may even be launched by or at the behest of nation states. In addition, new and amended PRC regulatory requirements regarding network security and information protection have been adopted in recent years to further strengthen the regulation in those areas. In 2021, both Data Security Law and Personal Information Protection Law were promulgated and became effective. We may be required to devote significant resources to establishing and maintaining our compliance with such new or amended legislation or regulations.

Although we have not experienced any material cybersecurity incidents in the past, we cannot assure you that we will not experience them in the future. Due to the evolving nature of cybersecurity threats, the scope and impact of any future incident cannot be predicted. While we devote significant resources to security measures to safeguard our systems and mitigate potential risks, such as deploying network protection devices and performing regular security assessment, there is no assurance that such actions will be sufficient to prevent cyber attacks or security breaches that manipulate or improperly use our systems or networks, compromise confidential or otherwise protected information, destroy or corrupt data, or otherwise disrupt our operations. The occurrence of such events could negatively impact our reputation and our competitive position and could result in litigation with third parties, regulatory action, loss of business, potential liability and increased remediation costs, any of which could have an adverse effect on our financial condition and results of operations.

We are subject to risks normally associated with cross-border transactions, and our export products may become subject to anti-dumping or countervailing duty proceedings.

During the past few years, we generated marginal revenue from exports of certain chemical alumina products and aluminum fabrication products and also from time to time from exports of certain non-ferrous metals and minerals products to foreign jurisdictions. In 2021, we only engaged in the export of certain chemical alumina products and aluminum fabrication products to foreign countries including, among others, South Korea, Japan and countries in Southeast Asia and revenue generated from such export accounted for approximately 4.8% of our total revenues in 2021. Such foreign jurisdictions and other countries may take restrictive measures, including, among others, imposition of tariffs, anti-dumping duties and other non-tariff barriers, to protect their own markets. The sales of our product in overseas markets may be adversely affected by increases in or new impositions of anti-dumping duties, countervailing duties, quotas or tariffs imposed on our exports. Further increases in or new imposition of anti-dumping duties, countervailing duties, quotas or tariffs on our sales in these markets could adversely affect the exports to these regions in the future. For example, since 2018, the U.S. government has imposed tariffs and other trade barriers on products imported from China, which elicited retaliatory tariff increases by the PRC government on the U.S. products. Since October 1, 2018, the U.S. government had imposed a 10% tariff on various aluminum products imported from China, including chemical alumina products. Starting from May 2019, this tariff rate was increased to 25%. In 2021, we exported approximately 24,000 tonnes of chemical alumina products to the United States, the revenue generated from which represented approximately 0.04% of our total revenues in 2021. Other than exports of chemical alumina products, we did not have any other exports to the United States in 2021. There is no assurance that such export volume of chemical alumina products will not further decrease in the future. In addition, such trade frictions and tariffs involved may decrease China's aluminum export to the United States and other countries and reduce global aluminum consumption, which could in turn have a material adverse effect on the demand of our products as well as our business, financial condition and results of operations. On January 15, 2020, the PRC government and the U.S. government entered into the U.S.-China Phase One trade deal agreement. Since then, the PRC government and the U.S. government have granted tariff exemptions on certain goods. However, it is not yet clear what further actions the U.S. government and the PRC government may take. There is no assurance that a broader trade agreement would be successfully negotiated between the U.S. and China, or no additional tariffs or other trade barriers would be imposed. If there is any escalation in trade frictions, we cannot assure you whether such development would not have a material adverse effect on the business environment in general, global economic conditions and the stability of global financial markets. Any of these factors affected by the developments in trade barriers could in turn have a material adverse effect on our business, financial condition and results of operations.

By virtue of our transactions with parties outside the PRC, we will be subject to the risks normally associated with cross-border business transactions and activities. We will also be exposed to the risk of changes in social, legal, political and economic conditions in the foreign jurisdictions. In particular, unexpected changes in regulatory requirements, tariffs and other trade barriers and price or exchange controls could limit our operations and make the repatriation of profits difficult.

Our operations are affected by a number of risks relating to conducting business in the PRC.

As most of our assets and operations are located in the PRC, we are subject to a number of risks relating to conducting business in the PRC, including the following:

- The PRC government continues to shape the structure and development of the aluminum industry through industry guidelines for energy conservation, safety, environmental protection and quality. The central and local PRC government will give more support to entities that meet the standards in such industry guidelines. If the PRC government changes its current industry guidelines or the interpretation of those industry guidelines, we may face pressure on profit margins and constraints on our ability to expand our business operations.

- Although the PRC has been one of the world's fastest-growing economies in terms of GDP growth in the past 30 years, the global financial crisis that unfolded in 2008, coupled with the ongoing structural adjustment of the PRC economy in the past few years, has led to a marked slowdown in the economic growth of the PRC. For example, the GDP growth rate of the PRC decreased from 11.4% in 2007 to 6.1% in 2019. Furthermore, the outbreak and global spread of the COVID-19 in 2020 and 2021 has adversely affected global and China's economy and financial market in general. As a result, the compound annual GDP growth rate of China was 5.1% in 2020 and 2021. Please refer to "– Our business may be materially and adversely affected by the COVID-19 pandemic" for further details of the impact of the outbreak of COVID-19. A slowdown or decline in the PRC economy could reduce business activities and demand for our products. In addition, the PRC government exercises control over China's economic growth through the allocation of resources, control of payments of obligations denominated in foreign currencies and monetary and tax policies. Some of these measures benefit the overall economy of China, but may have a materially adverse impact on us.

- We are subject to reviews and inspections by various governmental authorities and regulatory agencies. These reviews and inspections could cover a broad range of aspects in relation to our business and operations, including financial reporting, tax reporting, internal control and compliance with applicable laws, rules and regulations. We cannot predict the impact of any findings of these reviews and inspections to be carried out by governmental authorities and regulatory agencies in the future, and we cannot assure you that the outcome of any such reviews and inspections would not have a material adverse effect on our business, financial condition, results of operations and prospects.

- In 2005, China adopted a managed floating exchange rate system to allow the value of the Renminbi to fluctuate within a regulated band based on supply and demand with reference to a basket of currencies. Since then the exchange rate between the U.S. dollar and Renminbi has fluctuated and become increasingly unpredictable following the global financial crisis in 2008. In April 2012, the PRC government took a milestone step in turning the Renminbi into a global currency by doubling the size of its trading band against the U.S. dollar to 1%, pushing through a crucial reform that further liberalizes its financial markets. The PBOC further allows the Renminbi trading band against the U.S. dollar to rise or fall 2% from a mid-point every day, effective on March 17, 2014, compared with its previous 1% limit. In August 2015, the PBOC announced that the daily central parity quotes the market-makers reported to the China Foreign Exchange Trade System operated by the PBOC before the market opens should be based on the closing rate of the inter-bank foreign exchange rate market on the previous day, supply and demand in the market, and price movement of major currencies, effective on August 11, 2015. In recent years, the Renminbi has fluctuated against the U.S. dollar, at times significantly. It is difficult to predict how market forces or PRC or U.S. government policy may impact the exchange rate between the Renminbi and the U.S. dollar in the future. Any appreciation or depreciation of the Renminbi will affect the value of our U.S. dollar-denominated borrowings and overseas investments, the prices of our export sales denominated in foreign currencies and the Renminbi equivalent value of our trade and notes receivable denominated in foreign currencies, which may affect our financial condition and results of operations. Our financial condition and operating performance may also be affected by changes in the value of currencies other than Renminbi in which our earnings and obligations are denominated.

- There might be uncertainties regarding the interpretation and enforcement of PRC laws, rules and regulations. The Chinese legal system is a civil law system based on written statutes. Unlike common law systems, it is a system in which decided legal cases may be cited for reference but have limited precedential value. Over the past decades, the PRC government has promulgated a comprehensive system of laws, rules and regulations governing economic matters. However, because these laws, rules and regulations are relatively new, and because of the relatively limited volume of published cases and their non-binding nature, and because the laws, rules and regulations often give the relevant administrative and court authorities certain discretion in how to interpret and enforce them, uncertainties regarding the interpretation and enforcement of these laws, rules and regulations may adversely affect our operations.

You may experience difficulties in effecting service of legal process and enforcing judgments against us and our management, and the ability of U.S. authorities to bring actions in the PRC may also be limited.

Most of our assets and our subsidiaries are located in the PRC. In addition, most of our directors and officers reside within the PRC, and most of the assets of our directors and officers are located within the PRC. As a result, it may not be possible to effect service of process within the United States or elsewhere outside the PRC upon most of our directors or officers, including with respect to matters arising under applicable laws and regulations. Moreover, the PRC does not have treaties providing for the reciprocal recognition and enforcement of judgments of courts with the United States, the United Kingdom or most other Western countries, and Hong Kong has no arrangement for the reciprocal enforcement of judgments with the United States.

As a result, recognition and enforcement in the PRC or Hong Kong of judgments of a court in the United States and any of the other jurisdictions mentioned above in relation to any matter not subject to a binding arbitration provision may be difficult or impossible. Even if you sue successfully in a U.S. court or any of the other jurisdictions mentioned above, you may not be able to collect on such judgment against us or our directors and officers. In addition, the SEC, the U.S. Department of Justice and other U.S. authorities may also have difficulties in bringing and enforcing actions against us or our directors or officers in the PRC. Furthermore, class action lawsuits, which are available in the United States for investors to seek remedies, are generally uncommon in the PRC.

The audit reports included in this annual report are prepared by auditors who are not inspected by the Public Company Accounting Oversight Board and, as such, you are deprived of the benefits of such inspection.

Auditors of companies that are registered with the SEC and traded publicly in the United States, including our independent registered public accounting firms, must be registered with the U.S. Public Company Accounting Oversight Board (United States) (the "PCAOB") and are required by the laws of the United States to undergo regular inspections by the PCAOB to assess their compliance with the laws of the United States and professional standards. Because we have substantial operations within the PRC and the PCAOB is currently unable to conduct full inspections of the work of our auditors as they relate to those operations without the approval of the Chinese authorities, our auditors' work related to our operations in China is not currently inspected by the PCAOB.

This lack of PCAOB inspections of audit work performed in China prevents the PCAOB from regularly evaluating audit work of any auditor that was performed in China including that performed by our auditors. As a result, investors are deprived of the full benefits of PCAOB inspections. The inability of the PCAOB to conduct inspections of auditors in China makes it more difficult to evaluate the effectiveness of our independent registered public accounting firm's audit procedures or quality control procedures as compared to auditors outside of China that are subject to the PCAOB inspections, which could cause our investors and potential investors to lose confidence in our audit procedures and reported financial information and the quality of our financial statements.

Our ADSs will be delisted under the Holding Foreign Companies Accountable Act if the PCAOB is unable to inspect auditors who are located in China. In addition, legislative and regulatory developments related to U.S.-listed China-based companies due to lack of PCAOB inspection and other developments may have a material adverse impact on our listing and trading in the United States and the trading prices of our ADSs. The potential delisting of our ADSs, or the threat of their being delisted, may materially and adversely affect the value of your investment.

As part of continued regulatory focus in the United States on access to audit and other information currently protected by foreign law, in particular the PRC's law, on December 18, 2020, the United States enacted the Holding Foreign Companies Accountable Act, or the HFCA Act. The HFCA Act includes requirements for the SEC to identify issuers whose audit reports are prepared by auditors that the PCAOB is unable to inspect or investigate completely because of a restriction imposed by a non-U.S. authority in the auditor's local jurisdiction. The HFCA Act also requires public companies on this SEC list to certify that they are not owned or controlled by a foreign government and make certain additional disclosure in their SEC filings that cover a "non-inspection" year after the HFCA Act becomes effective. In addition, if the auditor of a U.S.-listed company is not subject to PCAOB inspections for three consecutive "non-inspection" years after the law becomes effective, the SEC is required to prohibit the securities of these issuers from being traded on a U.S. national securities exchange, such as the New York Stock Exchange, on OTC markets in the United States or through any other method within the SEC's jurisdiction to regulate.

On September 22, 2021, the PCAOB adopted a final rule implementing the HFCA Act, which provides a framework for the PCAOB to determine, as contemplated under the HFCA Act, whether the PCAOB is unable to inspect or investigate completely registered public accounting firms located in a foreign jurisdiction because of a position taken by one or more authorities in that jurisdiction. Final rules implementing certain requirements of the HFCA Act, or the Final Rules, were adopted by the SEC on December 2, 2021 and generally became effective on January 10, 2022. The Final Rules implement the submission and disclosure requirements in the HFCA Act, which apply to registrants the SEC identifies as having filed an annual report with an audit report issued by a registered public accounting firm that is located in a foreign jurisdiction and that the PCAOB is unable to inspect or investigate, or Commission-Identified Issuers. The Final Rules require Commission-Identified Issuers to submit documentation to the SEC establishing that, if true, it is not owned or controlled by a governmental entity in the public accounting firm's foreign jurisdiction. The Final Rules also require that a Commission-Identified Issuer that is a "foreign issuer" provide certain additional disclosures in its annual reports. Specifically, Item 16I (Disclosure Regarding Foreign Jurisdictions that Prevent Inspections) has been added in Form 20-F, which requires disclosure in a foreign issuer's annual report regarding the audit arrangements of, and governmental influence on, such foreign issuer. Further, the Final Rules established procedures the SEC will follow to identify issuers and to impose trading prohibitions on the securities of certain Commission-Identified Issuers, as required by the HFCA Act. On December 16, 2021, the PCAOB issued the HFCA Act Determination Report, according to which our auditor is subject to the determination that the PCAOB is unable to inspect or investigate it completely.

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Under the Final Rules, the SEC will identify Commission-Identified Issuers for fiscal years beginning after December 18, 2020. As of the date of this annual report, the SEC has named six PRC-based issuers on its "conclusive list of issuers identified under the HFCA Act," indicating that those companies are now Commission-Identified Issuers subject to the delisting provisions if they remain on the list for three consecutive years. In addition, the SEC has named 17 PRC-based issuers on its "provisional list of issuers identified under the HFCA Act." Issuers provisionally identified have 15 business days to submit evidence to dispute being provisionally identified as a Commission-Identified Issuer. We anticipate being added to the list shortly after the filing of this annual report on Form 20-F for the fiscal year ended December 31, 2021. A Commission-Identified Issuer will be required to comply with the submission and disclosure requirements in the annual report for each year in which it was identified. When we are identified as a Commission-Identified Issuer based on this annual report, we will be required to comply with the submission or disclosure requirements in our annual report filing covering the fiscal year ending December 31, 2022. Under the HFCA Act and the Final Rules, our securities will be prohibited from trading on the NYSE and in over-the-counter markets after we are identified as a Commission-Identified Issuer for three consecutive years, and this ultimately would result in our ADSs being delisted from the NYSE and prohibited from over-the-counter trading after we file our annual report for the fiscal year ending December 31, 2023 in 2024.

Furthermore, on June 22, 2021, the U.S. Senate passed the Accelerating Holding Foreign Companies Accountable Act, which, if enacted, would amend the HFCA Act and require the SEC to prohibit an issuer's securities from trading on any U.S. stock exchanges if its auditor is not subject to PCAOB inspections for two consecutive years instead of three years (the "Accelerating Amendments"). On February 4, 2022, the U.S. House of Representatives passed the America Creating Opportunities for Manufacturing, Pre-Eminence in Technology and Economic Strength Act, or America COMPETES Act, which includes the exactly same Accelerating Amendments. The America COMPETES Act however includes a broader range of legislation not related to the HFCA Act in response to the U.S. Innovation and Competition Act passed by the Senate in 2021. On March 28, the U.S. Senate voted on an amended version that substituted America COMPETES Act with the text of the U.S. Innovation and Competition Act, which does not include the Accelerating Amendments. The U.S. House of Representatives and Senate will need to align the legislation and pass their amended bill before the President can sign it into law. It is unclear when the U.S. Senate and House of Representatives will resolve the differences in the U.S. Innovation and Competition Act and the America COMPETES Act bills, or whether the final bill agreed by the U.S. Senate and House of Representatives will include the Accelerating Amendments. In the case that the bill containing the Accelerating Amendments becomes the law, our ADSs would be delisted from the NYSE and prohibited from over-the-counter trading in the U.S. after we file our annual report for the fiscal year ending December 31, 2022 in 2023.

We understand that there have been dialogues among the CSRC, the SEC and the PCAOB regarding the inspection of PCAOB-registered accounting firms in China. Furthermore, on April 2, 2022, PRC government issued the "Provisions on Strengthening Confidentiality and Archives Administration in Overseas Issuance and Listing of Securities by Domestic Enterprises (Draft for Comment)", which deleted the old requirement that "on-site inspections should be mainly conducted by PRC regulatory authorities, or rely on the inspection results of PRC regulatory authorities", but still required, among others, that inspection and evidence collection should be conducted by way of cross-border regulatory cooperation. There can be no assurance that PRC regulatory authorities will reach a regulatory cooperation agreement with the SEC and the PCAOB, or our auditor or we will be able to comply with requirements imposed by the U.S. regulators.

The delisting of our ADSs would substantially impair your ability to sell or purchase our ADSs when you wish to do so, and the risk and uncertainty associated with delisting would have a negative impact on the price of our ADSs. Also, such a delisting would adversely affect our ability to raise capital on terms acceptable to us, or at all, which would have a material adverse impact on our business, financial condition, and prospects. Holders of our ADSs may convert the ADSs into our H shares listed on the Hong Kong Stock Exchange but will incur costs in order to do so. See "Item 12. Description of Securities Other than Equity Securities" for further information. The value and liquidity of our ADSs may therefore be materially and adversely affected.

Item 4. Information on the Company

A. History and Development of the Company

We were incorporated as a joint stock limited company under the Company Law of the PRC on September 10, 2001 under the corporate name Aluminum Corporation of China Limited. Our principal executive and registered office is located in the People's Republic of China at No. 62 North Xizhimen Street, Haidian District, Beijing, China 100082, and our telephone number is (86) 10 8229 8322. Our website address is www.chalco.com.cn. The information on our website does not constitute a part of this annual report. Our U.S. public filings are available at the website maintained by the SEC at www.sec.gov, which contains reports, proxies and information statements, and other information regarding issuers that file electronically with the SEC.

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Pursuant to a reorganization agreement entered into among Chinalco, Guangxi Investment and Guizhou Development in 2001, substantially all of Chinalco's alumina and primary aluminum production operations, as well as a research institute and other related assets and liabilities, were transferred to us upon our formation. We acquired our bauxite mining operations and associated mining rights from Chinalco in a separate mining rights agreement.

Our A Shares have been listed on the Shanghai Stock Exchange since April 2007. Our H Shares and our ADSs, currently each representing 25 H Shares, have been listed on the Hong Kong Stock Exchange and New York Stock Exchange, respectively, since December 2001.

We are a vertically integrated aluminum producer with operations in bauxite and coal mining, alumina refining and primary aluminum smelting. We also produce ancillary products and services derived from or related to our aluminum operations. In addition, we are engaged in trading and logistics of alumina, primary aluminum, other non-ferrous metal products, coal products and raw and ancillary materials in bulk domestically and internationally. Since 2013, we have expanded our operations into power generation. See "– B. Business Overview" for more details.

We have substantially increased the size and scope of our operations through organic growth as well as selective acquisitions and joint ventures. Our key operating assets currently include six subsidiaries mainly engaged in bauxite mining; two integrated alumina and primary aluminum production plants; nine stand-alone alumina refineries; eight stand-alone primary aluminum smelters; one stand-alone secondary aluminum producer; four stand-alone carbon production plants; one integrated power generation company with coal mining operations and one institute providing research and development services. All of our principal alumina and primary aluminum production facilities are operated in accordance with ISO14001 standards.

For the details of our principal capital expenditures for the previous three years ended December 31, 2021 and those planned for 2022, see "Item 5. Operating and Financial Review and Prospects – B. Liquidity and Capital Resources – Capital Expenditures and Capital Commitments." We currently do not have any significant divestiture in progress.

Private Placement of A Shares

On March 8, 2012, our Board resolved to issue up to 1.25 billion A Shares in the PRC. The A Share issue plans previously proposed by our Board on June 30, 2009 and January 30, 2011 and approved by our shareholders at the extraordinary general meeting, A Share class meeting and H Share class meeting held on August 24, 2009 and on April 14, 2011, respectively, ceased. Pursuant to the new issue plan approved by our Board on March 8, 2012, we planned to issue up to 1.25 billion A Shares, with a nominal value of RMB1.00 each, by way of private placement for expected proceeds not exceeding RMB8 billion. We intended to issue the A Shares to no more than ten specific target subscribers within six months of obtaining the approval of the CSRC. The issue price of A Shares to be offered shall be not less than 90% of the average trading price of our A Shares in 20 trading days immediately preceding the pricing determination date. We intended to apply proceeds from this private placement to finance Chalco Xing County Alumina Project, Zhongzhou branch Ore-dressing Bayer Process expansion construction project and to supplement working capital. The issue plan was approved by the SASAC on April 5, 2012 and by our shareholders at the extraordinary general meeting, A Share class meeting and H Share class meeting held on May 4, 2012. On August 24, 2012, our Board resolved to adjust the issue plan by proposing, among others, to increase the number of A Shares to be issued to up to 1.45 billion A Shares. The adjusted issue plan was approved by the SASAC and our shareholders at an extraordinary general meeting, A Share class meeting and the H Share class meeting on October 12, 2012 and by the CSRC on December 7, 2012. On March 14, 2013, we obtained the approval from the CSRC on our proposed private placement of A Shares under such adjusted issue plan, with effective period of six months after the approval date. However, the CSRC temporarily retrieved its approval in July 2013 due to its ongoing investigation of the sponsor of our proposed private placement of A Shares. The period of authorization to the Board relating to the adjusted issue plan was extended by our shareholders at the 2013 annual general meeting, A Share class meeting held on June 27, 2014 and H Share class meeting held on June 27, 2014, with an effective period of 12 months after the approval date. On January 4, 2015, we submitted the "Report regarding the resumption of the approval of non-public offering of shares of Aluminum Corporation of China Limited" to the CSRC. On April 24, 2015, we received the Approval in Relation to the Non-public Issuance of Shares by Aluminum Corporation of China Limited issued by the CSRC, pursuant to which we were approved to issue no more than 1,450,000,000 new shares. We completed the non-public issuance of A Shares on June 15, 2015 and issued an additional 1,379,310,344 A Shares pursuant to the specific mandate as approved at the annual general meeting of the Company on June 27, 2014. Upon completion, the total number of A Shares of the Company was increased from 13,524,487,892 to 14,903,798,236. Please refer to "– Subscription of Equity Interest of Certain Subsidiaries and Subsequent Issuance of Additional A Shares" for further changes of our issuance of A Shares.

Disposal of Aluminum Fabrication Business

We disposed of substantially all of our aluminum fabrication operations to Chinalco pursuant to the approval of shareholders at the 2012 annual general meeting on June 27, 2013.

On May 13, 2013, we submitted the tender notice to CBEX to dispose of the equity interest we held in eight aluminum fabrication enterprises, including Henan Aluminum, Chalco Southwest Aluminum, Chalco Southwest Aluminum Cold Rolling, Huaxi Aluminum, Qingdao Light Metal, Chalco Ruimin, Chalco Sapa Aluminum Products (Chongqing) Co., Ltd. and Guizhou Chalco Aluminum Co., Ltd. (collectively, “Aluminum Fabrication Interests”) through open tender. Chinalco participated in and won the bid for the Aluminum Fabrication Interests on June 7, 2013. We entered into an agreement (the “Aluminum Fabrication Interests Transfer Agreement”) with Chinalco on June 9, 2013 for the disposal of Aluminum Fabrication Interests for a consideration of RMB3,242.2 million. Such consideration was the initial bidding price, which was determined with reference to the appraised value of the Aluminum Fabrication Interests. Pursuant to the Aluminum Fabrication Interests Transfer Agreement, Chinalco agreed to pay the consideration in cash in two installments, namely, 30% of the consideration to be paid within five business days after the effective date of the agreement and 70% of the consideration to be paid by June 30, 2014. Chinalco must pay interest for the second installment for the period starting from the date immediately after the effective date until the payment date at the one-year lending rate set by the PBOC. The disposal was approved at the 2012 annual general meeting held on June 27, 2013 and we completed the disposal on June 27, 2013. Chinalco paid the consideration in full by June 2014.

As a condition of the disposal of the Aluminum Fabrication Interests, on June 9, 2013, we entered into an agreement with Chinalco to transfer the outstanding entrusted loans we provided to Henan Aluminum and Qingdao Light Metal as of December 31, 2012 to Chinalco for a consideration of RMB1,756.0 million. Such consideration was determined based on negotiations between the parties, with reference to the appraised total value of the loans. Pursuant to the agreement, Chinalco agreed to pay the consideration in cash in five equal installments of RMB351.2 million, with the last installment, together with the relevant interests at the one-year lending rate set by the PBOC, to be paid by June 30, 2017. The transfer was approved at the 2012 annual general meeting held on June 27, 2013 and we completed the transfer on June 27, 2013. The payment was fully settled by Chinalco in accordance with the agreement.

In addition, we entered into an agreement with Northwest Aluminum Fabrication Plant, a subsidiary of Chinalco, on June 6, 2013 to dispose of all the assets of Northwest Aluminum for RMB1,659.6 million. Such consideration was determined based on negotiations between the parties, with reference to the appraised net asset value of Northwest Aluminum. Pursuant to the agreement, Northwest Aluminum Fabrication Plant agreed to pay the consideration in cash in five equal installments of RMB331.9 million, with the last installment, together with the relevant interests at the one-year lending rate set by the PBOC, to be paid by June 30, 2017. The disposal was approved at the 2012 annual general meeting held on June 27, 2013 and we completed the disposal on June 27, 2013. The payment was fully settled by Northwest Aluminum Fabrication Plant in accordance with the agreement.

Disposal of Assets of Alumina Production Line of Guizhou Branch

On June 6, 2013, we entered into an agreement with Guizhou Aluminum Plant, a subsidiary of Chinalco, to dispose of the assets of the alumina production line of our Guizhou branch for a consideration of RMB4,429.0 million. Such consideration was determined based on negotiations between the parties, with reference to the appraised net asset value of such alumina assets of our Guizhou branch. Pursuant to the agreement, Guizhou Aluminum Plant agreed to pay the consideration in cash in five equal installments of RMB885.8 million, with the last installment, together with the relevant interests at the one-year lending rate set by the PBOC, to be paid by June 30, 2017. The disposal was approved at the 2012 annual general meeting held on June 27, 2013 and we completed the disposal on June 27, 2013. The payment was fully settled by Guizhou Aluminum Plant in accordance with the agreement.

We decided to dispose of the assets of the alumina production line of Guizhou branch because the district in which they were located had been changed from an industrial district to a commercial district based on the local urban plan, which would significantly increase Guizhou branch’s environmental compliance costs. We built a new alumina refinery, Guizhou Huajin, in an area relatively close to major bauxite and coal mines in Guizhou Province, which commenced production with an annual capacity of 1.6 million tonnes of alumina in 2015.

Senior Perpetual Capital Securities Offering

In October 2013, we completed the issuance of US$350 million in aggregate principal amount of 6.625% senior perpetual capital securities (the "2013 Senior Perpetual Securities") through Chalco Hong Kong Investment Company Limited (the "Bond Issuer"), our wholly-owned subsidiary, which was exempted from, and not subject to, registration under the Securities Act. The 2013 Senior Perpetual Securities are guaranteed by Chalco Hong Kong and its certain subsidiaries. The 2013 Senior Perpetual Securities also have the benefit of a keepwell deed dated October 29, 2013 entered into by the Issuer, the Company, Chalco Hong Kong and the trustee and a deed of equity interest purchase undertaking dated on October 29, 2013 entered into by the Company and the trustee, both deeds being executed in favor of the trustee. The 2013 Senior Perpetual Securities were listed on the Hong Kong Stock Exchange on October 30, 2013. The net proceeds from the issue of the 2013 Senior Perpetual Securities after deduction of issuance costs are RMB2,122.6 million and have been on-lent to the Company or any of its subsidiaries for general corporate use. Coupon payments of 6.625% per annum on the 2013 Senior Perpetual Securities are paid semi-annually in arrears from October 29, 2013, and may be deferred at our discretion unless, during the six-month period ending on the day before the relevant scheduled coupon payment date, we have, or the Bond Issuer or Chalco Hong Kong has, declared or paid a discretionary dividend, distribution or other discretionary payment on or in respect of, or have/has at its discretion repurchased, redeemed or otherwise acquired, any securities of lower or equal rank, subject to certain exceptions. The 2013 Senior Perpetual Securities have no fixed maturity and are callable only at our option on or after October 29, 2018, at their principal amounts together with any accrued, unpaid or deferred coupon interest payments. We redeemed the 2013 Senior Perpetual Securities in October 2018.

On October 27, 2015, our Company issued RMB2,000 million perpetual medium-term notes at an initial distribution rate of 5.50% (the "2015 Perpetual Medium-term Notes"). The proceeds from the issuance were RMB2,000 million and were used for repayments of interest-bearing loans and borrowings. Coupon payments of 5.50% per annum on the 2015 Perpetual Medium-term Notes are paid annually in arrears from October 29, 2015 and may be deferred at the discretion of our Company. The 2015 Perpetual Medium-term Notes have no fixed maturity and are callable only at our option on October 29, 2020 or any coupon distribution date after October 29, 2020 at their principal amounts together with any accrued, unpaid or deferred coupon distribution payments. We repaid the principal amounts together with any accrued, unpaid or deferred coupon distribution payments of the 2015 Perpetual Medium-term Notes on October 29, 2020.

On October 31, 2016, the Bond Issuer issued US$500 million senior perpetual securities (the "2016 Senior Perpetual Securities") at a rate of 4.25%. The 2016 Senior Perpetual Securities are guaranteed by one of our subsidiaries, Chalco Hong Kong. The 2016 Senior Perpetual Securities also have the benefit of a keepwell deed entered into by the Bond Issuer, the Company, Chalco Hong Kong and the trustee. The 2016 Senior Perpetual Securities were listed on the Hong Kong Stock Exchange on November 7, 2016. The net proceeds from the issue of the 2016 Senior Perpetual Securities were approximately RMB3,374 million and were on-lent to the Company or any of its subsidiaries for general corporate use. Coupon payments of 4.25% per annum on the 2016 Senior Perpetual Securities have been made semi-annually on April 29 and October 29 in arrears from November 7, 2016 and may be deferred at our discretion. The first coupon payment date was April 29, 2017. The 2016 Senior Perpetual Securities have no fixed maturity date and are callable only at our option on or after November 7, 2021 at their principal amounts together with any accrued, unpaid or deferred coupon distribution payments. We repaid the principal amounts together with any accrued, unpaid or deferred coupon distribution payments of the 2016 Senior Perpetual Securities on November 7, 2021.

On October 19, 2018, we issued RMB2,000 million perpetual medium-term notes with an initial distribution rate at 5.10% (the "2018 Perpetual Medium-term Notes"). The proceeds from the issuance were RMB2,000 million. The proceeds were used for the repayment of interest-bearing loans and borrowings. Coupon payments of 5.10% per annum on the 2018 Perpetual Medium-term Notes are made annually in arrears from October 19, 2018 and may be deferred at our discretion. The 2018 Perpetual Medium-term Notes have no fixed maturity date and are callable only at our option on October 23, 2021 or any coupon distribution date after October 23, 2021 at their principal amounts together with any accrued, unpaid or deferred coupon distribution payments. We repaid the principal amounts together with any accrued, unpaid or deferred coupon distribution payments of the 2018 Perpetual Medium-term Notes on October 23, 2021.

On November 19, 2019, we issued RMB1,500 million perpetual medium-term notes with an initial distribution rate at 4.20% (the "2019 Perpetual Medium-term Notes"). The proceeds from the issuance were RMB1,499 million. The proceeds were used for the repayment of interest-bearing loans and borrowings. Coupon payments of 4.20% per annum on the 2019 Perpetual Medium-term Notes have been made annually in arrears from November 19, 2019 and may be deferred at our discretion. The 2019 Perpetual Medium-term Notes have no fixed maturity date and are callable only at our option on November 20, 2022 or any coupon distribution date after November 20, 2022 at their principal amounts together with any accrued, unpaid or deferred coupon distribution payments. The coupon distribution rate will be reset to a percentage per annum equal to the sum of (a) the initial spread of 1.31 per cent, (b) the China Treasury Rate, and (c) a margin of maximum 300 Bps every five years after November 20, 2022. While any coupon distribution payments are unpaid or deferred, the Company cannot declare or pay dividends to shareholders or decrease the share capital, or make material fixed asset investments.

On December 2, 2020, the Company issued RMB1,000 million perpetual medium-term notes with an initial distribution rate at 4.45% (the "2020 Perpetual Medium-term Notes"). The proceeds from the issuance of the 2020 Perpetual Medium-term Notes were RMB1,000 million. The proceeds were used for the repayment of interest-bearing loans and borrowings. Coupon payments of 4.45% per annum on the 2020 Perpetual Medium-term Notes have been made annually in arrears from December 2, 2020 and may be deferred at the discretion of the Company. The 2020 Perpetual Medium-term Notes have no fixed maturity date and are callable only at our option on December 3, 2022 or any coupon distribution date after December 3, 2022 at their principal amounts together with any accrued, unpaid or deferred coupon distribution payments. The coupon distribution rate will be reset to a percentage per annum equal to the sum of (a) the initial spread of 1.42 percent, (b) the China Treasury Rate, and (c) a margin of maximum 300 Bps every two years after December 3, 2022. While any coupon distribution payments are unpaid or deferred, the Company cannot declare or pay dividends to shareholders or decrease the share capital, or make material fixed asset investments.

Transfer of Equity Interest in Shanxi Huaxing

The Chalco Xing County Alumina Project, which was carried out by Shanxi Huaxing, commenced construction in May 2011 and undertook full operation in 2014. After completion of private placement of A Shares in June 2015, the Board resolved to replace the funds which have been invested by us in advance with the proceeds raised from the private placement of A Shares. In light of our strategic blueprint for the development of Shanxi aluminum recycle industrial park, we planned to introduce strategic investors for joint investment and cooperation to develop a new model of integrated coal, electricity and aluminum operations. In December 2015, we entered into an equity transfer agreement with Shenzhen CR Yuanta Asset Management Co., Ltd., a state-owned entity, to transfer 50% equity interests in Shanxi Huaxing, a wholly-owned subsidiary, through the Shanghai United Assets and Equity Exchange at a price of RMB2,351 million (the "2015 Equity Transfer Agreement"). The price was determined based on the appraisal value provided by an independent qualified appraisal company. According to the 2015 Equity Transfer Agreement, 30% of the consideration amounting to RMB705 million has been received by us in December 2015. In December 2016, Shenzhen CR Yuanta Asset Management Co., Ltd. transferred the 50% of equity interest in Shanxi Huaxing to Baotou Transportation Investment Group Co., Ltd. As agreed among Shenzhen CR Yuanta Asset Management Co., Ltd., Baotou Transportation Investment Group Co., Ltd. and the Company, Baotou Transportation Investment Group Co., Ltd., shall assume the payment obligation on the outstanding consideration of RMB1,646,035,160 payable by Shenzhen CR Yuanta Asset Management Co., Ltd. to the Company under the 2015 Equity Transfer Agreement and settle the outstanding consideration in full together with interest accrued thereon from January 1, 2017 to the date of payment before March 31, 2017. The payment was fully settled by Baotou Transportation Investment Group Co., Ltd. in March 2017.

In December 2018, we entered into an equity transfer agreement with Baotou Transportation Investment Group Co., Ltd., pursuant to which we agreed to acquire 50% equity interest in Shanxi Huaxing through the Shanghai United Assets and Equity Exchange at a price of approximately RMB2,665.2 million, which we paid in full in December 2018. Upon completion of the acquisition, Shanxi Huaxing became a wholly-owned subsidiary of the Company. The acquisition is conducted for the purpose of enhancing our profitability and is in line with our strategic layout of alumina and aluminum business, as the increase of our shareholding in Shanxi Huaxing, an alumina plant, is expected to enhance the synergy with our primary aluminum production in Shanxi, where we have newly added production capacity of primary aluminum.

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Transfer of Shares of Jiaozuo Wanfang

On January 22, 2015 and January 23, 2015, we decreased our shareholding in Jiaozuo Wanfang by 4,758,858 shares through the securities exchange system of the Shenzhen Stock Exchange. In March 2015, we transferred 100,000,000 shares of Jiaozuo Wanfang to Geo-Jade Petroleum Corporation by way of agreement after the public solicitation for potential transferees. On June 25, 2015, we further transferred 42,550,900 shares of Jiaozuo Wanfang by way of block trading through the securities exchange system of the Shenzhen Stock Exchange. On December 18, 21 and 22, 2015, we reduced our shareholding in Jiaozuo Wanfang by 16,695,100 shares through the centralized bidding trading system of the Shenzhen Stock Exchange. From December 23 to 25, 2015, we reduced our shareholding in Jiaozuo Wanfang by 13,865,000 shares through the centralized bidding trading system of the Shenzhen Stock Exchange and block trading. As a result, we held 29,582,057 shares of Jiaozuo Wanfang as of December 31, 2015, representing 2.46% of the total share capital of Jiaozuo Wanfang. During the period from July 8, 2016 to September 27, 2016, we reduced our shareholding of Jiaozuo Wanfang by an aggregate of 16,628,098 shares via the Shanghai Stock Exchange centralized bidding trading system, representing approximately 1.39% of the total share capital of Jiaozuo Wanfang. The average price of reduction was approximately RMB8.73 per share. After the reduction, the Company remained holding 12,953,959 shares of Jiaozuo Wanfang, representing approximately 1.09% of its total share capital. During the period from September 29, 2016 to January 26, 2017, we reduced our shareholding of Jiaozuo Wanfang by an aggregate of 12,953,959 shares via the Shanghai Stock Exchange centralized bidding trading system, representing approximately 1.09% of the total share capital of Jiaozuo Wanfang. The average price of reduction was approximately RMB10.19 per share. After such reduction in our shareholding, we no longer hold any shares of Jiaozuo Wanfang.

Disposal of Certain Assets of Guizhou Branch

Guizhou branch entered into a land reserve acquisition cooperation agreement with the People's Government of the Baiyun District of Guiyang, Guiyang Land Reserve Center, and Guizhou Aluminum Plant on November 13, 2015. As the land of Guizhou Aluminum Plant occupied by the primary aluminum plant of Guizhou branch shall be transferred to the respective land resources and reserve authorities, Guizhou branch sold the relevant assets, including buildings and structures located on the land occupied by the primary aluminum plant of Guizhou branch, to the Guiyang Land Reserve Center for a total consideration of RMB1.95 billion. The consideration was determined based on the asset appraisal conducted by an independent asset appraisal firm.

Disposal of the Environmental Protection Business

On May 30, 2016, the Board approved the transfer of the environmental protection assets in relation to the desulfurization, denitration and dedusting of the coal-fired generating units of five entities, namely Lanzhou branch, Baotou Aluminum, Shandong Huayu, Maliantai Power Station and Liupanshan Power Station of Ningxia Energy, by way of public bidding. On June 29, 2016, the assets transfer agreement in relation to disposal of the above environmental protection assets were entered into between Beijing Aluminum SPC Environment Protection Tech Co., Ltd., which had won the bid for the acquisition of the assets, and us. Pursuant to the asset transfer agreement, the aggregate consideration for the above environmental protection assets disposal was RMB1,754 million which was paid in two installments in June 2016 and December 2016, respectively.

We decided to dispose the environmental protection assets to reduce our capital investments and generate cash flows. We have been complying with the relevant standards of environmental protection through professional services rendered by specialized environmental protection companies.

Development of Gold Leasing Financing

On May 30, 2016, the Board resolved to develop gold leasing business to financing working capital. From 2016 to 2019, we have entered into several agreements with Bank of Communications Co., Ltd., China Everbright Bank and Agriculture Bank of China to finance working capital via gold leasing. We repaid the remaining gold leasing financing and did not enter into any new gold leasing agreement in 2020 and 2021.

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Establishment of Industry Investment Fund

On May 23, 2017, the Company, Bank of Communications International Trust Co., Ltd. ("BOCOMMTRUST") and Chinalco Jianxin Investment Fund Management (Beijing) Company Limited ("Chinalco Jianxin") entered into a partnership agreement in relation to the establishment of Beijing Chalco Bocom Size Industry Investment Fund Management Partnership (Limited Partnership) (the "Industry Fund"). On September 27, 2017, the Company, BOCOMMTRUST, Chinalco Jianxin and Bocommtrust Asset Management Co., Ltd. ("Bocommtrust Asset") entered into certain agreements with respect to Chinalco Jianxin's withdrawal from and Bocommtrust Asset's participation in the Industry Fund. On the same day, the Company, BOCOMMTRUST and Bocommtrust Asset entered into a capital contribution agreement and a new partnership agreement in relation to the Industry Fund. Pursuant to these agreements, the general partner of the Industry Fund changed from Chinalco Jianxin to Bocommtrust Asset while Chinalco Jianxin remained as the manager of the Industry Fund.

The Industry Fund provided funding for the construction of our major projects, replenish our working capital and support our structural adjustment, transformation and upgrade. As of December 31, 2021, the Industry Fund had exited all its investment and thereafter had been closed down and liquidated.

Merger and Reorganization of Shanxi Branch and Shanxi Huaze

On August 8, 2017, we entered into a reorganization agreement with Zhangze Electric Power, pursuant to which we contributed certain assets related to alumina production of our Shanxi branch, with an appraised net value of RMB3,425.7 million equaling the appraised net value of the assets and liabilities of Shanxi branch, to Shanxi Huaze. The assets injected into Shanxi Huaze included, among others, inventories, buildings, structures, machinery and equipment. Upon completion of our asset contribution in 2017, our shareholding in Shanxi Huaze increased from 60% to 85.98% and Shanxi Huaze was renamed to Shanxi New Material.

Subscription of Equity Interest of Certain Subsidiaries and Subsequent Issuance of Additional A Shares ("Asset Restructuring")

On December 4, 2017, we entered into certain investment and debt conversion agreements (the "Initial Agreements") with Huarong Ruitong Equity Investment Management Co., Ltd. ("Huarong Ruitong"), China Life Insurance Company Limited ("China Life"), Shenzhen Zhaoping Chalco Investment Center LLP ("Zhaoping Investment"), China Pacific Life Insurance Co., Ltd. ("CPIC Life"), China Cinda Asset Management Co., Ltd. ("China Cinda"), BOC Financial Asset Investment Co., Ltd. ("BOC Financial"), ICBC Financial Asset Investment Co., Ltd. ("ICBC Financial") and ABC Financial Asset Investment Company Limited ("ABC Financial") (collectively, the "Restructuring Investors"). Pursuant to the Initial Agreements, Huarong Ruitong, China Life, Zhaoping Investment, CPIC Life, BOC Financial, ICBC Financial and ABC Financial have agreed to make cash contributions to our wholly-owned subsidiaries, Chalco Shandong, Zhongzhou Aluminum, Baotou Aluminum and Chalco Mining (collectively, the "Target Subsidiaries"), while the principal of loans owed by Chalco Mining to Huarong Ruitong, Zhaoping Investment, China Cinda and BOC Financial prior to signing of the Initial Agreements would be treated as capital contribution to Chalco Mining and converted into equity interest in Chalco Mining held by Huarong Ruitong, Zhaoping Investment, China Cinda and BOC Financial. The Restructuring Investors have agreed to acquire 30.80%, 36.90%, 25.67% and 81.14% of equity interest of Chalco Shandong, Zhongzhou Aluminum, Baotou Aluminum and Chalco Mining, respectively, with an aggregate capital contribution of approximately RMB12.6 billion. Under the Initial Agreements, we have also agreed to acquire equity interest held by the Restructuring Investors in the Target Subsidiaries with consideration in the form of our A Shares to be issued to the Restructuring Investors. On December 20, 2017, the Initial Agreements and the transactions contemplated thereunder were approved at our 2017 second extraordinary general meeting. In December 2017, the capital contribution to the Target Subsidiaries by the Restructuring Investors was completed in accordance with the terms of the Initial Agreements.

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Subsequently, on January 31, 2018, we entered into equity acquisition agreements (the "Further Agreements") with the Restructuring Investors. Pursuant to the Further Agreements, we have agreed to acquire all the equity interest held by the Restructuring Investors in the Target Subsidiaries with consideration in the form of A Shares of the Company to be issued to the Restructuring Investors (the "Proposed Issuance"). The number of A Shares in issue pursuant to the Proposed Issuance would equal the appraised value of equity interest held by Restructuring Investors in Target Subsidiaries as of December 31, 2017 determined by China United Assets Appraisal divided by the issue price. The aforementioned appraised value might be subject to further adjustment by competent PRC authorities upon filing of the valuation report by China United Assets Appraisal. The issue price has been set at RMB6.00 per A Share with reference to 90% of the average trading price of our A Shares during the last 60 trading days prior to January 31, 2018 (i.e., the last 60 trading days prior to the suspension of trading of our A Shares) in accordance with rules and regulations of the PRC applicable to transaction of this kind. The appraised value, subject to further adjustment, was RMB12.7 billion and therefore we would issue to the Restructuring Investors approximately 2.1 billion A Shares in aggregate, representing approximately 14.2% of the total issued share capital of the Company as of January 31, 2018 and approximately 12.4% of the enlarged total issued share capital of the Company upon completion of the Proposed Issuance. On July 30, 2018, we entered supplemental equity acquisition agreements with the Restructuring Investors, amending, among others, the final consideration of the proposed acquisition and the number of the consideration shares to be issued from approximately RMB12,703.7 million and approximately 2,117,280,800 to approximately RMB12,713.2 million and 2,118,874,715, respectively. The Proposed Issuance was approved by our shareholders, the SASAC and the CSRC in 2018. In February 2019, all equity interests of Target Subsidiaries held by the Restructuring Investors were transferred to us, which resulted in us holding 100% equity interests of all Target Subsidiaries. On February 25, 2019, we issued an aggregate of 2,118,874,715 A Shares to the Restructuring Investors and our total share capital increased from 14,903,798,236 shares to 17,022,672,951 shares. The shares issued to the Restructuring Investors could be traded on the Shanghai Stock Exchange since February 26, 2020 after the expiry of the 12-month lock-up period.

Cash contributions received from the Restructuring Investors have been used by us for the repayment of loans. The Asset Restructuring has helped to reduce the gearing ratios of these subsidiaries and us as a whole.

Boffa Project

On June 8, 2018, Chalco Hong Kong and Chalco Guinea Company S.A., a wholly-owned subsidiary of Chalco Hong Kong, entered into a mining convention (the "Mining Convention") with the Guinean government, pursuant to which Chalco Hong Kong agreed to provide investment funds while the Guinean government agreed to provide mining licenses and rights to transport mining products for the development and operation of the Boffa Project, a project for the construction and development of a bauxite mine located in Boffa, Guinea.

Based on our preliminary research and analysis and after taking into account various factors, including but not limited to (i) the bauxite reserve and the minable quantity in the mining area of the Boffa Project; (ii) the advancement and effectiveness of the existing development technologies; (iii) labor costs, transportation expenses and other development costs and other factors, the total investment of the Boffa Project is estimated to be approximately US$706 million, subject to adjustment pursuant to the actual needs, which will be mainly allocated in the construction of mines, ports and lightering system and is expected to be funded through capital investment together with shareholders' loans or bank loans. According to our preliminary design plan, the total investment for the construction of mines is estimated to be approximately RMB3,088 million. The Boffa Project was completed and put into operation in April 2020. As of December 31, 2021, an aggregate of RMB2,821 million of capital expenditure had been incurred for the Boffa Project.

In accordance with the Mining Convention, a mining company (the "Mining Company") and a port company (the "Port Company") are established to act as the main operating bodies for mines construction and ports construction, respectively. In accordance with the Mining Convention, we own 85% and 95% equity interests in the Mining Company and the Port Company, respectively, while the Guinean government and its wholly-owned companies collectively own 15% and 5% equity interests in the Mining Company and the Port Company, respectively. Pursuant to the Mining Convention, Chalco Hong Kong shall grant the Guinean government and/or its wholly-owned companies an option to obtain additional equity interests in the Mining Company and grant Societe Guineenne de Patrimoine Minier, a company wholly-owned by the Guinean government, an option to obtain additional equity interests in the Port Company (together, the "Options"). If the Options are exercised in full, our equity interests in the Mining Company and Ports Company will reduce to 65% and 90%, respectively. As of December 31, 2021, the Options had not been exercised.

With a large reserve of resources, we believe the Boffa Project would provide sustainable bauxite resources for our alumina production and its high ore grades would help reduce alkali and energy consumption in our alumina production. In addition, as the mines are close to port, we are able to consolidate inland waterway transportation and maritime transportation, which benefits long-term development of the project and effectively controls investment risks at the early stage.

The Boffa Project commenced construction in September 2018 with an expected annual bauxite output capacity of 12 million tonnes. The project was completed and put into operation in April 2020. From then through the end of 2021, we extracted approximately 20.4 million tonnes of bauxite from the Boffa mine. The annual bauxite output capacity is expected to increase to 15 million tonnes in 2022.

Merger and Reorganization of Zunyi Alumina and Zunyi Aluminum

On June 21, 2018, in order to streamline our production chains, enhance synergistic effects and control operating costs, we entered into a contribution agreement with other shareholders of Zunyi Aluminum, pursuant to which we contributed all assets in Zunyi Alumina to Zunyi Aluminum. The appraised net value of Zunyi Alumina, equaling the appraised net value of its assets and liabilities, was RMB2,311 million. Upon completion of the merger, our shareholding in Zunyi Aluminum increased from 62.1% to 67.445%.

Controlling Shareholder's Shareholding Increase in the Company

On June 24, 2018, Chinalco notified us of its plan to increase its shareholding in us via the trading system of the Shanghai Stock Exchange in an amount of not less than RMB400 million and not more than RMB1 billion in 12 months. Chinalco would, based on its reasonable judgment on our share price as well as the fluctuations of our share prices and the overall trend in the capital market, gradually implement the plan on increase in shareholding to the extent not exceeding 2% of our total share capital. The purpose of such increases in shareholding is to boost confidence of investors, protect the interests of minority shareholders and stabilize the capital market based on Chinalco's confidence in the future development of the company and the recognition of our value.

For the period from June 25, 2018 to June 24, 2019, as the result of the aforesaid plan, Chinalco increased its shareholding in us by 160,512,964 A shares (representing approximately 0.94% of our total issued share capital as of June 24, 2019) in the amount of RMB608 million on a cumulative basis via the trading system of the Shanghai Stock Exchange. In addition, during the same period of time, Chinalco also, through its subsidiaries, had increased its shareholding in us by 115,276,000 H shares (representing approximately 0.68% of our total issued share capital as of June 24, 2019) in the amount of HK$365 million on a cumulative basis via the trading system of the Hong Kong Stock Exchange.

Acquisition of Carbon Assets and Equity Interests

On August 30, 2018, our Group and the affiliates of Chinalco Assets entered into a series of assets transfer agreements and equity transfer agreements for the acquisition of certain carbon assets and equity interests from the affiliates of Chinalco Assets, including: (i) the assets of the carbon plant under Shandong Aluminum Industry Co., Ltd; (ii) the assets of the carbon plant under Pingguo Aluminum Company Limited; (iii) 49% equity interests of Baotou Sendu Carbon Company Limited; and (iv) 57.69% and 19.96% equity interests of Chibi Great Wall Carbon Products Company Limited from two separate shareholders. Upon completion of the acquisition, we expect this acquisition would help us consummate our industrial chain, ensure our steady production, and improve our competitiveness and anti-risk capabilities, as carbon products are one of major raw materials for production of primary aluminum. As of December 2018, we had paid the total consideration of RMB735.6 million in full and the acquisition had been completed.

Transfer Between China Copper and Yunnan SASAC

On November 13, 2018, China Copper, a wholly-owned subsidiary of our controlling shareholder, entered into a transfer agreement with Yunnan SASAC, pursuant to which Yunnan SASAC shall transfer its 51% equity interest in Yunnan Metallurgical Group Co., Ltd. to China Copper with no consideration. The transfer was approved by the SASAC on December 19, 2018, by the State Administration for Market Regulation on December 20, 2018 and by the CSRC on December 29, 2018. Chinalco completed the transfer on January 8, 2019. As Yunnan Aluminum, an affiliated company of Yunnan Metallurgical Group Co., Ltd., competes with us in the business segments of alumina and primary aluminum, on January 2, 2019, Chinalco, as the indirect controlling shareholder of Yunnan Aluminum and our direct controlling shareholder, issued a letter of undertakings on non-competition to us in order to address business competition and safeguard the legitimate interests of the Company and our minority shareholders. According to the letter of undertakings, Chinalco undertook to start in 2019 planning the integration of the businesses in which Yunnan Aluminum and we compete with each other, and address business competition between Yunnan Aluminum and us within five years.

Transfer of Primary Aluminum Capacity Quota of Shanxi Huasheng

On May 28, 2019, Shanxi Huasheng and Yixin Aluminum entered into a transfer agreement, pursuant to which Shanxi Huasheng agreed to sell to Yixin Aluminum the primary aluminum capacity quota of 190,000 tonnes at a total transfer consideration of RMB950 million and a transfer price of RMB5,000 per tonne. With the adjusted number of annual capacity quota finally determined by relevant PRC authority, we completed the transfer of the primary aluminum capacity quota of 170,000 tonnes to Yixin Aluminum with the total transfer consideration of RMB850 million in June 2019. We expect this transfer would help to reverse Shanxi Huasheng’s losses, achieve its transformation and upgrading, and optimize our industrial layout and asset structure.

Proposed Issuance of H Shares

On June 29, 2021, our shareholders at the 2020 annual general meeting passed a special resolution, which will remain valid until the earliest of (i) the conclusion of our next annual general meeting, (ii) the expiration of 12 months following the date of passing the resolution, or (iii) the date on which the authority set out in this resolution is revoked or varied by a special resolution at a general meeting. The resolution authorizes us to issue additional H Shares up to 20% of the number of H Shares in issue as of the resolution date. Our Board has been authorized to determine the use of the proceeds. The proposed issuance is subject to all the necessary approval by the CSRC and/or other relevant PRC government authorities.

Our Gallium Assets

On August 27, 2019, we entered into a capital contribution agreement with China Rare Metals and Rare Earths Company Ltd., a subsidiary of Chinalco, pursuant to which we agreed to make a capital contribution of RMB352,848,100 to China Rare Metals and Rare Earths Company Ltd. with our gallium assets. Upon completion of the transaction in August 2019, the shareholding proportion we held in China Rare Metals and Rare Earths Company Ltd. increased from 14.62% to 23.94%. In September 2021, we repurchased the gallium assets from three branches of China Rare Metals and Rare Earths Company Ltd for a cash consideration of RMB395,624,218.12.

Capital Contribution to Yixin Aluminum

On December 10, 2019, we entered into a capital contribution agreement with Yixin Aluminum and its shareholders, pursuant to which we agreed to make a capital contribution of RMB850 million in cash to Yixin Aluminum, which we paid in full in December 2019. Upon completion of the transaction, we held 38.90% equity interests of Yixin Aluminum. We expect this capital contribution to facilitate us in participating in the green development layout on the integration of hydropower and aluminum in Yunnan Province and obtaining competitive assets for our principal business.

Subscription for A Shares of Yunnan Aluminum

On December 19, 2019, we entered into a shares subscription agreement with Yunnan Aluminum, pursuant to which we agreed to subscribe through non-public offering for 314,050,688 A shares of Yunnan Aluminum at a price of RMB4.10 per share with the total subscription amount of RMB1,287,607,820.80. The subscription price of RMB4.10 per A share was determined through bidding and based on the minimum issuance price of the non-public offering by Yunnan Aluminum, which represented 90% of the average trading price of the shares in the 20 trading days prior to the first day of the issuance period, namely December 13, 2019. We paid the consideration in full and 314,050,688 A shares of Yunnan Aluminum were registered under our name in December 2019, representing approximately 10.04% of the total share capital of Yunnan Aluminum. Pursuant to the shares subscription agreement, we shall not transfer the subscribed A shares thereto within 36 months from the listing date. We expect our subscription for A shares of Yunnan Aluminum will help resolve business competitions between Yunnan Aluminum and us and is in line with our development strategies and in our interests as a whole.

On December 23, 2020 and March 16, 2021, we entered into a conditional shares subscription agreement and a supplemental agreement with Yunnan Aluminum, respectively, pursuant to which we agreed to subscribe for A shares of Yunnan Aluminum to be issued through non-public offering with the total subscription amount ranging from RMB200 million to RMB320 million. On December 2, 2021, we entered into a supplemental agreement with Yunnan Aluminum, pursuant to which we agreed to subscribe for 36,240,090 A shares of Yunnan Aluminum at a price of RMB8.83 per share with a total subscription amount of RMB319,999,994.70 and the subscription price per share is finally determined based on the results of enquiry. Upon completion of this subscription in December 2021, Yunnan Aluminum did not become a subsidiary of the Company.

B. Business Overview

Our Principal Products

We are a leading enterprise in the non-ferrous metal industry in China. In terms of comprehensive scale, we ranked among the top enterprises in the global aluminum industry. We have benefited from the development of the PRC aluminum market, the world's largest aluminum market. We refine bauxite into alumina, which is then smelted into primary aluminum. In addition to alumina and primary aluminum, we also produce and sell chemical alumina products (alumina hydrate and alumina-based industrial chemical products) and carbon products (carbon anodes and cathodes). We are also engaged in the trading and logistics of alumina, primary aluminum, other non-ferrous metal products, coal products and raw and ancillary materials in bulk manufactured by us or sourced from external suppliers domestically and abroad. In addition, we are engaged in coal mining and power generation. The remainder of our revenues was derived from research and development activities and other products and services. Accordingly, we organize and manage our operations in five business segments: alumina segment, primary aluminum segment, trading segment, energy segment and corporate and other operating segment. After elimination of inter-segment sales, revenues attributable to our alumina segment, primary aluminum segment, trading segment, energy segment, and corporate and other operating segment accounted for approximately 6.9%, 23.7%, 66.4%, 2.8% and 0.1%, respectively, of our total revenues in 2021.

Our alumina segment includes the mining and purchasing of bauxite and other raw materials, and production and sale of alumina as well as chemical alumina. Alumina accounted for approximately 93.1% of our total production volume for this segment in 2021. Chemical alumina products are used in the production of chemical, pharmaceutical, ceramic and construction materials. In the process of refining bauxite into alumina, we produce gallium as a by-product, which is a rare, high value metal with applications in the electronics and telecommunication industries.

Our primary aluminum segment includes the procurement of alumina, other raw materials, supplemental materials and electrical power, the production and sale of primary aluminum and aluminum-related products, such as carbon products, aluminum alloy products , renewable aluminum and other aluminum products. Our principal primary aluminum products are ingots, molten aluminum and aluminum alloys, which accounted for approximately 18.6%, 44.1% and 37.3%, respectively, of our total production volume of primary aluminum in 2021. Our standard 20 kilogram remelt ingots are used for general aluminum fabrication in the construction, electricity, electronics, transportation, packaging, machinery and durable goods industries. We internally produce substantially all the carbon products used at our smelters and sell our remaining carbon products to external customers.

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Our trading segment is mainly engaged in the trading of alumina, primary aluminum, aluminum fabrication products, other non-ferrous metal products, and crude fuels such as coal products, as well as supplemental materials and logistics and transport services to our internal manufacturing plants and external customers. We established our trading business under Chalco Trading as a separate segment in July 2010 as a result of our operational structural adjustment. Since 2014, we have established Chalco Materials, Chalco Logistics and Chalco Trading Group to continuously promote and deepen development of our trading business, jointly constituting our trading segment. Established in 2018, Chalco Trading Group has undertaken the businesses that used to be operated by Chalco Trading.

Our energy segment includes the research and development, production and operation of energy products, including coal mining and conventional coal-fire power generation as well as renewable energy generation such as wind power and solar power. We are also engaged in new energy equipment production. We established our energy segment in January 2013 as a result of our acquisition of Ningxia Energy in line with our development strategy to partially offset our future energy costs. In 2021, we supplied the majority of the electricity we generated for our own production use, supplied a portion of the coal output to our own electric power plant and sold the remaining portion to external customers. Ningxia Energy supplied the electricity it generated mainly to the state grid in China.

Our corporate and other operating segment mainly includes corporate and other aluminum-related research, development, and our other activities.

Our Production Capacity

As of December 31, 2021, our annual alumina production capacity and primary aluminum production capacity was approximately 20.86 million tonnes and 4.46 million tonnes, respectively. The following table sets forth the production capacity of each of our principal plants by business segment as of the indicated date:

Plant	As of December 31, 2021	
	Alumina	Primary Aluminum
	(in thousand tonnes)(1)	
Guangxi branch	2,210	—
Zhongzhou Aluminum	3,050	—
Qinghai branch	—	420
Guangxi Huasheng	2,000	—
Chalco Mining	2,410	—
Chalco Shandong	2,270	—
Shanxi New Material	2,600	424
Chongqing branch	800	—
Lanzhou Aluminum	—	450
Zunyi Aluminum	1,000	375
Shandong Huayu	—	65
Baotou Aluminum(2)	—	1,340
Zhengzhou Institute	20	—
Liancheng branch	—	550
Guizhou Huajin	1,600	—
Xinghua Technology	900	—
Shanxi Huaxing	2,000	—
Guizhou Huaren	—	400
Shanxi Zhongrun	—	432
Total	20,860	4,456

(1) Production capacity is calculated based on designed capacity, which takes into account various assumptions including downtime for ordinary maintenance and repairs, the ore grade of bauxite feedstock and subsequent capacity modifications.
(2) Including the primary aluminum production capacity of Inner Mongolia Huayun, a subsidiary of Baotou Aluminum.

In 2021, we produced approximately 16.23 million tonnes of alumina (excluding chemical alumina products), 4.12 million tonnes of chemical alumina products and 3.86 million tonnes of primary aluminum. Our production of alumina (with chemical alumina products included) and primary aluminum represented approximately 23.6% and 10.1%, respectively, of the total output of alumina (with chemical alumina products included) and primary aluminum in China in 2021.

The following table sets forth a breakdown of our production volume by product segment for the periods indicated:

Production Volume by Product	Year Ended December 31, 2019	2020	2021
	(in thousand tonnes, except Gallium)		
Alumina segment			
Alumina	13,803	14,526	16,229
Chemical alumina products	3,802	3,942	4,123
Gallium (in tonnes)(1)	98	95	137
Primary aluminum segment			
Primary aluminum(2)	3,788	3,695	3,863
Carbon	1,472	1,840	2,055

(1) As we repurchased our gallium assets in 2021 after disposal through capital contribution in 2019, we present the production volume as if we never disposed of our gallium assets. See "– A. History and Development of the Company – Our Gallium Assets" for details.
(2) Including ingots, molten aluminum and aluminum alloys.

Production Process

Alumina

Alumina is refined from bauxite, an aluminum-bearing ore, through a chemical refining process. The refining process applied is determined by the mineral composition of the bauxite used in production. Our refineries may employ the Bayer process, the Bayer-sintering series process, the Bayer-sintering combined process or the ore-dressing Bayer process. Most of the bauxite reserves in China contain diasporic bauxite, which contains high alumina content but relatively high silica content, resulting in bauxite reserves with low alumina-to-silica ratio. The Bayer process cannot efficiently refine diasporic bauxite that has not undergone processing to increase its alumina-to-silica ratio. The Bayer-sintering process and the Bayer-sintering combined process are suitable for refining low alumina-to-silica ratio bauxite. We have developed and improved these processes to increase our refining yield. In addition, we also produce some chemical alumina products (alumina hydrate and alumina-based industrial chemical products).

Primary Aluminum

We smelt alumina into primary aluminum through electrolytic reduction. The electrolytic process takes place in a reduction cell, or pot, a steel shell lined with carbon cathodes and refractory materials. Powerful electric currents are passed through the pot to produce molten aluminum. The molten aluminum is transferred to holding furnaces and then poured directly into molds to produce foundry ingots, or further refined to form fabricating ingots, which may be used directly in the aluminum fabrication process. The primary aluminum we produce is in the form of ingots, molten aluminum and aluminum alloys.

All of our primary aluminum smelters use pre-bake anode reduction pot-lines. In the pre-bake reduction process, the anodes are pre-formed in a separate facility where pollutants can be contained. The cells themselves are enclosed with removable panels so that the waste gas produced during the process can be extracted using large exhaust fans. Our waste gas is treated and purified to reduce dust and fluoride emissions to acceptable levels set by state environmental protection agencies.

Production Facilities

Alumina

We currently operate 11 alumina refineries and one research institute with a total designed annual production capacity of approximately 20.86 million tonnes as of December 31, 2021. Two of our refineries are integrated with primary aluminum smelters. In 2021, we produced approximately 16.23 million tonnes of alumina and approximately 4.12 million tonnes of chemical alumina products. The overall utilization rate for our refineries was 86% as of December 31, 2021.

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The following table sets forth the annual production capacity, output of alumina and chemical alumina products, utilization rate and production process applied in each of our alumina refineries and our Zhengzhou Institute:

	As of December 31, 2021		For the Year Ended December 31, 2021		
	Annual Production Capacity(1)	Utilization Rate(2)	Alumina Production Output	Chemical Alumina Products Output	Production Process
	(in thousand tonnes, except percentages)				
Shanxi New Material	2,600	62 %	1,570	70	Bayer-sintering
Chalco Mining	2,410	74 %	1,363	36	Bayer-sintering
Chalco Shandong	2,270	100 %	1,615	2,666	Sintering and Bayer
Zhongzhou Aluminum	3,050	84 %	2,027	1,054	Sintering and Bayer
Guangxi branch	2,210	100 %	2,288	185	Bayer
Zunyi Aluminum	1,000	100 %	1,043	10	Bayer
Chongqing branch(3)	800	0 %	—	—	Bayer-sintering
Zhengzhou Institute(4)	20	0 %	—	27	Bayer
Guizhou Huajin	1,600	100 %	1,631	—	Bayer
Xinghua Technology	900	100 %	962	15	Bayer
Shanxi Huaxing	2,000	100 %	1,591	—	Bayer
Guangxi Huasheng	2,000	100 %	2,140	60	Bayer
Total	20,860	86 %	16,229	4,123	

(1) Production capacity is calculated based on designed capacity, which takes into account various assumptions including downtime for ordinary maintenance and repairs, the ore grade of bauxite feedstock and subsequent capacity modifications.
(2) Capacity utilization rate is calculated by dividing our utilized production capacity as of the date indicated by our total designed annual production capacity.
(3) Since 2018, we have leased the alumina production facilities of our Chongqing branch to a third party.
(4) The chemical alumina products produced at our Zhengzhou Institute are sold commercially and such sales are included in our total revenues.

Primary Aluminum

We operate nine primary aluminum smelters in China. Our smelters had an aggregate annual production capacity of approximately 4.46 million tonnes as of December 31, 2021.

In 2021, we produced approximately 3.86 million tonnes of primary aluminum and the average utilization rate for our smelters was 86% as of December 31, 2021. The following table sets forth the annual production capacity, aluminum output, utilization rate and smelting equipment used in each of our aluminum smelters:

	As of December 31, 2021		For the Year Ended December 31, 2021	
Plant	Annual Production Capacity(1)	Utilization Rate(2)	Aluminum Output(3)	Smelting Equipment
			(in thousand tonnes, except percentages)	
Baotou Aluminum(4)	1,340	99 %	1,276	200Ka, 240Ka, 400Ka and 500Ka pre-bake
Lanzhou Aluminum	450	99 %	415	200Ka and 350Ka pre-bake
Qinghai branch	420	99 %	404	180Ka and 210Ka pre-bake
Shandong Huayu(5)	65	0 %	—	240Ka pre-bake
Shanxi New Material	424	84 %	298	300Ka pre-bake
Zunyi Aluminum	375	92 %	398	200Ka and 400Ka pre-bake
Liancheng branch	550	28 %	151	200Ka and 500Ka pre-bake
Guizhou Huaren	400	92 %	437	500Ka
Shanxi Zhongrun	432	100 %	484	500Ka
Total	4,456	86 %	3,863	

(1) Production capacity takes into account designed capacity, downtime for ordinary maintenance and repairs and subsequent capacity modifications.

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(2) Capacity utilization rate is calculated by dividing our utilized production capacity as of the date indicated by our total designed annual production capacity.
(3) Includes ingots, molten aluminum and aluminum alloys.
(4) Including the primary aluminum production facilities at Inner Mongolia Huayun, a subsidiary of Baotou Aluminum.
(5) Shandong Huayu halted its primary aluminum production since 2019. See "- Principal Facilities – Shandong Huayu" for details.

Raw Materials

Alumina

Bauxite is the principal raw material in alumina production. Most of the bauxite in China is monohydrate, consisting mainly of aluminosilicate compounds. Bauxite deposits have been discovered across a broad area of central China and are especially abundant in the southern and northern parts of central China. The largest bauxite deposit in China lies in the Shanxi Province.

Rock Formation and Mineralization. Except for our Guangxi Pingguo mine which is an accumulation deposit due to original erosion, the bauxite deposits of our mines in China usually have similar stratigraphic sequences. Primary bauxite deposit, as a type of sedimentary boehmite ($Al_2O_3.H_2O$) of the Carboniferous or Permian age, is contained in clay rock, limestone or coal seams. A zonary red shale is usually located at the bottom of the bauxite and the red seam distributes over the irregular "karst-type" erosion face on the top of Ordovician limestone. Aluminum deposits in northern China are usually covered with a very thick Quaternary weathering.

The thickness and quality of deposits vary with our mine locations. Quality is usually consistent in smooth sections but changes sharply in karst "billabong" terrain. The level of hardness of minerals also varies. A sequence that includes a seam of hard bauxite of fine quality in the middle and soft bauxite of inferior quality on the bottom and top seams is common in deposits.

Generally, deposits are horizontal or with an obliquity of 0 to 8 degrees, but there are also steep deposits at an angle of 75 degrees, such as in our Guizhou mine. Most of the original mineralization is not influenced by folds and faults, and some fractures of a low obliquity and folds emerge in certain deposits, which is evident in the Guizhou mine area. In most of the Guizhou mine area, the underground mining method must be used due to the obliquity of its bauxite body reaching 70 degrees with the influence of folds and several meters of dislocation arising from partial faults.

Economic Significance. Our bauxite deposits in China are divided into three groups. They are primarily distinguished by drill hole spacing and the composition of the deposit, which can encompass rock formations such as intercalated clays, bauxite, footwall iron clay or Ordovician limestone. Bauxite deposit groups vary in the thickness and mineral quality of its reserves.

We use the Chinese bauxite deposit estimation method, which is calculated using cut-off grades and thickness to outline continuous areas within the limits defined by samples of marginal grade. We utilize actual limiting sample points that are joined to create a polygonal outline, and grades are then calculated using a length weighted arithmetic average. We believe that the Chinese bauxite deposit estimation method of test boring, inspection pit, trial trench, density, tonnage analysis and calculation applied to the geological work of bauxite in China is an appropriate method to analyze these types of deposits.

Supply. To support the growth of our alumina production, we continuously seek opportunities to streamline and optimize our bauxite procurement. Except for Chalco Shandong, all of our refineries are located in the four provinces where over 90% of China's potentially mineable bauxite has been found. We generally source our domestic bauxite from mines close to our refineries to control transportation costs. Historically, we have procured our bauxite supply principally from three sources:

- our own bauxite mining operations, which include the mining operations of the Boffa mine in Guinea since 2020;
- jointly-operated mines; and
- other suppliers, which principally include small independent mines in China and international suppliers.

On average, our refineries consumed approximately 2.4 tonnes of bauxite to produce one tonne of alumina in 2021. Our mines supplied approximately 28.1 million tonnes of bauxite to our refineries in 2021. We purchase bauxite from a number of suppliers and do not depend on any supplier for our bauxite requirements.

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The following table sets forth the volumes and percentages of bauxite supplied by our own mines and other suppliers for the periods indicated:

	Year Ended December 31,					
	2019		2020		2021	
	Bauxite Supply	Percentage of Bauxite Supply	Bauxite Supply	Percentage of Bauxite Supply	Bauxite Supply	Percentage of Bauxite Supply
		%	(in thousand tonnes, except percentages)	%		%
Own mines(1)	14,791.2 (2)	37.6	20,498.3	46.4	28,140.0	63.5
Other suppliers	24,499.9	62.4	23,723.2	53.6	16,204.3	36.5
Total	39,291.1	100.0	44,221.5	100.0	44,344.3	100.0

(1) Including the bauxite supplied by the Boffa mine in Guinea since 2020.
(2) In 2019, bauxite supplied by our own mines exceeded the bauxite output from our own mines because we supplied certain inventory of bauxite extracted prior to 2019.

Own Mines. As of December 31, 2021, we owned and operated 14 mines in China that had approximately 173.01 million tonnes of aggregate bauxite reserves. In addition, we own Boffa mine in Guinea, which had approximately 111.69 million tonnes of total bauxite reserves as of December 31, 2021. In 2019, 2020 and 2021, we extracted approximately 14.4 million tonnes, 17.2 million tonnes and 16.0 million tonnes, respectively, of bauxite from our domestic mines. In addition, in 2020 and 2021, we extracted approximately 8.1 million tonnes and 12.3 million tonnes of bauxite from the Boffa mine, respectively. We continue to explore new bauxite reserves to replenish our reserves. Please refer to "– Our Mines" for further details of our own bauxite mines.

Other Suppliers. In addition to our mines, we also source bauxite from other suppliers. The majority of other domestic suppliers are small independent mines. Small independent mines are not affiliated with us and generally have annual bauxite production capacities not exceeding 200,000 tonnes. These mines have been an important source of bauxite for our operations. We purchase bauxite directly from small independent mines or through local distributors that procure bauxite from these mines. In addition, we also secure a portion of bauxite overseas. In 2021, bauxite secured from other suppliers accounted for approximately 36.5% of our total bauxite supply, primarily because our demand for bauxite exceeded the production of our mines.

Bauxite Procurement. The production and quality management department at our headquarters is responsible for the oversight and coordination of our supply of bauxite in general. The sales and marketing department is responsible for management and coordination of procurement of imported bauxite. To determine how our bauxite requirement will be allocated among our principal sources each year, we first estimate our total bauxite needs for the year. Based on market conditions, production costs and other factors, we determine the amount of bauxite that we wish to source from our mines, and the remaining requirements from other suppliers.

Alumina-to-Silica Ratio. The production method for alumina refining is determined by the mineral composition of the bauxite, in particular, its alumina-to-silica ratio. Most of the bauxite reserves in China are diasporic with low alumina-to-silica ratios. Based on our current technology and economic considerations, an efficient application of the Bayer process requires bauxite with an alumina-to-silica ratio of 4.5:1 or higher, while the Bayer-sintering process can refine bauxite with an alumina-to-silica ratio as low as 4:1. In 2021, the average alumina-to-silica ratio of the proven and probable reserves of our mines ranges from approximately 3.73:1 to 34.16:1.

Prices. There is neither governmental regulation on bauxite prices nor an official trading market for bauxite in China. We negotiate bauxite prices with our suppliers based on ore quality, mining costs, market conditions, transportation costs and various governmental taxes or levies, including a resource tax imposed by local governments. Our total bauxite cost is currently influenced by the following factors:

- the cost of our mining operations;
- the market conditions relating to purchases from small independent mines; and
- the market conditions relating to purchases from overseas.

The average purchase price of bauxite per tonne from our other suppliers in 2021 decreased by approximately 6.2% to RMB386.83 compared to 2020, primarily because (i) with higher bargaining power due to less reliance on external bauxite suppliers, we were able to procure bauxite from external suppliers with a lower price in 2021, and (ii) the international freight decreased in 2021, in each case compared to that in 2020. The average cost of bauxite per tonne from our own mines is mainly related to the cost of our bauxite mining operations and transportation costs. In 2021, the average cost of bauxite per tonne from our own mines increased by approximately 6.3% to RMB299.03 compared to 2020, mainly due to increase of the cost of our bauxite mining operations.

We purchase a substantial amount of bauxite to satisfy our alumina production needs. Additionally, to fully utilize the bauxite from our mines, we refine all bauxite that meets the minimum technical requirements for our production of alumina. We also purchase higher-grade ore from other suppliers and blend the ore of various grades to meet the technical requirements for our alumina production. This practice allows for flexibility and the inclusion of lower-grade bauxite to optimize the use of bauxite deposits available to us.

Primary Aluminum

An average of approximately 1.91 tonnes of alumina and 13,361 kWh of electricity was required to produce one tonne of primary aluminum ingots in 2021.

Alumina and electricity, the two principal components of costs in the smelting process, accounted for approximately 40% and 37%, respectively, of our unit primary aluminum production costs in 2021. Apart from alumina and electricity, we also require carbon anodes, carbon cathodes, fluoride salt and cryolite for our smelting operations.

Alumina is the main raw material used in the production of primary aluminum. Our primary aluminum plants that do not have integrated alumina refining operations onsite obtain alumina internally from our alumina refineries located elsewhere or externally on the market.

Our Mines

Overview of Our Mining Properties and Operations

As of December 31, 2021 and up to the date of this annual report, our mining operations are primarily related to bauxite mines and also cover certain coal mines.

Bauxite Mines

As of December 31, 2021, we owned and operated 14 bauxite mines in China and one bauxite mine in Guinea. In accordance with the requirements of Regulation S-K 1300, we consider our Boffa mine in Guinea as the sole mining property that is material to our business. Please refer to "– D. Property, Plants and Equipment – Boffa Mine" for more details of Boffa mine and refer to Exhibit 96.1 for the technical report summary that has been prepared for Boffa mine in accordance with Regulation S-K 1300 and Item 601(b)(96) of Regulation S-K, or the Technical Report Summary.

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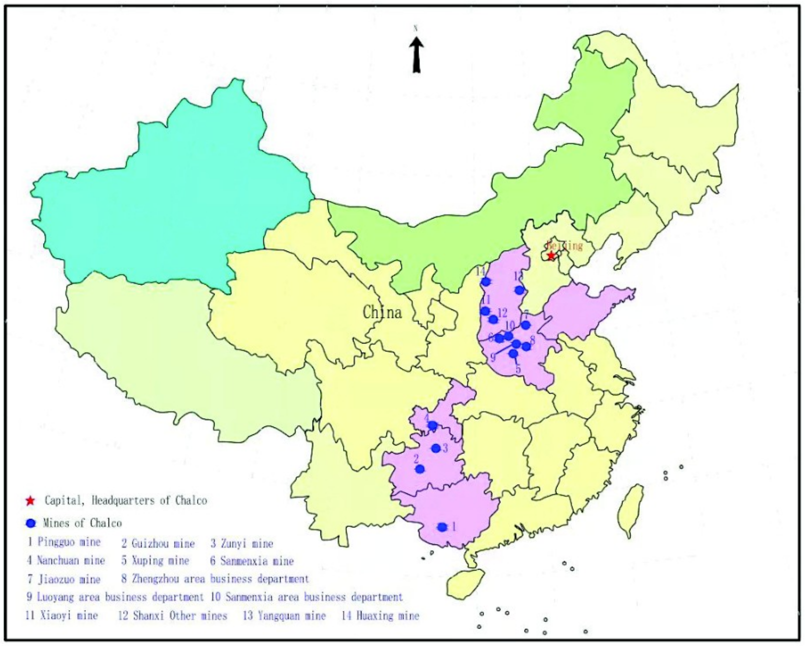
The following map shows the locations of our 14 bauxite mines in China.



Bauxite Mines in China

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The following table sets forth information for our bauxite mines as of December 31, 2021 and the annual production for the three years ended December 31, 2021:

				Mining Permit[1]		Exploration Permit[1]			Bauxite Production (in Thousand tonnes)			
Mine	**Location**	**Amount of ownership intersests and Operator**	**Mining method**	**Mining permit renewal**	**Area (km^2)**	**Exploration permit renewal**	**Area (km^2)**	**Stage**	**2019**	**2020**	**2021**	**Processing plants and facilities [2]**
Pingguo mine	Guangxi Zhuang Autonomous Region, China	100% owned and operated by Chalco (Guangxi branch)	Open pit	March 2024 – April 2036	229.70	November 2021[3] –January 2022	82.05	Partially production and partially exploration	5,988	5,806	5,531	Washing and crushing system
Guizhou mine[4]	Guizhou Province, China	100% owned and operated by Chalco (Guizhou branch)	Open pit/underground	October 2024 – December 2038	34.93	N/A	N/A	Production	1,921	2,000	1,962	Crushing system
Zunyi mine	Guizhou Province, China	Owned and operated by Zunyi Aluminum, a 67.45% subsidiary of Chalco	Open pit/underground	July2026 – May 2031	17.28	December 2020 – June 2026	6.25	Partially production and partially exploration	904	1,003	1,004	Crushing system
Nanchuan mine	Chongqing Municipality, China	100% owned and operated by Chalco (Chongqing branch)	Underground	December 2022 – November 2026	10.25	N/A	N/A	Production suspended	0	0	0	Crushing system
Xuping mine[5]	Henan Province, China	100% owned and operated by Chalco (Zhongzhou Aluminum)	Open pit/underground	May 2019 – September 2031	34.63	N/A	N/A	Production	172	277	168	Crushing system
Sanmenxia mine	Henan Province, China	100% owned and operated by Chalco (Zhongzhou Aluminum)	Underground	May 2025 – February 2035	13.03	N/A	N/A	Production	445	507	170	Crushing system
Jiaozuo mine	Henan Province, China	100% owned and operated by Chalco (Zhongzhou Aluminum)	Open pit/underground	September 2018 – October 2024	17.07	N/A	N/A	Production	111	388	335	Crushing system
Zhengzhou area business department[5]	Henan Province, China	100% owned and operated by Chalco (Chalco Mining)	Open pit/underground	June 2021– October 2031	58.98	N/A	N/A	Production	601	853	922	Crushing system
Luoyang area business department[5]	Henan Province, China	100% owned and operated by Chalco (Chalco Mining)	Open pit/underground	June 2022 – October 2031	7.30	July 2017 – March 2027	29.59	Partially production and partially exploration	379	753	741	Crushing system
Sanmenxia area business department[5]	Henan Province, China	100% owned and operated by Chalco (Chalco Mining)	Open pit/underground	December 2020 – October 2031	14.53	February 2021 – February 2026	5.51	Partially production and partially exploration	375	400	337	Crushing system
Xiaoyi mine	Shanxi Province, China	100% owned and operated by Chalco (Shanxi New Material[6])	Open pit	June 2018 – September 2031	24.67	N/A	N/A	Production	843	499	999	Crushing system
Shanxi Other Mines	Shanxi Province, China	100% owned and operated by Chalco (Shanxi New Material[6])	Open pit/underground	September 2017 – July 2035	41.64	July 2013- January 2023	21.07	Partially production and partially exploration	560	1,523	1,135	Crushing system
Yangquan mine	Shanxi Province, China	100% owned and operated by Chalco (Chalco Shandong)	Open pit	September 2031 – May 2036	5.78	N/A	N/A	Production	133	426	429	Crushing system
Huaxing mine	Shanxi Province, China	100% owned and operated by Chalco (Shanxi Huaxing)	Underground	September 2020[3] – August 2022	17.44	November 2021 – December 2022	13.49	Partially production and partially exploration	2,018	2,768	2,278	Crushing system
Boffa mine[7]	Boffa, Guinea	Owned and operated by Chalco Guinea Company S.A., an 85% subsidiary of Chalco	Open pit	July 2018 – July 2033	1,248.16	N/A	N/A	Production	0	8,062	12,303	Various facilities [7]
Total					**1,775.40**		**157.96**		**14,441**	**25,265**	**28,314**	

(1) All conditions to retain our properties or leases have been fulfilled as of December 31, 2021. Each mine may be covered by one or more mining permits and/or exploration permits and the range of permit renewal dates is set forth above.

(2) We have modern facilities at our bauxite mines in China, which were designed by professional PRC mine design institutes and adhere to international standards. Our bauxite mines are either open pit or underground. Our bauxite mines generally have mining offices and transportation facilities that have access to local roads and highways. In addition, we utilize advanced heavy equipment such as bulldozers and scrapers. All of our mining facilities in China are connected to the local or regional electric power grids. Our mining facilities are also connected to reliable water sources, all of which were sufficient for the requirements of each individual mine. For details of the processing plants and other available facilities for these mines, see "– Principal Facilities."

(3) We are in the process of renewing these permits.

(4) Including both Guizhou No. 1 mine and Guizhou No. 2 mine throughout this annual report.

(5) To enhance our mine management system and improve management efficiency and coordination, in 2020, Mianchi mine was renamed as Sanmenxia area business department; Luoyang mine was renamed as Luoyang area business department; Xiaoguan mine, Gongyi mine, Dengfeng mine and Xinmi mine were integrated as Zhengzhou area business department; and Xuchang mine and Pingdingshan mine were integrated as Xuping mine. These new names are used throughout this annual report.

(6) As disclosed in "– C. Organizational Structure," Chalco does not own 100% ownership interests of Shanxi New Material. Nevertheless, Chalco holds the permits for 100% interests of Xiaoyi mine and Shanxi Other Mines while Shanxi New Material is the operator of these mines.

(7) For details of our sole individually material mining property, Boffa mine, please refer to "– D. Property, Plants and Equipment – Boffa Mine."

For the years ended December 31, 2019, 2020 and 2021, we extracted approximately 14.4 million tonnes, 17.2 million tonnes and 16.0 million tonnes, respectively, of bauxite from our domestic mines. In addition, in 2020 and 2021, we extracted approximately 8.1 million tonnes and 12.3 million tonnes of bauxite from the Boffa mine, respectively. The decrease in the volume of bauxite extracted from our domestic mines in 2021 was primarily because (i) some of the mine resources depleted and the replacements failed to meet the previous output in a timely manner, (ii) safety and environmental protection control standards improved in some regions where certain mines were located, (iii) we proactively reduced the production of a small number of mines with low-grade ore. The increase in the volume of bauxite extracted from Boffa mine in 2021 was primarily because our Boffa mine entered into normal operation stage for the full year of 2021.

We hold the requisite mining permit for three bauxite mines (i.e. PT ALUSENTOSA, PT KALMIN and PT VISITAMA) in West Kalimantan, Indonesia through our 96.28% owned subsidiary, PT Nusapati Prima. Our bauxite deposits in Indonesia are lateritic gibbsite and were formed by weathering and leaching of aluminum-rich silicate rock in tropical climates. We have suspended our bauxite mining in Indonesia since September 2014 due to restraints on export of bauxite imposed by the Indonesian government. Since 2017, the Indonesian government has issued, and amended from time to time, relevant rules pursuant to which export of bauxite may be allowed upon satisfaction of certain requirements. We have been actively exploring the possibility of meeting these requirements. However, Indonesia plans to stop the exports of bauxite in 2022. We do not expect to engage in exploration, development or production of bauxite on PT ALUSENTOSA, PT KALMIN or PT VISITAMA mines in the near future. Our mines in Indonesia have access to local roads. The mineral resources and mineral reserves of PT ALUSENTOSA, PT KALMIN and PT VISITAMA are also not available.

We are required to obtain mining rights permits to conduct mining activities. Under PRC laws and regulations, a mining enterprise must prepare and submit exploration reports for a mine to the local government to obtain a mining rights permit for a mine. A mining right owner is also permitted to lease the mining right through a lease arrangement. The mining rights permit is subject to renewal on a regular basis.

Furthermore, the mining right owner is required to obtain land use rights on the land in order to operate the mines. We lease the land use rights relating to our mines in China from Chinalco pursuant to a land use rights lease agreement that became effective upon our formation. Chinalco's land use rights relating to over 90% of our mining properties in China are for 50-year terms beginning on July 1, 2001. The remaining land use rights relating to other mines in China are for shorter terms, some as short as one year. All of our land use rights lease agreements end on the expiry date of the mining rights or the end of the working life of the mine, whichever is earlier. Both the land use rights and land use rights lease agreements are renewable.

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The following table sets forth our capital expenditures for our bauxite mines for the periods indicated:

	Year Ended December 31,		
	2019	2020	2021
	(RMB in thousands)		
Capital Expenditures			
Infrastructure construction	1,314,802.9	831,375.0 (1)	279,536.0 (1)
Facility upgrade	6,079.8	— (2)	—
Total	1,320,882.7	831,375.0	279,536.0

(1) The decreases in capital expenditures on infrastructure construction in 2020 and 2021 were primarily attributable to the completion of construction of the Boffa Project in April 2020. See "– A. History and Development of the Company – Boffa Project" for more details.

(2) The decrease in capital expenditures on facility upgrade in 2020 was primarily because our technology transformation projects had been completed and we did not have any new technology transformation projects in 2020.

Coal Mines

As of December 31, 2021, our non-wholly owned subsidiaries owned and operated five coal mines in China.

We completed the acquisition of 70.82% of the equity interest in Ningxia Energy in January 2013, which holds mining rights or exploration rights for certain coal deposits in Ningxia Autonomous Region. The coal mines directly owned and operated by Ningxia Energy include Wangwa mine, Wangwa No.2 mine and Yindonggou mine. In addition, Ningxia Energy holds 50% of interest in Ningxia Yinxing Coal Industry Co., Ltd., which owns and operates Yinxingyijing mine. As the other 50% owner of in Yinxingyijing mine does not participate in its operation, Ningxia Energy is able to control its operation and consolidate its financial statements. Each of Wangwa mine, Wangwa No.2 mine, Yindonggou mine and Yinxingyijing mine is an underground thermal coal mine in extraction stage. The operations at these coal mines are powered by electricity from local power grids and are accessible by public roads. For the year ended December 31, 2021, Ningxia Energy incurred capital expenditures of approximately RMB360.4 million on infrastructure construction.

We acquired 70% of the equity interest in Gansu Huayang in March 2011, which holds exploration rights for a portion of Luochuan mine in Gansu Province. We renewed the exploration permit in 2020, which will expire in October 2025. We are in the process of applying for the exploration permit for the rest of Luochuan mine. Luochuan mine is an underground mine. We have completed the exploration but have not commenced development of Luochuan mine.

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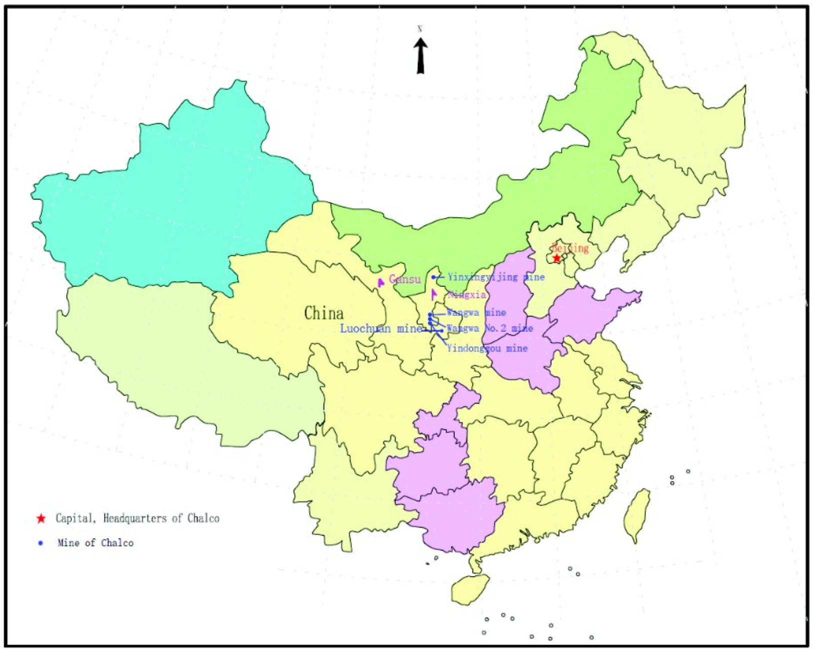
The following map shows the locations of five coal mines of our subsidiaries in China.



Coal Mines in China

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The following table sets forth information for five coal mines owned and operated by our subsidiaries as of December 31, 2021 and the annual production for the three years ended December 31, 2021:

Mine	Location	Amount of ownership and Operator	Mining method	Mining Permit/ Exploration Permit	Area (km^2)	Coal Production (in thousand tonnes) Stage	2019	2020	2021	Processing plants and facilities
Wangwa mine	Ningxia Autonomous Region, China	Owned and operated by Ningxia Energy, a 70.82% subsidiary of Chalco	Mining well	October 2021 – November 2046	23.97	Production	1,846.3	3,953.2	1,792.8	Coal preparation plant with capacity of 12 million tonnes/y
Wangwa No.2 mine	Ningxia Autonomous Region, China	Owned and operated by Ningxia Energy, a 70.82% subsidiary of Chalco	Mining well	October 2021 – June 2031	8.72	Production	2,978.6	2,913.6	2,977.2	Coal preparation plant with capacity of 12 million tonnes/y
Yindonggou mine	Ningxia Autonomous Region, China	Owned and operated by Ningxia Energy, a 70.82% subsidiary of Chalco	Mining well	July 2016 – July 2036	2.79	Production	2,958.1	2,254.6	1,580.8	Coal preparation plant with capacity of 12 million tonnes/y
Yinxingyijing mine	Ningxia Autonomous Region, China	Owned and operated by Ningxia Yinxing Coal Industry Co., Ltd., 50% subsidiary of Ningxia Energy	Mining well	February 2018 – February 2048	60.42	Production	3,008.2	2,081.0	1,890.5	Coal preparation plant with capacity of four million tonnes
Luochuan mine	Gansu Province, China	Owned and operated by Gansu Huayang, a 70% subsidiary of Chalco	Mining well	October 2020 – October 2025	260.13	Exploration	—	—	—	N/A
Total					**356.03**		**10,791.2**	**11,202.4**	**8,241.3**	

In addition to the coal mines above, as of December 31, 2021, we held minority interests in certain other coal mines owned or operated by our joint ventures and associates, including Xuehugou Coal Industry Co., Ltd., Huasheng Wanjie Coal Co., Ltd., Guizhou Yuneng Mining Co., Ltd., Shanxi Jiexiu Xinyugou Coal Industry Co., Ltd., Qinghai Province Energy Development (Group) Co., Ltd., Shaanxi Chengcheng Dongdong Coal Co., Ltd., Guizhou Chalco Hengtaihe Mining Co., Ltd. (formerly known as Chalco Liupanshui Hengtaihe Mining Co., Ltd.) and Huozhou Coal Group Xingshengyuan Coal Co., Ltd. The coal mines owned or operated by these joint ventures and associates are individually and collectively immaterial to our business operations and financial condition. The mineral resources and mineral reserves of these coal mines are not available.

Our Mineral Resources and Reserves

Our estimates of mineral resources and mineral reserves have been prepared in accordance with the disclosure requirements of Regulation S-K 1300. As a result of the SEC's revised disclosure requirements for mining registrants, we replaced our previous estimate of reserves with estimates of mineral resources and mineral reserves in accordance with Regulation S-K 1300.

With respect to our bauxite mines, we, through CINF Engineering Co., Ltd., engaged Mr. Shengfa Tu, a fellow of Australasian Institute of Mining and Metallurgy, as the qualified person as defined under Regulation S-K 1300. Mr. Tu is not our employee. He is an external consultant of CINF Engineering Co., Ltd., a wholly-owned subsidiary of China Aluminum International Engineering Corporation Limited, in which our controlling shareholder Chinalco owns 73.56% interests. The scientific and technical information concerning our mineral resources and mineral reserves of bauxite mines in this annual report has been reviewed and approved by Mr. Tu. In addition, with respect to Boffa mine, our sole individually material mining property, Mr. Tu has prepared the Technical Report Summary in accordance with Regulation S-K 1300 and Item 601(b)(96) of Regulation S-K, filed as Exhibit 96.1 to this annual report.

With respect to our coal mines, we engaged Mr. Wen Chen, a member of Geological Society of China, as the qualified person as defined under Regulation S-K 1300. Mr. Chen is not our employee. He is employed by Ningxia Coal Mine Geological Bureau, which is a non-profitable organization not affiliated with us. The scientific and technical information concerning our mineral resources and mineral reserves of coal mines in this annual report has been reviewed and approved by Mr. Chen.

For discussion of risks associated with our estimates of mineral resources and mineral reserves, please refer to "Item 3. Key Information – D. Risk Factors – Estimates of mineral reserves and mineral resources are uncertain and the volume and grade of minerals actually extracted may vary from our estimates."

As used in this annual report, the terms "mineral resource," "measured mineral resource," "indicated mineral resource," "inferred mineral resource," "mineral reserve," "proven mineral reserve" and "probable mineral reserve" are defined and used in accordance with Regulation S-K 1300. In addition, all disclosure of mineral resources and reserves in this annual report is only for the portion of the resources or reserves attributable to Chalco's interest in the mining properties.

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Summary of Mineral Resources

A "mineral resource" is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade, or quality and quantity that there are reasonable prospects for eventual economic extraction. A mineral resource is a reasonable estimate of mineralization, taking into account relevant factors such as cut-off grade, likely mining dimensions, location or continuity, that, with the assumed adjustifiable technical and economic conditions, is likely to, in whole or in part, become economically extractable. It is not merely an inventory of all mineralization drilled or sampled. A "measured mineral resource" is a resource for which the quantity and grade are estimated from detailed, closely spaced sampling, and geologic characterization that defines the size, shape, depth and mineral content to a high degree of confidence. An "indicated mineral resource" is a resource for which quantity and grade are estimated from information similar to that used for measured mineral resources where the samples are farther apart, and the geological characterization is adequate. An "inferred mineral resource" is a resource for which quantity and grade are estimated from information similar to that used for measured and indicated mineral resources, but with limited geological evidence and sampling. Inferred mineral resource grade and mineralization continuity have a lower degree of confidence. Accordingly, no assurance can be given that the estimated mineral resources not included in mineral reserves will become proven and probable mineral reserves. The measured, indicated, and inferred resource figures presented herein are estimates based on information available at the time of calculation and are exclusive of reserves.

The following table sets forth certain estimated details of the measured, indicated and inferred resources, exclusive of mineral reserves, for our bauxite mines as of December 31, 2021:

	Measured Resources				Indicated Resources				Measured and Indicated Resources				Inferred Resources			
Mine	**Tonnage *(in million tonnes)***	**Al_2O_3 *(%)***	**SiO_2 *(%)***	**A/S(1)**	**Tonnage *(in million tonnes)***	**Al_2O_3 *(%)***	**SiO_2 *(%)***	**A/S(12)**	**Tonnage *(in million tonnes)***	**Al_2O_3 *(%)***	**SiO_2 *(%)***	**A/S(12)**	**Tonnage *(in million tonnes)***	**Al_2O_3 *(%)***	**SiO_2 *(%)***	**A/S(1)**
Pingguo mine	1.86	52.28	4.07	12.85	2.43	49.97	3.83	13.04	4.29	50.97	3.93	12.96	3.01	50.68	4.00	12.67
Guizhou mine	/	/	/	/	0.37	66.20	9.74	6.80	0.37	66.20	9.74	6.80	69.75	65.80	7.72	8.52
Zunyi mine	0.07	63.55	13.41	4.74	0.67	63.65	7.51	8.48	0.74	63.64	8.05	7.91	8.5	60.43	9.65	6.26
Nanchuan mine	/	/	/	/	6.35	62.51	11.17	5.59	6.35	62.51	11.17	5.59	1.14	63.71	14.50	4.39
Xuping mine	/	/	/	/	0.99	60.19	14.46	4.16	0.99	60.19	14.46	4.16	8.58	63.08	12.23	5.16
Sanmenxia mine	0.80	66.59	9.90	6.72	4.70	65.42	11.27	5.81	5.51	65.59	11.07	5.93	9.51	68.03	9.50	7.16
Jiaozuo mine	0.25	63.56	12.17	5.22	0.06	60.49	13.00	4.65	0.31	62.98	12.32	5.11	1.58	60.44	14.25	4.24
Zhengzhou area business department	0.19	67.98	9.27	7.34	2.37	66.17	9.69	6.83	2.56	66.31	9.66	6.87	12.47	64.35	12.09	5.32
Luoyang area business department	3.46	63.27	13.42	4.71	9.25	63.32	13.03	4.86	12.71	63.31	13.14	4.82	9.57	63.16	13.25	4.77
Sanmenxia area business department	2.34	64.76	12.21	5.30	6.43	64.15	12.50	5.13	8.77	64.31	12.42	5.18	11.02	64.11	12.46	5.15
Xiaoyi mine	/	/	/	/	0.79	64.72	12.39	5.22	0.79	64.72	12.39	5.22	5.99	64.00	12.82	4.99
Shanxi Other Mines	1.47	65.72	12.15	5.41	4.74	65.12	12.27	5.31	6.22	65.26	12.24	5.33	24.37	64.99	12.38	5.25
Yangquan mine	/	/	/	/	0.02	61.35	13.28	4.62	0.02	61.35	13.28	4.62	1.70	59.55	12.36	4.82
Huaxing mine	7.81	61.40	7.45	8.24	30.03	61.02	6.87	8.88	37.84	61.10	6.99	8.74	21.77	61.69	7.06	8.73
Boffa mine(2)	58.97	37.51	1.29	29.13	66.92	37.84	1.19	31.92	125.89	37.68	1.23	30.56	1,535.77	39.02	1.09	35.93
Total	**77.22**				**136.12**				**213.36**				**1,724.73**			

(1) Refers to the ratio of average grade of Al_2O_3 to the average grade of SiO_2 of the reserves.

(2) Alumina for the Boffa mine is stated as available alumina (AAl_2O_3) and Silica is stated as reactive silica ($RSiO_2$). For details of Boffa mine, please refer to "– D. Property, Plants and Equipment – Boffa Mine."

(3) Estimation of mineral resources of our bauxite mines other than Boffa mine is based on the following per tonne price, which is the five-year average sales price of bauxite from the respective mines between 2017 and 2021: RMB300-320 for Pingguo mine, RMB300-350 for Guizhou mine, Zunyi mine and Nanchuan mine, RMB400-450 for Yangquan mine, RMB450-500 for Xuping mine, Sanmenxia mine, Jiaozuo mine, Sanmenxia area business department and Luoyang area business department, RMB500-550 for Zhengzhou area business department, Xiaoyi mine, Shanxi Other Mines and Huaxing mine. Since each of these mines may contain multiple mining areas for which the qualified person used slightly different prices when estimating the mineral resources of different areas, the prices above are stated as a range. The point of reference selected by the qualified person is the point where bauxite is delivered to ore storage yard and available for use by alumina refineries.

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The following table sets forth certain estimated details of the measured, indicated and inferred resources, exclusive of mineral reserves, for our four coal mines as of December 31, 2021:

	Measured Resources			Indicated Resources			Measured and Indicated Resources			Inferred Resources		
Mine[(1)]	**Tonnage**	**Heat Value (MJ/kg)**	**Coal ash (%)**	**Tonnage**	**Heat Value (MJ/kg)**	**Coal ash (%)**	**Tonnage**	**Heat Value (MJ/kg)**	**Coal ash (%)**	**Tonnage**	**Heat Value (MJ/kg)**	**Coal ash (%)**
	(in ten thousand tonnes)			*(in ten thousand tonnes)*			*(in ten thousand tonnes)*			*(in ten thousand tonnes)*		
Wangwa mine	1,805.15	24.85	16.10 %	921.57	24.85	16.10 %	2,726.73	24.85	16.10 %	7,001.05	24.85	16.10 %
Wangwa No.2 mine	2,128.46	26.11	12.98 %	1,436.45	26.11	12.98 %	3,564.91	26.11	12.98 %	2,719.61	26.11	12.98 %
Yindonggou mine	462.04	24.50	18.52 %	83.13	24.50	18.52 %	545.18	24.50	18.52 %	1,197.23	24.50	18.52 %
Yinxingyijing mine	1,572.89	28.00	12.50 %	1,433.78	28.00	12.50 %	3,006.67	28.00	12.50 %	26,041.28	28.00	12.50 %
Total	**5,968.54**			**3,874.93**			**9,843.49**			**36,959.17**		

(1) Measured, indicated and inferred resources for Luochuan mine are not available because it is still in exploration stage.

(2) Estimation of mineral resources in this table is based on RMB478, RMB478, RMB522 and RMB582 per tonne of coal for Wangwa mine, Wangwa No.2 mine, Yindonggou mine and Yinxingyijing mine, respectively. Such prices are the respective average selling price of coal extracted from these mines during 2021. The point of reference selected by the qualified person is the point where raw coal mined from the coal mines can be saleable product after being washed by the supporting coal preparation plant.

Summary of Mineral Reserves

A "mineral reserve" is an estimate of tonnage and grade or quality of indicated and measured mineral resources that, in the opinion of the qualified person, can be the basis of an economically viable project. More specifically, it is the economically mineable part of a measured or indicated mineral resource, which includes diluting materials and allowances for losses that may occur when the material is mined or extracted. The term "economically viable," as used in the definition of reserve, means that the qualified person has analytically determined that extraction of the mineral reserve is economically viable under reasonable investment and market assumptions.

The term "proven reserves" means the economically mineable part of a measured mineral resource and can only result from conversion of a measured mineral resource. The term "probable reserves" means reserves for which quantity and grade are computed from information similar to that used for proven reserves, but the sites for sampling are farther apart or are otherwise less closely spaced. The degree of assurance, although lower than that for proven reserves, is high enough to assume continuity between points of observation. Our proven and probable reserves include bauxite or coal attributable to our ownership or economic interest.

Proven and probable mineral reserves were determined from the application of relevant modifying factors to geological data, in order to establish an operational, economically viable mine plan. The proven and probable reserve figures presented herein are estimates based on information available at the time of calculation. No assurance can be given that the indicated levels of recovery of bauxite or coal will be realized. Reserve estimates may require revision based on actual production. Market fluctuations in the price of aluminum and coal, as well as increased production costs or reduced metallurgical recovery rates, could render certain proven and probable reserves containing higher cost uneconomic to exploit and might result in a reduction of reserves.

The following table sets forth details of proven and probable reserves for our bauxite mines as of December31, 2021:

Mine	Proven Mineral Reserves Tonnage (in million tonnes)	Proven Al_2O_3 (%)	Proven SiO_2 (%)	Proven A/S(1)	Probable Mineral Reserves Tonnage (in million tonnes)	Probable Al_2O_3 (%)	Probable SiO_2 (%)	Probable A/S(1)	Total Mineral Reserves Tonnage (in million tonnes)	Total Al_2O_3 (%)	Total SiO_2 (%)	Total A/S(1)
Pingguo mine	17.50	52.14	4.56	11.45	29.02	51.95	5.44	9.56	46.52	52.02	5.11	10.19
Guizhou mine	6.85	62.44	9.32	6.70	26.24	66.56	8.02	8.30	33.09	65.70	8.29	7.93
Zunyi mine	1.97	58.73	10.27	5.72	3.27	62.10	9.91	6.27	5.24	60.84	10.04	6.06
Nanchuan mine	1.52	57.23	16.08	3.56	16.30	58.62	15.63	3.75	17.82	58.50	15.67	3.73
Xuping mine	0.11	65.21	13.32	4.89	3.24	64.24	12.60	5.10	3.36	64.28	12.62	5.09
Sanmenxia mine	20.09	62.22	13.03	4.77	3.90	61.23	15.19	4.03	23.99	62.06	13.38	4.64
Jiaozuo mine	0.25	63.56	12.17	5.22	0.06	60.49	13.00	4.65	0.31	62.98	12.32	5.11
Zhengzhou area business department	5.12	64.23	13.83	4.65	5.80	64.09	12.68	5.05	10.92	64.15	13.22	4.85
Luoyang area business department	1.80	62.93	14.10	4.46	0.93	62.57	14.71	4.25	2.73	62.80	14.31	4.39
Sanmenxia area business department	0.14	63.54	13.88	4.58	4.37	61.87	15.18	4.07	4.51	61.92	15.14	4.09
Xiaoyi mine	0.23	66.16	12.24	5.41	7.09	65.24	12.50	5.22	7.31	65.27	12.49	5.23
Shanxi Other Mines	3.82	64.39	13.22	4.87	10.40	62.48	13.64	4.58	14.22	62.99	13.53	4.66
Yangquan mine	/	/	/	/	1.02	58.36	13.94	4.19	1.02	58.36	13.94	4.19
Huaxing mine	0.47	58.07	10.68	5.44	1.50	58.51	10.57	5.54	1.97	58.40	10.59	5.51
Boffa mine(2)	49.45	41.71	1.07	39.13	62.24	41.74	1.35	31.03	111.69	41.73	1.22	34.16
Total	**109.32**				**175.38**				**284.70**			

(1) Refers to the ratio of average grade of Al_2O_3 to the average grade of SiO_2 of the reserves.

(2) Alumina for the Boffa mine is stated as available alumina (AAl_2O_3) and Silica is stated as reactive silica ($RSiO_2$). For details of Boffa mine, please refer to "– D. Property, Plants and Equipment – Boffa Mine."

(3) Estimation of mineral resources of our bauxite mines other than Boffa mine is based on the following per tonne price, which is the five-year average sales price of bauxite from the respective mines between 2017 and 2021: RMB300-320 for Pingguo mine, RMB300-350 for Guizhou mine, Zunyi mine and Nanchuan mine, RMB400-450 for Yangquan mine, RMB450-500 for Xuping mine, Sanmenxia mine, Jiaozuo mine, Sanmenxia area business department and Luoyang area business department, RMB500-550 for Zhengzhou area business department, Xiaoyi mine, Shanxi Other Mines and Huaxing mine. Since each of these mines may contain multiple mining areas for which the qualified person used slightly different prices when estimating the mineral resources of different areas, the prices above are stated as a range. The point of reference selected by the qualified person is the point where bauxite is delivered to ore storage yard and available for use by alumina refineries.

The following table sets forth details of proven and probable reserves for our four coal mines as of December 31, 2021:

Mine(1)	Proven Mineral Reserves Tonnage (in ten thousand tonnes)	Proven Heat Value (MJ/kg)	Proven Coal ash (%)	Probable Mineral Reserves Tonnage (in ten thousand tonnes)	Probable Heat Value (MJ/kg)	Probable Coal ash (%)	Total Mineral Reserves Tonnage (in ten thousand tonnes)	Total Heat Value (MJ/kg)	Total Coal ash (%)
Wangwa mine	10,482.73	24.85	16.10 %	6,381.03	24.85	16.10 %	16,863.76	24.85	16.10 %
Wangwa No.2 mine	7,766.77	26.11	12.98 %	432.75	26.11	12.98 %	8,199.50	26.11	12.98 %
Yindonggou mine	2,618.23	24.50	18.52 %	471.10	24.50	18.52 %	3,089.33	24.50	18.52 %
Yinxingyijing mine	2,430.83	28.00	12.50 %	2,215.85	28.00	12.50 %	4,646.68	28.00	12.50 %
Total	**23,298.56**			**9,500.73**			**32,799.27**		

(1) Proven and probable reserves for Luochuan mine are not available because it is still in the exploration stage.

(2) Estimation of mineral reserves in this table is based on RMB478, RMB478, RMB522 and RMB582 per tonne of coal for Wangwa mine, Wangwa No.2 mine, Yindonggou mine and Yinxingyijing mine, respectively. Such prices are the respective average selling price of coal extracted from these mines during 2021. The point of reference selected by the qualified person is the point where raw coal mined from the coal mines can be a saleable product after being washed by the supporting coal preparation plant.

Internal Controls over the Mineral Reserves and Mineral Resources Estimation Process

We have internal controls over the mineral reserves and mineral resources estimation processes that are able to reach reasonable and reliable estimates aligned with industry practice and reporting regulations, which includes (i) a quality control and quality assurance plan, and (ii) verification of analytical procedures.

With respect to quality control and quality assurance, we engage third-party professional technical firms to conduct the mineral exploration and mineral resources estimation, the results of which are evaluated by internal and external experts. The conversion of mineral resources into mineral reserves is determined by third-party professional consulting firms based on feasibility studies or pre-feasibility studies, or supported by mine production data. The estimates of mineral resources and mineral reserves by third-party professional firms will first be reviewed by Chalco's internal experts, and then reviewed and confirmed by the qualified person to ensure the reliability of mineral reserves and mineral resources estimation results. The annual report and results of mineral reserve and resources estimation of coal mines are also filed with the Department of Natural Resources of the local government.

The verification of analytical procedures is entrusted to third-party qualified firms. The fundamental analysis of the samples is carried out by a certified laboratory. During the analysis, standard samples were used for quality control. At the same time, duplicate samples were taken according to the ratio of 7% to 10% by such laboratory. In each batch of analysis samples, 3% to 5% of the samples are taken and sent to another certified laboratory for external inspection and analysis, and standard samples are also used for quality control during external inspection and analysis.

These controls and other measures help to validate the reasonableness of the estimates of our mineral resources and mineral reserves. However, estimates could change due to a number of factors, including future changes in permitting requirements, geological conditions, ongoing mine planning, macroeconomic and industry conditions, and regulatory disclosure requirements. The industry risks to which estimates are subject include risks related to metal prices, metallurgical performance and geological modeling. Please refer to "Item 3. Key Information – D. Risk Factors – Estimates of mineral reserves and mineral resources are uncertain and the volume and grade of minerals actually extracted may vary from our estimates" for a discussion of risks inherent in our estimates of mineral resources and mineral reserves.

Mine Safety Disclosure

We have been in compliance with the PRC National Mining Safety Law and related rules and regulations in China. We closely supervise and routinely inspect mining conditions with continual implementation of safety measures and procedures at our own bauxite mines and safety trainings for our mining personnel. For our Boffa mine, we strictly abide by the mining convention with the Guinean government and Guinean laws and regulations relating to mining. We continuously screen, identify and control safety hazards and regularly organize safety trainings for our personnel. In 2021, we extracted approximately 16.0 million tonnes of bauxite from our domestic mines and approximately 12.3 million tonnes of bauxite from the Boffa mine. We did not experience any mining operation-related accidents that involved serious work injuries or death.

Supplemental Materials, Electricity and Fuel

The sales and marketing department at our headquarters coordinates and manages our supply chain for all our major raw materials in conjunction with the procurement center at each production facility, which manages the logistics and inventory of raw materials locally. We are able to purchase diesel, the main fuel used by our mining and manufacturing equipment, from the public markets, and we source our water from local rivers, lakes or underground sources.

Alumina

Electricity, coal, alkali (caustic soda or soda ash) and natural gas are the principal materials and energy used in our alumina production. Electricity is one of the principal cost components in our refining process. We generate electricity at a number of alumina refineries and meet our remaining electric power requirements through purchasing from regional power grids at government-mandated rates or directly from power generation enterprises. Most of our power supply agreements have a term of one year and are renewed by mutual agreement. Power prices in China can vary, sometimes substantially, from one region to another, based on demand and power production costs in the region. Power costs for our various alumina refineries vary accordingly.

Large quantities of coal are used as a reducing agent and fuel to produce steam and gas in the alumina refining process. See "– B. Business Overview – Our Mines" for details of coal mines of which we own majority or minority interests. By investing in coal mining enterprises and acquiring mining rights for coal deposits, we plan to partially offset our future energy costs.

Alkali is used as a supplemental material in alumina refining. The Bayer-sintering process and the Bayer-sintering combined process require soda ash while caustic soda is used in the Bayer process. Our alumina refineries use natural gas and coal gas as fuel to refine alumina. There is no governmental regulation of the prices of coal, alkali or fuel. We purchase these raw materials from external suppliers under negotiated supply contracts, which we believe are competitively priced. We have not experienced difficulty in obtaining these materials in sufficient quantity and at acceptable prices.

Primary Aluminum

Electricity, carbon anodes and cathodes are the principal materials and energy used in our smelting process. Smelting primary aluminum requires a substantial and continuous supply of electricity. The availability and price of electricity are key factors in our primary aluminum production. See "Item 5. Operating and Financial Review and Prospects - A. Operating Results - Overview - Factors Affecting Our Results of Operations - Manufacturing Costs."

We generate electricity at four of our smelters to supply a portion of the electricity consumed by these smelters. We meet our remaining electric power requirements through purchasing directly from power generation enterprises. As of December 31, 2021, five of our smelters had direct purchase arrangements with power generation enterprises and the rest of our smelters were in the negotiation process for the renewal of direct purchase arrangements. In 2021, direct purchase transactions were organized by the local government. Starting from January 1, 2022, direct purchase transactions have been carried out based on the relevant rules and regulations in different regions. Because power prices in China vary from one region to another, power costs for our various smelters could vary substantially. The average electricity cost (including tax) of our smelters increased by 27% from 2020 to 2021.

Carbon anodes and cathodes are key raw materials in the smelting process. We are generally able to manufacture carbon anodes necessary for the operations of our smelters. In addition, our Qinghai branch possesses production capacity of carbon cathodes and is able to manufacture carbon cathodes products.

Sales and Marketing

We coordinate substantially all of our sales and marketing activities for our self-produced alumina products and some of our sales and marketing activities for our self-produced primary aluminum products through Chalco Trading Group. Our subsidiaries and branches sell some of our self-produced primary aluminum products directly to external customers. Our alumina refineries sell our self-produced chemical alumina products directly to external customers or indirectly through Chalco Trading Group for subsequent external trading. For all of our self-produced products that are sold either through Chalco Trading Group for subsequent external sale or directly to external customers, our subsidiaries and branches play an important role in providing after-sale services and strengthening our presence in the marketplace. Since late 2009, we have also been engaged substantially in the trading of non-ferrous metal products including alumina, primary aluminum, copper, zinc and lead, as well as coal products that we source from third-party suppliers through Chalco Trading Group, or previously Chalco Trading.

Alumina

We sell our self-produced alumina to external customers primarily through Chalco Trading Group, giving priority to customers with whom we have long-standing relationships and who have established a strong credit history, after reserving sufficient alumina for our forecasted primary aluminum production. In 2021, we supplied approximately 7.1 million tonnes of alumina produced at our alumina refineries to our smelters, which represented approximately 43.8% of our total alumina production, and sold the remainder to our customers. In addition, we also procure and sell outsourced alumina under long-term agreements or on the spot market through Chalco Trading Group. We sold approximately 1.9 million tonnes of outsourced alumina in 2021.

The sales prices of alumina that our alumina refineries sell internally to Chalco Trading Group are determined based on our budgeted sale prices, spot market prices and the prices of primary aluminum on SHFE. Chalco Trading Group coordinates the external negotiation and execution of sales contracts of our alumina products. Chalco Trading Group sells our self-produced alumina and alumina sourced from third-party suppliers to customers throughout China. Most of our major customers in the past three years have been domestic smelters. We primarily sourced alumina from third-party suppliers on the spot market, and we are normally required to pay the full price of the outsourced alumina before each delivery.

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Chalco Trading Group sells our self-produced alumina and outsourced alumina under spot sales agreements and long-term sales agreements with terms ranging from one year to three years. Our long-term sales agreement for alumina normally sets forth the quantity of alumina to be sold by us in each month and each year, the price determination mechanism, payment method, place of delivery and delivery method. Places of delivery under our sales agreements are arranged to be where we could efficiently manage the transportation of alumina and help reduce logistics cost. Our customers are normally required to pay for their procurement before each delivery. As a result, the spot price of alumina and fluctuations of primary aluminum prices on the SHFE affect the alumina prices at which we sell.

Chalco Trading Group sets the price for the external sales of alumina products after taking into account the following factors:

- international and domestic supply-demand situation;
- CIF Chinese ports prices for alumina imports into China and other relevant import expenses;
- international and domestic alumina transportation costs;
- effects of the PRC government's policies on raw materials required by our alumina refineries; and
- our short-term and mid-term projections for alumina prices.

Primary Aluminum

We sell all of our self-produced and outsourced primary aluminum to domestic customers. We expect China to remain our key market for primary aluminum for the foreseeable future. Customers of our primary aluminum products principally consist of aluminum fabricators and distributors that resell our primary aluminum products to aluminum fabricators or other purchasers.

To improve the efficiency of our distribution, we divide our China market into the following regions: southern China (including Guangdong and Fujian Provinces); eastern China (including Jiangsu and Zhejiang Provinces and Shanghai Municipality); southwestern China (including Sichuan Province and Chongqing Municipality); the Beijing-Tianjin-Tanggu area; and central China. In general, we satisfy each purchase order with products from our nearest smelter to minimize transportation costs.

Our primary aluminum smelting subsidiaries and branches sell a portion of our primary aluminum output directly to external customers. Each of our smelters is normally responsible for the sale of products to the customers from neighboring markets, negotiating the pricing and delivery terms based on market conditions.

Our primary aluminum smelting subsidiaries and branches also sell a portion of our primary aluminum output internally to Chalco Trading Group at prices based on the spot prices of primary aluminum on Yangtze or Nanchu. We establish pricing guidelines for Chalco Trading Group to conduct external domestic sales of our self-produced primary aluminum products, taking into account four main factors: the primary aluminum spot prices and futures price on the SHFE; spot prices in the regions of eastern China and southern China; our production costs and expected profit margins; and supply and demand. Chalco Trading Group then coordinates the external sales of primary aluminum. Chalco Trading Group sells our self-produced primary aluminum products to external customers through the following three channels:

- Contract sales. Most of our primary aluminum sales are made pursuant to contracts entered into directly with our long-standing customers. The terms for our sales contracts for primary aluminum are typically one year. We price our primary aluminum products based on the SHFE prices and spot market prices for primary aluminum.
- Sales on the SHFE. As part of our effort to manage market risk, we sell a portion of our primary aluminum products on the SHFE through futures contracts with terms ranging from one month to 12 months to hedge against declines in primary aluminum prices.
- Sales on the spot market. We also sell our primary aluminum products on the spot market at prices with reference to various factors, such as market spot prices and transportation costs.

In addition, we also procure and sell outsourced primary aluminum on the spot market or through short-term futures and options transactions. We determine our sales prices of the outsourced primary aluminum through negotiations with our customers, taking into consideration factors including our procurement prices and prevailing market conditions. We sold approximately 5.8 million tonnes of outsourced primary aluminum in 2021.

Chemical Alumina Products and Gallium

Chemical alumina products are derived from our alumina production. We adjust our production of these products based on market demand. Our alumina refineries sell our chemical alumina products directly to external customers or indirectly to external customers through Chalco Trading Group for subsequent external trading. We sell most of our chemical alumina products in China. Prices for our chemical alumina products are determined through negotiations with our customers, taking into consideration the market conditions.

In addition, in the process of refining bauxite into alumina, we produce gallium as a by-product. We adjusted our production of gallium based on market demand. Prices for our gallium were determined through negotiations with our customers, taking into consideration the market conditions.

Coal

Ningxia Energy sells a portion of its self-produced coal directly to external customers through short-term contracts at prices determined through negotiations with our customers, taking into consideration factors including our procurement prices and prevailing market conditions. Ningxia Energy consumes the rest of its self-produced coal at its own electric power plant.

In addition, we also procure and sell outsourced coal under long-term agreements or on the spot market through Chalco Trading Group. We sold approximately 2.0 million tonnes of outsourced coal in 2021.

Trading of Outsourced Non-ferrous Metal Products and Other Materials

Since late 2009, we have been actively engaged in the trading of alumina and primary aluminum sourced from third-party suppliers. Please see "– Alumina" and "– Primary Aluminum" for more details. Through Chalco Trading Group, we also sell other non-ferrous metal products such as copper, zinc and lead as well as coal products that we procure from our third-party suppliers to external customers on the spot market or under long-term sales agreements. Please see "– Coal." In 2021, we sold approximately 0.8 million tonnes of outsourced electrolytic copper, copper concentrate and zinc. In addition, we also sell outsourced raw and ancillary materials such as iron ore, charred coal and cathode copper in bulk to customers such as steel manufacturers and copper processing companies on the spot market.

Chalco Trading Group has a team with trading expertise to conduct research on the markets of non-ferrous metal products and other materials. From time to time, we may enter into futures and options transactions to hedge against price fluctuations in the non-ferrous metal product market.

Delivery

We rely on rail shipping and trucks for the delivery of products within China.

Our alumina is transported by rail or trucks, and transportation costs are generally borne by our customers and excluded from our sales prices. For long-distance deliveries, we maintain spur lines connecting our plants to the national railway routes.

Our molten aluminum is delivered to our customers primarily by trucks. Other primary aluminum products are primarily transported by rail. Our coal products are transported both by trucks and by rail.

Rail shipping on the PRC national railway system is subject to government mandated pricing.

Principal Facilities

Our principal facilities include 22 principal production plants and our Zhengzhou Institute. Set forth below is a description of our principal production plants.

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Guangxi Branch

Our Guangxi branch commenced operations in 1994 and is located in Guangxi Zhuang Autonomous Region in southwestern China, an area rich in bauxite reserves. Our Guangxi branch obtains bauxite delivered via highway from our Pingguo mine, one of our wholly-owned mines, located less than 17 kilometers from our Guangxi branch.

Our Pingguo mine contains large, easily exploitable bauxite reserves with high alumina-to-silica ratios. Our Guangxi branch is our only principal refinery that exclusively uses the Bayer process. With technology and production equipment imported from Europe, the Guangxi refinery features a high level of automation and energy efficiency. Since its inception, we have continually increased the designed production capacity at this branch by overcoming production bottlenecks and investing in capacity expansions. Guangxi branch had an annual alumina production capacity of approximately 2,210,000 tonnes as of December 31, 2021. In 2021, our Guangxi branch produced approximately 2,287,519 tonnes of alumina, along with approximately 184,623 tonnes of chemical alumina products.

Guizhou Branch

Our Guizhou branch commenced its smelting operations in 1966 and was subsequently expanded to include alumina refining operations in 1978. Our Guizhou branch used 160Ka and 230Ka pre-bake reduction pot-lines in its primary aluminum production. The smelter in our Guizhou branch has undergone technological innovations and overhauls since its inception. Since November 2017, we have been engaged in the gradual closing down of the 160Ka pre-bake reduction pot-lines and, subsequently, the closing down of the 230Ka pre-bake reduction pot-lines. As of January 2018, the production in our Guizhou branch had been fully shut down. In 2019, we disposed of the primary aluminum production facilities in our Guizhou branch. Our Guizhou branch did not have any annual primary aluminum production capacity as of December 31, 2021 and did not produce any primary aluminum in 2021. It was mainly engaged in bauxite mining and production of aluminum alloys in 2021. As of December 31, 2021, our Guizhou branch had an annual aluminum alloy production capacity of approximately 348,000 tonnes. In 2021, our Guizhou branch produced approximately 284,771 tonnes of aluminum alloy products.

Chalco Mining

Chalco Mining was incorporated as one of our subsidiaries in the PRC in 2007 and is currently our wholly-owned subsidiary. To optimize the allocation of our resources and further consolidate our operations, we transferred all of the assets and liabilities of our Henan branch to Chalco Mining in August 2017. Our Henan branch commenced its alumina refining operation in 1966 and primary aluminum smelting operation in 1967 (the latter of which was ceased in 2013) in Henan Province, a province rich in bauxite reserves. It was the first refinery in China to develop the Bayer-sintering combined process. Bauxite is delivered to Chalco Mining via railway and highway from our following mines: Zhengzhou area business department located in Zhengzhou, Luoyang area business department in Luoyang and Sanmenxia area business department in Mianchi. The alumina production line that we put into operation at Chalco Mining uses the ore-dressing Bayer process, which we developed to refine low alumina-to-silica ratio bauxite. Chalco Mining's production facilities have been substantially upgraded with equipment imported from Germany and Denmark. The refinery has also benefited from its access to high alumina-to-silica ratio bauxite from certain of our mines and through purchases on the market. Chalco Mining had an annual alumina production capacity of approximately 2,410,000 tonnes as of December 31, 2021. In 2021, Chalco Mining produced approximately 1,362,618 tonnes of alumina and 35,577 tonnes of chemical alumina products.

Chalco Shandong

Chalco Shandong was incorporated as one of our subsidiaries in the PRC in 2015 and is currently our wholly-owned subsidiary. The predecessor of Chalco Shandong was our Shandong branch, which commenced operations in 1954. Chalco Shandong has the capacity to produce alumina and chemical alumina products. Its alumina refinery was China's first production facility for alumina. It produces its alumina through the Bayer-sintering process and the Bayer process. Through technology renovation, Chalco Shandong has the capacity to produce high-quality alumina products used for the production of refined aluminum and high-purity aluminum. Chalco Shandong obtains bauxite supplies primarily from extractions of our Boffa mine in 2021. Chalco Shandong had an annual alumina production capacity of approximately 2,270,000 tonnes as of December 31, 2021. It produced approximately 1,682,765 tonnes of alumina in 2021.

In addition, Chalco Shandong produces a substantial amount of chemical alumina products. In 2021, it produced approximately 2,665,556 tonnes of chemical alumina products. It is the largest and most technologically advanced production facility for chemical alumina products in China with the ability to produce a wide variety of chemical alumina products.

Qinghai Branch

Located in Qinghai Province, our Qinghai branch is a stand-alone primary aluminum production facility. This branch commenced operations in 1987 and is one of the most technologically advanced primary aluminum smelters in China. It operates 180Ka and 210Ka automated pre-bake anode reduction pot-lines that were developed domestically. In addition, our Qinghai branch also possesses production capacity of carbon cathodes and is able to manufacture carbon cathodes products. Our Qinghai branch benefits from relatively low electricity costs in Qinghai Province due to the hydroelectric power stations in the region. The Qinghai branch sources alumina from Shanxi New Material, Chalco Shandong, Chalco Mining and Zhongzhou Aluminum and incurs higher transportation costs for both raw materials and its primary aluminum products than our other branches.

Our Qinghai branch had an annual primary aluminum production capacity of approximately 420,000 tonnes as of December 31, 2021. It produced approximately 403,685 tonnes of primary aluminum in 2021.

Guizhou Huaren

Established in May 2017 and located in Qingzhen, Guizhou Province, Guizhou Huaren is a stand-alone primary aluminum production facility that commenced full operation in September 2018. Guizhou Huaren had an annual primary aluminum production capacity of approximately 400,000 tonnes as of December 31, 2021. It produced approximately 437,223 tonnes of primary aluminum products in 2021.

Shanxi Zhongrun

Established in November 2015 and located in Lvliang, Shanxi Province, Shanxi Zhongrun specializes in producing primary aluminum products. The first batch of electrolytic cells of Shanxi Zhongrun was put into operation in May 2018. Shanxi Zhongrun was fully put into operation in December 2020. Shanxi Zhongrun had an annual primary aluminum production capacity of approximately 432,000 tonnes as of December 31, 2021. It produced approximately 483,719 tonnes of primary aluminum products in 2021.

Zhongzhou Aluminum

Located in Henan Province, Zhongzhou Aluminum is a stand-alone alumina plant, located near abundant bauxite, coal and water supplies. Zhongzhou Aluminum was incorporated as one of our subsidiaries in the PRC in 2015 and is currently our wholly-owned subsidiary. The predecessor of Zhongzhou Aluminum was our Zhongzhou branch. Zhongzhou Aluminum commenced operations in 1993 and is equipped with imported and self-developed technology and has undergone various improvements and upgrades, in particular to its Bayer-sintering process and Bayer process. Zhongzhou Aluminum obtains bauxite supplies partly from extractions of our mines, including Boffa mine, and partly from external suppliers in Henan Province and overseas.

Zhongzhou Aluminum had an annual alumina production capacity of approximately 3,050,000 tonnes as of December 31, 2021. Zhongzhou Aluminum produced approximately 2,058,274 tonnes of alumina and approximately 1,053,774 tonnes of chemical alumina products in 2021.

Chongqing Branch

Our Chongqing branch is located in Chongqing. Our Chongqing branch completed the construction of alumina production facilities in 2010 and its annual alumina production capacity was approximately 800,000 tonnes as of December 31, 2021. We have suspended production in our Chongqing branch since July 2014 due to the relatively significant decrease in the price of alumina as compared with the price of alumina during the construction period, large negative variation of mineral resources and the high costs of natural gas and other energy at the time of suspension. In 2018, we entered into agreements with a third party to lease the alumina production facilities of Chongqing branch and to cooperate on mine operations, respectively. In 2021, we continued to lease alumina production facilities to such third party.

Guangxi Huasheng

Established in June 2017 and located in Fangchenggang, Guangxi Province, Guangxi Huasheng is mainly engaged in producing alumina products and was put into production in the third quarter of 2020. Guangxi Huasheng had an annual alumina production capacity of approximately 2,000,000 tonnes as of December 31, 2021. Guangxi Huasheng produced approximately 2,140,058 tonnes of alumina in 2021.

Guizhou Huajin

Established in July 2014 and located in Qingzhen, Guizhou Province, Guizhou Huajin specializes in producing alumina products. Guizhou Huajin had an annual alumina production capacity of approximately 1,600,000 tonnes as of December 31, 2021. Guizhou Huajin produced approximately 1,630,706 tonnes of alumina in 2021.

Shanxi Huaxing

Located in Shanxi Province, Shanxi Huaxing is a stand-alone alumina plant which commenced trial production in October 2013. Shanxi Huaxing obtains bauxite supplies from our own mines delivered primarily via highway and is located near abundant coal and water supplies.

In December 2015, we transferred out 50% of our equity interests in Shanxi Huaxing, a then wholly-owned subsidiary of our Company, through the Shanghai United Assets and Equity Exchange. In December 2018, we acquired the 50% equity interests in Shanxi Huaxing through the Shanghai United Assets and Equity Exchange from Baotou Transportation Investment Group Co., Ltd. Upon completion of the acquisition, Shanxi Huaxing became our wholly-owned subsidiary. Please see "- A. History and Development of the Company - Transfer of Equity Interest in Shanxi Huaxing" for more details about the transfer of equity interest.

Shanxi Huaxing had an annual alumina production capacity of approximately 2,000,000 tonnes as of December 31, 2021. Shanxi Huaxing produced approximately 1,591,454 tonnes of alumina products in 2021.

Lanzhou Aluminum

Located in Lanzhou city in Gansu Province, Lanzhou Aluminum is a stand-alone primary aluminum plant. In April 2007, we acquired a primary aluminum plant in Lanzhou, which was divided into two parts in July 2007: our Lanzhou branch and Northwest Aluminum. In January 2019, we turned the Lanzhou branch into our wholly-owned subsidiary, Lanzhou Aluminum, in order to promote its business vitality. Lanzhou Aluminum owns a primary aluminum smelting plant with a designed annual primary aluminum production capacity of approximately 450,000 tonnes as of December 31, 2021. It produced approximately 415,196 tonnes of primary aluminum in 2021.

Shanxi New Material

Shanxi New Material is situated in Shanxi Province. In March 2003, we established the joint venture company, Shanxi Huaze, with Zhangze Electric Power to commence the construction of a primary aluminum production facility. In 2017, we contributed certain assets related to alumina production of our Shanxi branch to Shanxi Huaze. Upon completion of our asset contribution, our shareholding in Shanxi Huaze increased from 60% to 85.98% and Shanxi Huaze was renamed to Shanxi New Material. Shanxi New Material had an annual alumina production capacity of approximately 2,600,000 tonnes as of December 31, 2021 and produced approximately 1,569,663 tonnes of alumina and 69,684 tonnes of chemical alumina products in 2021. Its designed annual production capacity of primary aluminum was approximately 424,000 tonnes as of December 31, 2021 and it produced approximately 298,371 tonnes of primary aluminum in 2021. Please see "- A. History and Development of the Company - Merger and Reorganization of Shanxi Branch and Shanxi Huaze" for more details about the reorganization.

Zunyi Aluminum

Zunyi Aluminum is situated in Guizhou Province. In 2018, we merged Zunyi Alumina into Zunyi Aluminum. Upon the completion of the merger, our shareholding in Zunyi Aluminum increased from 62.1% to 67.445%. After the merger, Zunyi Aluminum had an annual alumina production capacity of approximately 1,000,000 tonnes as of December 31, 2021 and the aggregate production of Zunyi Aluminum was approximately 1,043,395 tonnes of alumina and 9,834 tonnes of chemical alumina products in 2021. Its post-merger designed annual production capacity of primary aluminum was approximately 375,000 tonnes as of December 31, 2021 and it produced approximately 398,030 tonnes of primary aluminum in 2021. Please see "- A. History and Development of the Company - Merger and Reorganization of Zunyi Alumina and Zunyi Aluminum" for more details about the merger.

Fushun Aluminum

Fushun Aluminum is situated in Liaoning Province and was a stand-alone primary aluminum plant. In March 2006, we entered into a share transfer agreement with Liaoning Fushun Aluminum Plant to acquire 100% of the equity interests in Fushun Aluminum for a consideration of RMB500 million. Fushun Aluminum's primary business was the production of primary aluminum and carbon products. We stopped production of primary aluminum in Fushun Aluminum in October 2015 due to the relatively significant decrease in the price of primary aluminum and high costs of electricity at that time. In 2018, we disposed of the primary aluminum production facilities in Fushun Aluminum. Fushun Aluminum did not have any annual primary aluminum production capacity as of December 31, 2021 and did not produce any primary aluminum in 2021.

Fushun Aluminum had an annual anode carbon production capacity of approximately 530,000 tonnes as of December 31, 2021 and it produced approximately 331,437 tonnes of baked carbon anodes in 2021.

Shandong Huayu

Shandong Huayu is situated in Shandong Province and is a stand-alone primary aluminum plant. We currently hold 55% equity interest in Shandong Huayu. Since November 2018, we have gradually suspended production of aluminum at Shandong Huayu due to market environment and production restriction for environmental protection. In 2019, we halted its primary aluminum production and before that Shandong Huayu produced approximately 8,500 tonnes of primary aluminum in 2019. In October 2020, Shandong Huayu agreed to transfer its primary aluminum capacity quota of 135,000 tonnes to Yunnan Aluminum through judicial auction at a consideration of RMB538.66 million. Shandong Huayu had an annual primary aluminum production capacity of approximately 65,000 tonnes as of December 31, 2021. The supporting facilities and coal-fired generators of Shandong Huayu are being disposed of.

Gansu Hualu

Gansu Hualu is situated in Gansu Province and was a stand-alone primary aluminum plant. In August 2006, we entered into a share transfer agreement with Baiyin Nonferrous Metal (Group) Co., Ltd. ("Baiyin Nonferrous") and Baiyin Ibis Aluminum Co., Ltd. ("Baiyin Ibis"). Baiyin Nonferrous contributed 127,000 tonnes of primary aluminum smelting and supporting facilities owned by Baiyin Ibis as capital contribution and holds a 49% equity interest in Gansu Hualu. We hold a 51% equity interest in Gansu Hualu. Since November 2015, the production of primary aluminum has been suspended. In 2019, most of the primary aluminum production facilities in Gansu Hualu were disposed and the rest were disposed in 2020. Gansu Hualu had no annual primary aluminum production capacity as of December 31, 2021 and did not produce any primary aluminum in 2021.

In addition, Gansu Hualu also possesses production capacity of carbon products. Its designed annual production capacity of anode carbon products was approximately 150,000 tonnes as of December 31, 2021 and it produced approximately 95,804 tonnes of anode carbon products in 2021.

Baotou Aluminum

Baotou Aluminum is located in the Inner Mongolia Autonomous Region and is a stand-alone primary aluminum plant. On December 28, 2007, through A Shares issuance and exchange for Baotou Aluminum shares, we acquired 100% of the equity interest of Baotou Aluminum. Baotou Aluminum is currently our wholly-owned subsidiary. In April 2015, Baotou Aluminum and Baotou Transportation Investment Group Co., Ltd. established Inner Mongolia Huayun. Inner Mongolia Huayun commenced operations in 2017. Together with the primary aluminum production facilities at Inner Mongolia Huayun, Baotou Aluminum had a consolidated annual primary aluminum production capacity of approximately 1,340,000 tonnes as of December 31, 2021 and a consolidated output of approximately 1,275,243 tonnes of primary aluminum in 2021.

Liancheng Branch

Our Liancheng branch is located in Gansu Province. In late May 2008, we acquired 100% of the equity interest in Liancheng Longxing Aluminum Company Limited from Chinalco on the China Beijing Equity Exchange and subsequently turned it into our Liancheng branch which specializes in producing primary aluminum. We have implemented a flexible production arrangement for certain primary aluminum production facilities in our Liancheng branch since November 2018 as a result of high electricity costs. Our Liancheng branch had an annual primary aluminum production capacity of approximately 550,000 tonnes as of December 31, 2021. It produced approximately 151,271 tonnes of primary aluminum in 2021.

Ningxia Energy

Ningxia Energy is an integrated power generation company with coal mines located in Ningxia Autonomous Region. Its principal business includes conventional coal-fire power generation and renewable energy generation. Ningxia Energy was established in June 2003. In January 2013, we acquired an aggregate of 70.82% of the equity interest in Ningxia Energy. Ningxia Energy had a total installed capacity of 4,459.1 MW as of December 31, 2021. It also operates coal mines located in the Ningxia Autonomous Region. Please see "- B. Business Overview - Our Mines." In 2021, Ningxia Energy produced approximately 934.8 million tonnes of coal and approximately 14.8 billion kWh of electricity.

Zhengzhou Institute

The Zhengzhou Institute, located in Zhengzhou, Henan Province, was incorporated as our subsidiaries in 2015. Its predecessor was established in August 1965 and has served as the center for our research and development efforts. The Zhengzhou Institute specializes in the research and development of technologies for primary aluminum smelting, alumina refining and the development of new products of chemical alumina. Zhengzhou Institute is the only professional research institute in China dedicated to the research and development of aluminum smelting technologies and has played a key role in bringing about technological innovations in China's aluminum industry. The Zhengzhou Institute was approved by the Ministry of Science and Technology of the PRC in 2003 to establish the National Research Center of Aluminum Refinery Technologies and Engineering. As of December 31, 2021, the Zhengzhou Institute had a limited production capacity for chemical alumina products, which it uses in connection with its research and development efforts.

Xinghua Technology

We acquired a 66% equity interest in Xinghua Technology in December 2016. Located in Shanxi Province, Xinghua Technology is an alumina plant with an annual alumina production capacity of approximately 900,000 tonnes as of December 31, 2021. It produced approximately 962,210 tonnes of alumina and approximately 15,207 tonnes of chemical alumina in 2021.

Competition

Competition from Domestic Competitors

Alumina

In 2021, we supplied approximately 43.8% of our total production of alumina to our own smelters and sold substantially all of the remaining self-produced alumina to our domestic customers. Our competitors mainly include other domestic and international alumina producers that conduct sales in China. In 2021, our alumina production (with chemical alumina products included) represented approximately 23.6% of total domestic production in China.

We are a leading enterprise in the non-ferrous metal industry in China. As of December 31, 2021, 39 alumina producers in China (including Chalco) each had annual production capacity of 500,000 tonnes or above, which collectively represented approximately 96.5% of the total alumina production capacity in China. As of the same date, among these 39 alumina producers, 24 alumina producers (including Chalco) each had annual production capacity of one million tonnes or above, which collectively represented approximately 81.4% of the total alumina production capacity in China. In order to improve the efficiency and competitiveness of the Chinese alumina industry as well as to protect the environment, MIIT published the Standard Conditions for Aluminum Industry in July 2013 and issued a new version in March 2020, which provides stringent standards for the existing alumina enterprises. Although we face competition from other domestic and international refineries, we have several advantages over such competitors, including:

- we have access to a substantial and stable supply of bauxite;
- we are experienced in alumina production and our production technologies are specifically adapted to the particular chemical composition of bauxite found in China;
- we have strong capabilities in technology research and hold certain proprietary technologies and patents; and
- we have a substantial workforce that has extensive experience in production and management.

Primary Aluminum

We derived all of our primary aluminum revenues from domestic sales in 2021. Our competitors include other domestic and international primary aluminum producers that conduct sales in China. In 2021, our primary aluminum production represented approximately 10.1% of total domestic production in China.

We are a leading enterprise in the non-ferrous metal industry in China. As of December 31, 2021, 34 primary aluminum producers in China (including Chalco) each had annual production capacity of 500,000 tonnes or above, which collectively represented approximately 62.5% of the total primary aluminum production capacity in China. As of the same date, among these 34 primary aluminum producers, seven primary aluminum producers (including Chalco) each had annual production capacity of one million tonnes or above, which collectively represented approximately 21.1% of the total primary aluminum production capacity in China. The PRC government encourages consolidation in the Chinese primary aluminum industry to create larger, more efficient producers that are better positioned to implement measures to reduce emissions. Moreover, according to the current Standard Conditions for Aluminum Industry and other administrative regulations, aluminum smelting enterprises must ensure the availability of resources, energy and water resources, and are encouraged to merge with hydropower, coal power and other power enterprises through reorganization. Alumina and electrolytic aluminum enterprises are required to comply with environmental laws, regulations and policies, and establish, implement and maintain an environmental management system.

Although we face competition from other domestic and international smelters, we have several advantages over such competitors, including:

- Scale of production. With nine primary aluminum smelters, we can achieve significant economies of scale. In addition, our scale of production enables us to achieve high production volumes to fill large customer orders and maintain a large customer base. Through our national distribution network, we are able to make timely deliveries to customers from our local warehouses.

- Technology. We believe we have a more sophisticated technological innovation system and stronger innovation capability than most of our domestic competitors. In terms of technological support and research and development capabilities, we are equipped with the most advanced research and development institute within the aluminum industry in China and enjoy advantages over other domestic smelters in technology advancement.

- Vertical integration. As a leading integrated alumina and primary aluminum producer in China, we are able to supply alumina internally to our primary aluminum plants. As a result, we save on transportation, warehousing and related costs. In addition, because we operate our own alumina refineries, we are able to assure a stable supply of alumina for our primary aluminum smelting operations.

- Quality. We have maintained and will continue to improve on the high quality standards for our primary aluminum, which has satisfied national and industrial standards and customers' need.

The primary aluminum produced by most of our smelters satisfies the quality standards of the LME.

Competition from International Competitors

The tariff rate for alumina and primary aluminum imports remained zero in 2021. In 2021, China had a net import of approximately 3.21 million tonnes of alumina (with chemical alumina products included), a decrease from a net import of 3.65 million tonnes in 2020, primarily attributable to the fact that the supply of alumina in the international market decreased in 2021 and we imported less alumina compared to 2020. China had a net import of approximately 1.57 million tonnes of primary aluminum in 2021, compared to a net export of approximately 1.06 million tonnes of primary aluminum in 2020, primarily because the production curtailment policy in Yunnan has affected the production of the facilities in Yunnan and resulted in increased prices of domestic primary aluminum. We expect to continue to face competition from international suppliers of alumina and primary aluminum which are large international companies.

Research and Development

Our research and development efforts over the years have facilitated the expansion of our production capacity and reduced our unit costs. We have successfully commercialized our previous research and development results in various technologies. In 2021, we completed 263 technological projects, including 244 research and development projects undertaken independently by our branches or subsidiaries, seven special key science and technology projects and 12 science and technology application projects. In addition, we filed a total of 203 patent applications in 2021.

As of December 31, 2021, we owned 1,486 patents, which were primarily related to technologies and processes, equipment and new products. Once granted, a patent in China for an invention is valid for 20 years and for a utility model or a design 10 years from the date of the patent application. As of December 31, 2021, we owned 25 trademarks, each of which had a term of 10 years.

We do not regard any single patent, license, or trademark to be material to our sales and operations as a whole. We are not involved in any material intellectual property disputes.

Environmental Protection

Our operations are subject to PRC national and local environmental laws and regulations, including laws and regulations governing pollutant emissions, waste generation, treatment and disposal of hazardous materials, land reclamation and environmental issues associated with mining.

The pollutants discharged from our alumina refining process include red mud, waste water and gas emissions and particulates. Our primary aluminum production process generates fluorides, sulphur dioxide and particulates. It is illegal to release these pollutants untreated. The discharge of these pollutants after treatment must comply with national and local discharge limits.

Each of our alumina refineries, primary aluminum smelters and other production plants has its own waste treatment facilities onsite or has developed other methods to dispose of industrial waste in compliance with applicable environmental laws and regulations. Each of our production plants has established its environmental management system. All of our alumina refineries, primary aluminum smelters and carbon production plants in production passed the ISO14001 accreditations.

We have increased our energy efficiency by implementing new production techniques and technologies, upgrading our production facilities, optimizing our production process and enhancing our logistics and operations management. In 2021, we saved energy equivalent to 299,292 tonnes of standard coal as a result of implementing new production techniques and technologies, upgrading our production facilities, optimizing our production process and enhancing our logistics and operations management. We have established the industrial waste water recycling system. All of our aluminum smelting plants have achieved “zero discharge” of industrial waste water and 100% of the industrial waste water is reused for production after treatment.

In addition, we have focused on sustainable development of mine sites and achieved significant progress in mine reclamation. We reclaimed 12.8 thousand hectares of land throughout the year 2021, representing a cumulative reclamation rate of over 100% as of December 31, 2021.

Our total expenditures for maintaining compliance with environmental laws and regulations were RMB914 million, RMB1,171 million and RMB1,384 million for 2019, 2020 and 2021, respectively. In 2021, we did not have any major environmental pollution incidents.

Insurance

We maintain insurance coverage for our fixed assets such as plant, machinery, equipment, office facilities and transportation vehicles against accidents or natural disasters such as typhoons, hurricanes, floods, landslides and lightning strikes. However, there are certain types of losses, such as losses from war, acts of terrorism and nuclear radiation, for which we cannot obtain insurance at a reasonable cost or at all.

We are covered under the work-related injury insurance required by the relevant local government labor departments, and we have procured additional business accidental insurance for our employees. More extensive insurance is either unavailable in China or would impose a cost on our operations that would reduce our competitiveness.

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Our insurance premiums were RMB42.9 million, RMB38.6 million and RMB45.6 million in 2019, 2020 and 2021, respectively.

Seasonality

Our business in general is not subject to seasonality. Separately, our bauxite output in the Boffa mine may be subject to seasonal fluctuations due to the rainy season in Guinea.

Cybersecurity

With respect to our internal internet policies on cybersecurity, we have established an information safety management system and issued internal regulations on cybersecurity, internal hardware and data safety systems and we are gradually implementing measures relating to the office environment information safety management, information system access control, protection from any malicious software, and internal review and audit of information safety risks, in order to prevent loss of information due to cybersecurity incidents, network outages or hardware incidents. In 2021, we did not experience any material cybersecurity incidents or related losses.

Regulatory Overview

Producers of alumina and primary aluminum are subject to national industrial policies and relevant laws and regulations in areas of environmental protection, import and export, land use, foreign investment regulation and taxation. We are also subject to regulations relating to activities such as mining.

We are principally subject to governmental supervision and regulation by four agencies of the PRC government:

- the NDRC, which sets and implements the major policies concerning China's economic and social development, approves investments exceeding certain amounts, coordinates and improves the reform of the economic system;
- the Ministry of Natural Resources of China, which has the authority to grant land use rights and mining right permits;
- the MIIT, which formulates industrial policies and investment guidelines for all industries, including the aluminum industry; and
- the CSRC, the securities regulatory commission of China.

The following is a brief summary of the principal laws, regulations, policies and administrative directives to which we are subject.

Requirements for Capital Investments

Any capital markets financing activities by an enterprise or company incorporated in the PRC such as those to finance capital projects, are subject to approval by the CSRC and/or other relevant authorities in China, regardless of whether the funds are raised in China or on the international capital markets. An issuer incorporated in the PRC must obtain prior approval from the CSRC for issuance of equity securities or equity-linked securities. Offering of corporate bonds in the PRC is also subject to supervision of the CSRC. Offering of bonds by a PRC-incorporated company outside the PRC shall be filed with NDRC. For all overseas financing activities by an enterprise or company incorporated in the PRC, the issuer must register with and obtain prior approval from the administrative authorities of foreign exchange. Foreign investment in the exploring and mining of alumina and primary aluminum is permitted by the PRC government.

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Standard Conditions for Aluminum Industry

The Standard Conditions for Aluminum Industry was issued by MIIT on July 18, 2013 and a new version was issued on February 28, 2020 to replace the 2013 version, which became effective on March 30, 2020. The new Standard Conditions for Aluminum Industry only applies to existing bauxite mining, alumina and primary aluminum enterprises and indicates that such standards do not constitute administrative approval or mandatory requirement. It provides that bauxite mining, alumina and primary aluminum production must comply with the state and local industry policies and overall plans on the mining resources and development of aluminum industry, as well as laws, regulations and policies related to the environmental protection, energy conservation, mining and production safety. According to the new Standard Conditions for Aluminum Industry, aluminum smelting enterprises must ensure the availability of resources, energy and water resources, and are encouraged to merge with hydropower, coal power and other power enterprises through reorganization. It further encourages that alumina enterprises use intelligent systems and equipment in their operations to achieve energy-conserving and environment-protective purposes. The new Standard Conditions for Aluminum Industry further set out guidelines and standards for enterprises in the aluminum industry regarding product quality, facilities, energy consumption, resources consumption, environmental protection, production safety and occupational disease prevention.

Under the Standard Conditions for Aluminum Industry, the MIIT shall, in accordance with the applicable regulatory standards, review the applicants and disclose the names of applicants that meet the regulatory conditions. The MIIT promulgated on April 4, 2014, January 4, 2015 and February 14, 2016, respectively, the first, the second and the third lists of enterprises that meet the Standard Conditions for Aluminum Industry of 2013. Most of our production branches and subsidiaries have met the Standard Conditions for Aluminum Industry of 2013 version and are included on these lists. According to the current Standard Conditions for Aluminum Industry, enterprises that would like to be named in the list under this new Standard Conditions for Aluminum Industry need to resubmit application for the MIIT's review. The MIIT promulgated the first list of enterprises that meet the Standard Conditions for Aluminum Industry of 2020 version on January 5, 2021, which includes three of our production branches and subsidiaries. We are actively taking rectification measures to comply with the new Standard Conditions for Aluminum Industry and will participate in the subsequent applications.

Pricing

The PRC government does not impose any limitations with respect to the pricing of alumina, primary aluminum and related products. Thus, alumina and primary aluminum producers are free to set prices for their products. All the raw materials, supplemental materials and other supplies that we purchase are based on market prices. Freight transportation on the national railway system is subject to government mandated pricing.

Electricity Supply and Price

The National Energy Administration is responsible for the supervision and administration of the power industry in China. The NDRC and local governments regulate electricity pricing.

The Electric Power Law of China and related rules and regulations govern construction, generation, supply and consumption of electric power. Currently, China's state-owned power companies, through their respective local subsidiaries, operate all the regional power grids in China from which we obtain a part of our electricity requirements. In October 2007, the PRC government issued "Notice on Further Solutions of the Difference in Electricity Rates," according to which the preferential electricity prices originally enjoyed by Chinese primary aluminum enterprises have been gradually abolished. In December 2007, the PRC government issued "Notice of Eliminating Preferential Electricity Rate for High Energy Consuming Enterprises and Related Matters," which further eliminated the preferential electricity price arrangement enjoyed by Chinese primary aluminum enterprises. In December 2013, the NDRC and MIIT issued the "Circular on the Policies for Tiered Pricing of Electricity Used by Electrolytic Aluminum Enterprises", which became effective on January 1, 2014, to impose tiers of electricity prices on primary aluminum smelters. In March 2015, new policies and reforms relating to electricity generation, retail, usage, and other related sectors were introduced. Under "Several Opinions of the CPC Central Committee and the State Council on Further Deepening the Reform of the Electric Power System," a series of reforms relating to electricity pricing, distribution and retail segments, electricity trading, distributed generation, and other aspects has been put forward. In November 2015, NDRC and the National Energy Administration of the PRC jointly issued further supplemental measures, including "Implementation Opinions on Promoting Transmission-Distribution Price Reform," "Implementation Opinions on Promoting Power Market Construction," "Implementation Opinions on Establishing Power Trading Institutions and Their Normative Operation," "Implementation Opinions on Orderly Releasing Plans of Power Generation and Power Utilization," "Implementation Opinions on Promoting Power-Sales Side Reform," and "Guidance Opinions on Reinforcing and Regulating Supervision and Management of Coal-Fired Self-Generation Power Plants," which set out further requirements and implementation steps in relation to the reform of electric power systems. Towards the end of 2016, NDRC promulgated "Measures of Electricity Pricing for Transmission-Distribution Grid at the Provincial Level," which established a regulatory framework of electricity transmission and distribution pricing.

On August 26, 2021, NDRC further issued "Circular for Improvement of the Policies for Tiered Pricing of Electricity Used by Electrolytic Aluminum Enterprises," which came into effect on January 1, 2022. It provides that if the comprehensive alternating current consumption of molten aluminum is not higher than 13,650 kWh per ton, the electricity price will not be increased. If power consumption exceeds 13,650 kWh per ton, the electricity price will be increased by RMB0.01 per kWh for every additional 20 kWh. The grading standard will be lowered to 13,450 kWh in 2023 and further to 13,300 kWh in 2025, in each case excluding power consumed in the desulfurization process. In addition, it prohibits implementation of any preferential electricity price policies in the electrolytic aluminum industry.

On October 11, 2021, NDRC issued "Notice on Further Deepening the Market Reform of the Feed-in Tariff for Coal-fired Power Generation, which requires the orderly liberalization of the feed-in tariff for all coal-fired power generation and the expansion of the fluctuation range of the market trading tariff, resulting in a significant increase in our cost of electricity. In order to reduce the impact of electricity price increase, we have been actively participating in market trading with power generation enterprises with cost advantages, while carrying out energy saving and consumption reduction at the same time.

Regulations Concerning Imports and Exports of Alumina and Primary Aluminum

Import taxes on alumina and primary aluminum have been eliminated. The export tariff on certain primary aluminum products has been 15% since August 1, 2007.

Environmental Protection Laws and Regulations

The Ministry of Ecology and Environment of China is responsible for supervision and administration of environmental protection in China. It formulates national environmental quality and discharge standards and monitors China's environmental system. Bureau of Ecology and Environment at the municipal level or above is responsible for environmental protection within its jurisdiction.

The Law on Environment Impact Assessment and relevant regulations require each enterprise to file an environmental impact report with the relevant Bureau of Ecology and Environment for approval before undertaking the construction of a new production facility or any major expansion or renovation of an existing production facility. New facilities built pursuant to this approval are not permitted to operate until the relevant environmental bureau has performed an inspection and concluded that the facilities are in compliance with environmental standards.

The Environmental Protection Law requires any facility that produces pollutants or other hazards to incorporate environmental protection measures in its operations and establish an environmental protection responsibility system. Such system includes adoption of effective measures to control and properly dispose of waste gases, waste water, waste residue, dust or other waste materials. Any entity that discharges pollution must register with the relevant environmental protection authority. Regulations on the Administration of Pollutant Discharge Permits became effective on March 1, 2021, pursuant to which enterprises that discharge pollutants need to obtain permits from relevant environmental authorities in accordance with the regulations.

Penalties for breaches of the Environmental Protection Law include warning, payment of damages and imposition of fines. Any entity undertaking a construction project that fails to install pollution prevention and control facilities in compliance with environmental standards for a construction project may be ordered to suspend production or operations or to cease operations and may be fined. Criminal liability may be imposed for a material violation of environmental laws and regulations that causes any significant loss of property or personal injuries or death.

On December 25, 2016, the PRC government promulgated the Environmental Protection Tax Law, which became effective from January 1, 2018 and was amended on October 26, 2018. The Environmental Protection Tax Law imposes environmental protection tax to enterprises, entities, producers or operators that discharge taxable pollutants into air, water or lands. Taxable pollutants include air pollutants, water pollutants, solid wastes and noises. The environmental protection tax is collected by the tax authority and levied in accordance with a table attached to the Environmental Protection Tax Law. However, emission of taxable pollutants into the centralized sewage and domestic waste treatment facilities, or storage or disposal of solid wastes in facilities or places that meet the national or local environmental protection standard, by enterprises, entities, producers or operators, is not deemed as direct emission of pollutants into the environment and is exempted from the environmental protection tax for such pollutants.

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In April 2020, the PRC government promulgated the amended Law on Prevention and Control of Environmental Pollution Caused by Solid Waste. Effective on September 1, 2020, the amended law imposes stricter responsibilities on the entities that generate industrial solid waste for environmental pollution caused by industrial solid waste. For example, under the revised version, if an entity that generates industrial solid waste engages a third-party contractor to deliver, use or dispose such industrial solid waste, it shall verify the qualification of such third-party contractor and enter into an agreement with such third party on requirements for the environment pollution prevention, failing which the entity will be jointly liable for any damages to the environment caused by the third-party contractor in relation to such arrangement. In conjunction with the amendment of the Law on Prevention and Control of Environmental Pollution Caused by Solid Waste, the National Catalogue of Hazardous Wastes was revised in November 2020, which amended and reclassified some hazardous wastes.

Mineral Resources Laws and Regulations

All mineral resources in China are owned by the state under the current Mineral Resources Law. Exploration, exploitation and mining operations must comply with the relevant provisions of the Mineral Resources Law and are under the supervision of the Ministry of Natural Resources. Exploration and exploitation of mineral resources are also subject to examination and approval by the Ministry of Natural Resources or relevant local authorities. Upon approval, the relevant administrative authorities, which are responsible for supervision and inspection of mining exploitation in their jurisdiction, will issue an exploration permit or mining permit. The holders of mining rights are required to file with the relevant administrative authorities annually.

The PRC government permits mine operators of collectively owned mines to exploit mineral resources in designated areas and individuals to mine scattered mineral resources. Such mine operators and individuals are subject to government regulation. Mining activities by individuals are restricted. Individuals are not permitted to exploit mineral reserves allocated for exploitation by a mining enterprise or company, or specified minerals prescribed by the state for protective mining. Indiscriminate mining that damages mineral resources is prohibited.

If mining activities result in damage to arable land, grassland or afforested area, the mining operator must take measures to return the land to an arable state within the prescribed time frame. Any entity or individual which fails to fulfil its remediation obligations may be fined and denied application for land use rights for new land by the relevant land and natural resources authorities.

It is unlawful for an entity or individual to conduct mining operations in areas designated for other legal mining operators. A mining operator whose exploitation causes harm to others in terms of production or in terms of living standards is liable for compensation and is required to take necessary remedial measures. When a mine is closed, a mine closure report and information concerning the mining facilities, hidden dangers, remediation and environmental protection must be submitted for examination and approval in accordance with the relevant PRC law and regulations.

Mineral products that have been illegally extracted and the related income derived from such activities may be confiscated and may result in fines, revocation of the mining permit and, in serious circumstances, criminal liability.

Energy Conservation Law

The amended Energy Conservation Law came into effect on October 26, 2018. It sets out the general principles for reducing energy waste and improving efficiency of energy consumption. It urges the adjustment of industry structure and replacement of high energy consumption projects with new energy or renewable energy resources. It provides that an energy conservation assessment and review system shall apply to new investment projects and where a project does not meet the mandatory energy conservation standards, the project cannot be constructed. If a project that does not meet the mandatory energy conservation standards has been completed, it cannot be put into use.

In March 2014, the MIIT issued a regulation, the “Opinion on Implementing Supervision of Industrial Energy Conservation,” which lists the primary aluminum smelting as one of the high energy consumption operations that will be strictly monitored. In December 2014, the MIIT issued the Guidance for National Industrial Efficiency, which sets forth industrial efficiency standards for producers of major products in industries that involve high energy consumption, which included primary aluminum and alumina products.

The State Council issued the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy on September 22, 2021. It sets China’s main objective for energy consumption per unit of GDP and carbon dioxide (CO_2) emissions per unit of GDP for 2025, 2030 and 2060. It predicts that by 2060, China will reach carbon neutrality.

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Regulations Concerning Electrolytic Aluminum Industry

In June 2016, the General Office of the State Council promulgated "Guiding Opinions on Creating a Favorable Market Environment and Promoting the Non-Ferrous Metals Industry to Adjust Structure, Advance Transformation and Increase Efficiency," under which the construction of new electrolytic aluminum projects and the reconstruction or expansion of existing electrolytic aluminum projects would be approved only if such construction, reconstruction or expansion would introduce new electrolytic aluminum production capacity in an amount equal to or smaller than the amount of existing electrolytic aluminum production capacity to be replaced by such construction, reconstruction or expansion.

In April 2017, NDRC, MIIT, the Ministry of Land and Resources (now known as the Ministry of Natural Resources) and the Ministry of Environmental Protection (now known as the Ministry of Ecology and Environment) jointly issued the "Notice Regarding the Plan on Special Action for Clean-up and Rectification of Projects in Violation of Laws and Regulations in the Electrolytic Aluminum Industry," which sets forth a comprehensive plan to inspect electrolytic aluminum projects and rectify violations of applicable laws or regulations revealed in the inspection.

On January 1, 2018, MITT issued the "Notice Regarding Electrolytic Aluminum Enterprises to Realize Capacity Replacement by Acquisition, Merger and Restructure," which requires electrolytic aluminum enterprises to achieve capacity replacement by acquisition, merger or capacity transferring and exchange of capacity quotas with its group companies.

Tax Laws and Regulation

In March 2007, the PRC government promulgated the Enterprise Income Tax Law which became effective from January 1, 2008 and was revised in 2018. The Enterprise Income Tax Law imposes a single income tax rate of 25% on both domestic and foreign invested enterprises. Pursuant to the Enterprise Income Tax Law, important high- and new-tech enterprises that are necessary to be supported by the state are subject to a reduced enterprise income tax rate of 15%. Certain branches and subsidiaries of us were granted tax concessions including preferential tax rates of 15%. On December 6, 2007, the PRC government promulgated the Enterprise Income Tax Law Implementation Rules which also became effective on January 1, 2008 and was later revised in 2019.

In March 2016, the MOF and the SAT jointly promulgated "Circular on Comprehensively Promoting the Pilot Program of the Collection of Value-added Tax in Lieu of Business Tax," pursuant to which we are allowed to deduct input tax from output tax according to the amount set forth in the special value-added tax invoices obtained from our purchases of services, intangible assets or real estate. On April 4, 2018, the MOF and the SAT issued the Circular on Adjusting Value-added Tax Rates, which became effective on May 1, 2018. Pursuant to this circular, for sale or import of goods, the previous applicable value-added tax rates of 17% and 11% were adjusted to 16% and 10%, respectively.

On March 20, 2019, the MOF, the SAT and the General Administration of Customs jointly issued the Announcement on Policies for Deepening Reform of Value-added Tax, which became effective on April 1, 2019. Pursuant to this announcement, for sales or import of goods by a general taxpayer that were previously subject to value added tax at the rate of 16%, the applicable tax rate has been adjusted to 13%, and for those previously subject to value added tax at the rate of 10%, the applicable tax rate has been adjusted to 9%.

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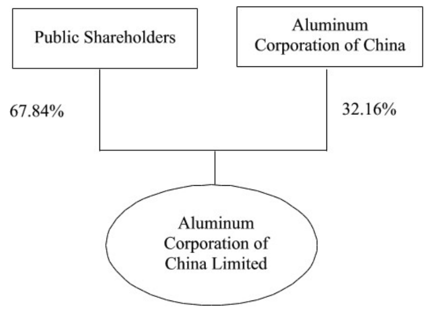
C. Organizational Structure

Set out below is a chart illustrating our corporate structure as of March 31, 2022:



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The following table sets forth further information of our principal subsidiaries as of December 31, 2021:

Company[(1)]	Percentage of ownership interest attributable to the Company		Principal activities
Baotou Aluminum Co., Ltd.	100.00	%	Manufacture and distribution of primary aluminum, aluminum alloy and related fabricated products and carbon products
Chalco Hong Kong Ltd.	100.00	%	Overseas investments and alumina import and export activities, and mining and distribution of bauxite
China Aluminum International Trading Co., Ltd.	100.00	%	Trading, import and export activities
Chalco Mining Co., Ltd.	100.00	%	Manufacture, acquisition and distribution of bauxite mines, limestone ore, manufacturing and distribution of alumina
Chinalco Shanxi Jiaokou Xinghua Technology Ltd.[(2)]	66.00	%	Manufacture and distribution of alumina
Chalco Shanghai Company Limited	100.00	%	Trading and engineering project management and leasing
Chalco Shanxi New Material Co., Ltd.	85.98	%	Manufacture and distribution of alumina, primary aluminum and anode carbon products and electricity generation and supply
Zunyi Aluminum Co., Ltd.	67.45	%	Manufacture and distribution of primary aluminum and alumina
Chalco Energy Co., Ltd.	100.00	%	Thermoelectric supply and investment management
China Aluminum Ningxia Energy Group Co., Ltd.	70.82	%	Thermal power, wind power and solar power generation, coal mining, and power-related equipment manufacturing
Guizhou Huajin Aluminum Co., Ltd.	60.00	%	Manufacture and distribution of alumina
Chalco Zhengzhou Research Institute of Non-ferrous Metal Co., Ltd.	100.00	%	Research and development services
Chalco Shandong Co., Ltd.	100.00	%	Manufacture and distribution of alumina
Chalco Zhongzhou Aluminum Co., Ltd.	100.00	%	Manufacture and distribution of alumina
Chalco Aluminum Logistics Group Corporation Co., Ltd.	100.00	%	Logistics and transportation
Shanxi Huaxing Aluminum Co., Ltd.[(3)]	100.00	%	Manufacture and distribution of alumina
Shanxi China Huarun Co., Ltd.	40.00	%	Manufacture and distribution of primary aluminum
Guizhou Huaren New Material Co., Ltd.	40.00	%	Manufacture and distribution of primary aluminum
China Aluminum International Trading Group Co., Ltd.	100.00	%	Trading, importing and exporting of non-ferrous metal products
Chalco Materials Co., Ltd.	100.00	%	Procurement of materials including raw materials and fuels

(1) Chalco Hong Kong Ltd. is incorporated in Hong Kong. All other principal subsidiaries are incorporated in the PRC.
(2) We directly hold 33% shares and indirectly hold 33% shares, through Chalco Shandong Co., Ltd.
(3) We directly hold 60% shares and indirectly hold 40% shares, through Chalco Hong Kong Ltd.

D. Property, Plants and Equipment

Bauxite Mines and Coal Mines

For summary disclosure of our bauxite mines and coal mines, please refer to "– B. Business Overview – Our Mines."

Boffa Mine

In accordance with the requirements of Regulation S-K 1300, we consider our Boffa mine in Guinea as the sole mining property that is material to our business. We have engaged Mr. Shengfa Tu as the qualified person for our bauxite mines. Mr. Tu has prepared the Technical Report Summary for our Boffa mine in compliance with Regulation S-K 1300 and Item 601(b)(96) of Regulation S-K, filed as Exhibit 96.1 to this annual report.

The information that follows relating to our Boffa mine is derived, for the most part, from the Technical Report Summary. Portions of the following information are based on assumptions, qualifications, and procedures that are not fully described herein. Reference should be made to the full text of the Technical Report Summary.

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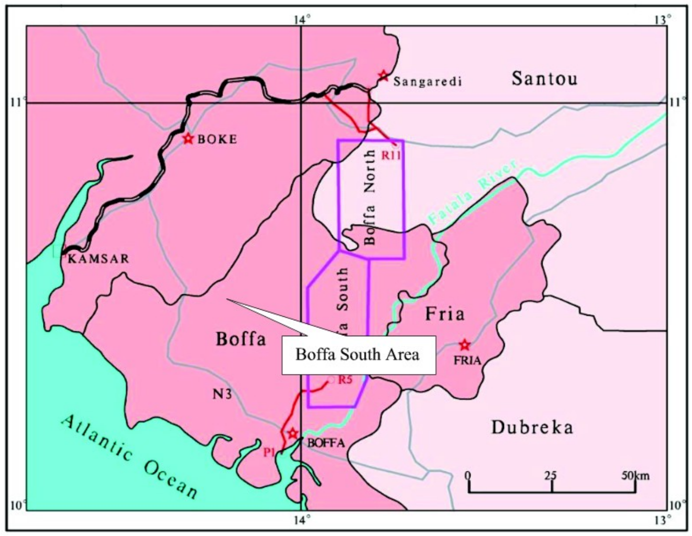
Location, Infrastructure and Facilities

The following map sets forth details of the area surrounding our Boffa mine in Guinea:



The Boffa mine is located eight kilometers north east of Boffa, the capital of Boffa Prefecture in Guinea. The linear distance between Boffa mine and Conakry, the capital of Guinea, is approximately 86 kilometers and the linear distance between the southwest corner of Boffa mine and the Atlantic Ocean is 25 kilometers. Conakry is connected to the city Boffa by the N3 road, which is a tarmac road with a distance of approximately 150 kilometers and a width of approximately six meters. The southern part of the Boffa mine is connected to the N3 road by a hasty road with a distance of approximately five kilometers. The Boffa mine consists of Boffa north area and Boffa south area, which covers an area of 653.55 km^2 and 594.61 km^2, respectively.

There are two main railways in Guinea. One railway links Conakry and the Fria smelter east of Boffa. The other railway runs from the CBG mine near Sangaredi to the port of Kamsar and has a larger transport capacity.

Guinea has two major ports. The first is the port of Conakry, adjacent to Conakry. The port handles container shipments and exportation of alumina and bauxite. The second port is Kamsar CBG, which is primarily used to export bauxite and has two smaller terminals for other bulk cargoes.

The Boffa mine is open pit, equipped with 2500SM open pit mining machines. We have facilities such as mining industrial sites, raw ore storage yards, low-grade ore storage yards, open-pit mining machines, belt conveyor systems, bridges, inland terminals, electric power stations and a temporary dump site. It has transportation facilities that have access to local roads and a belt conveyor system. Our mining facilities in the Boffa mine are connected to the electric power stations, which are powered by heavy oil fuel. Most of the facilities started to operate since Boffa mine was put into operation in April 2020. The quality of groundwater in the Boffa mine area meets the requirements for drinking, and the production and domestic water in the mine area is extracted groundwater. We believe all of our equipment in the Boffa mine is in good physical condition and suitable for our operations. The total book value of Boffa mine's fixed assets is RMB1.698 billion as of December 31, 2021.

History, Mining Rights and Operations

From August 2005 to May 2006, 10 exploration leases were granted to BHP Billiton in Guinea, which cover Boffa. In 2008 and 2011, BHP Billiton applied to the Guinea Government to reduce the size of the mine covered by the leases. In 2012, BHP Billiton submitted "Boffa Santou Houda Project Close Out Report" to the Guinea Government and handed the exploration leases back to the Guinea Government.

On October 31, 2016, Chalco signed cooperation framework agreements with the Guinea Government and Guinean State Mining Company for the development of the Boffa mine. On June 8, 2018, Chalco Hong Kong and Chalco Guinea Company S.A., a wholly-owned subsidiary of Chalco Hong Kong, entered into a mining convention with the Guinean government, pursuant to which Chalco Hong Kong agreed to provide investment funds while the Guinean government agreed to provide mining licenses and rights to transport mining products for the development and operation of the Boffa Project. On July 9, 2018, the president of Guinea signed a decree to grant both Boffa north area and Boffa south area a mining permit, effective from July 2018 to July 2033. For more details of the history of Boffa mine, please refer to "Item 4. Information on the Company – A. History and Development of the Company – Boffa Project."

Upon expiration of the current 15-year period, our mining permit for the Boffa mine is renewable for additional periods, each of which would also be 15 years except that the last renewal period would be subject to the depletion timing of the Boffa mine. We will not need to pay additional consideration for each renewal of the mining permit. The Boffa Project commenced construction in September 2018 and was completed and put into operation in April 2020. We must pay a royalty of US$0.208 per tonne based on the volume of bauxite extracted from the Boffa mine.

Chalco Guinea Company S.A. has 620 employees. From then through the end of 2021, we extracted approximately 20.4 million tonnes of bauxite from the Boffa mine. The annual bauxite output capacity is expected to increase to 15 million tonnes in 2022.

As of the date of this annual report, we have not been found any violation or subject to any fine for our mining operations at the Boffa mine.

Mineral Resources and Mineral Reserves

The following table sets forth the summary of mineral resources, exclusive of mineral reserves, for the Boffa mine as of December 31, 2021:

	Amount *(in million tonnes)*	**AAl_2O_3** *(%)*	**$RSiO_2$** *(%)*	**A/S**	**Cut-off grades**		**Metallurgical recovery**[(1)]
Measured mineral resources	58.97	37.51	1.29	29.13	AAl_2O_3	35 %	
Indicated mineral resources	66.92	37.84	1.19	31.92	AAl_2O_3	35 %	85%
Measured + Indicated mineral resources	125.89	37.68	1.23	30.56	AAl_2O_3	35 %	
Inferred mineral resources	1,535.77	39.02	1.09	35.93	AAl_2O_3	35 %	

(1) The metallurgical recovery of bauxite refers to dissolution rate.

(2) AAl_2O_3 means available aluminum and $RSiO_2$ means reactive silica.

(3) The resources include stockpiled ore or ore to be stockpiled in the local area.

(4) Estimation of mineral resources in this table is based on US$22.02 per wet tonne of bauxite, which is the loading price in Guinea, calculated based on the FOB price of US$32.5 per wet tonne and deduction of cost of wharf, inland waterway and platform transship. The corresponding CIF price of bauxite arriving in China is $53.16 per dry tonne. This price is close to the five-year average CIF price of Guinea bauxite imported by China from 2017 to 2021. Mineral resources are estimated at $AAl_2O_3 \geq 35\%$ cut off grade and at a minimum mining thickness of 1 meter. The point of reference selected by the qualified person is the point where bauxite is delivered to wharf yard and available for use by alumina refineries. For further information on assumptions used in preparing the estimates, please refer to Chapter 11 of the Technical Report Summary.

The following table sets forth the summary of mineral reserves for the Boffa mine as of December 31, 2021:

	Amount *(in million tonnes)*	AAl_2O_3 *(%)*	$RSiO_2$ *(%)*	A/S	Cut-off grades	Metallurgical recovery[(1)]
Proven mineral reserves	49.45	41.71	1.07	39.13	AAl_2O_3 39 %	
Probable mineral reserves	62.24	41.74	1.35	31.03	AAl_2O_3 39 %	85%
Total mineral reserves	111.69	41.73	1.22	34.16	AAl_2O_3 39 %	

(1) The metallurgical recovery of bauxite refers to dissolution rate.

(2) AAl_2O_3 means available aluminum and $RSiO_2$ means reactive silica.

(3) Estimation of mineral resources in this table is based on US$22.02 per wet tonne of bauxite, which is the loading price in Guinea, calculated based on the FOB price of US$32.5 per wet tonne and deduction of cost of wharf, inland waterway and platform transship. The corresponding CIF price of bauxite arriving in China is $53.16 per dry tonne. This price is close to the five-year average CIF price of Guinea bauxite imported by China from 2017 to 2021. Mineral reserves are estimated at $AAl_2O_3 \geq 39\%$ cut off grade and at a minimum mining thickness of 1 meter. The point of reference selected by the qualified person is the point where bauxite is delivered to wharf yard and available for use by alumina refineries. For further information on assumptions used in preparing the estimates, please refer to Chapter 12 of the Technical Report Summary.

In this annual report on Form 20-F, we adopt the disclosure requirements of Regulation S-K 1300 for the first time. We adopted the disclosure requirements of United States Securities and Exchange Commission Industry Guide 7, or Industry Guide 7, in the annual report on Form 20-F for the fiscal year ended December 31, 2020, or FY2020 20-F. Industry Guide 7 did not allow the reporting of mineral resources and included different rules for disclosing mineral reserves. As disclosed in FY2020 20-F, neither proven nor probable reserves have been established in accordance with Industry Guide 7 as of the date of FY2020 20-F. Accordingly, a comparison of the Boffa mine's mineral resources and reserves as of December 31, 2021 against the mineral resources and reserves as of December31, 2020 is not available.

Land

Chinalco leases to us 417 pieces or parcels of land, located in 10 provinces, covering an aggregate area of approximately 49.93 million square meters for any purpose related to our operations and businesses. Currently, all leases for our properties are valid and have not expired. The leased land mainly consists of:

- 40 pieces of allocated land with an area of approximately 5.3 million square meters. Chinalco has obtained authorization from the relevant administrative authorities to manage and lease the land use rights for such land; and
- 377 pieces of land with an area of approximately 44.7 million square meters. Chinalco has paid the land premiums and obtained land use rights certificates.

The land is leased for the following terms:

- allocated land: 50 years commencing from July 1, 2001 (except for land use rights of mines operated by us, whose leased terms shall end on the expiration date of the mining rights or at the end of the actual mine life, whichever is earlier);
- granted land: until expiration of the relevant land use right permits; and
- for both allocated or granted land: normal commercial terms that stipulate, among other conditions, the terms of use, monthly or annual rental amounts payable in Renminbi and a six-month notification provision for termination of any lease agreement.

Buildings

Our principal executive offices, which we lease from Chinalco, are located at No. 62 North Xizhimen Street, Haidian District, Beijing, People's Republic of China, 100082.

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Pursuant to the reorganization in connection with our initial public offering in 2001, Chinalco transferred to us, among other operating assets, ownership of the buildings and properties for the operation of our core businesses. Chinalco retained its remaining buildings and properties for its operations. The buildings transferred to us comprise 4,631 buildings with an aggregate gross area of approximately 4.2 million square meters. These buildings may be sold or transferred only with the consent of Chinalco and in accordance with applicable land transfer procedures. Chinalco has undertaken to provide its consent and the necessary assistance to affect land grant procedures to ensure that our buildings can be legally transferred or sold.

We and Chinalco also lease to each other a number of other buildings and properties for ancillary uses, which comprise mainly buildings for offices, dormitory, canteen and storage purposes. As of the date of this annual report, we leased to Chinalco buildings with an aggregate gross area of approximately 146,228 square meters, while Chinalco leased to us buildings with an aggregate gross area of approximately 174,969 square meters. In December 2021, we and China Aluminum Investment and Development Co., Ltd., a wholly-owned subsidiary of Chinalco, renewed a tenancy agreement pursuant to which we would lease from Chinalco the office premises at certain floors of No. 62 North Xizhimen Street, Haidian District, Beijing, PRC, with an aggregate gross floor area of 22,303 square meters. This agreement will expire on December 31, 2024.

Our Expansion

Our expansion projects in 2021 primarily include:

- The 2,000,000 tonne bauxite project of Guangxi branch: we expect to invest a total amount of approximately RMB545 million in this project. By the end of 2021, an aggregate of RMB164 million of capital expenditure had been incurred. The project is expected to be completed in August 2022.

Item 4A. Unresolved Staff Comments

None.

Item 5. Operating and Financial Review and Prospects

The following discussion and analysis should be read in conjunction with our audited consolidated financial statements and selected historical financial data, in each case together with the accompanying notes included elsewhere in this annual report.

This section contains certain "forward-looking statements" within the meaning of the United States Private Securities Litigation Reform Act of 1995. Forward-looking statements are not guarantees of our future performance or results and our actual results could materially differ from those disclosed in the forward-looking statements. In evaluating our business, you should carefully consider the information provided in "Item 3. Key Information – D. Risk Factors."

As the business combinations under common control incurred in the years ended December 31, 2019, 2020 and 2021, the comparative financial data for the years ended December 31, 2018, 2019 and 2020 are revised to reflect the business combinations under common control. Unless otherwise indicated in this section, our financial data for the years ended December 31, 2019 and 2020 are presented based on those revised amounts. Please see Note 39 to our audited consolidated financial statements.

A. Operating Results

Overview

We are a leading enterprise in the non-ferrous metal industry in China. We are engaged principally in alumina refining, primary aluminum smelting, and trading of non-ferrous metal products, coal products and other products. In addition, we are engaged in coal mining and power generation. The remainder of our revenues was derived from research and development activities and other products and services. We organize and manage our operations according to the following key segments:

- Our alumina segment, which consists of the mining and purchasing of bauxite and other raw materials, and production and sale of alumina as well as chemical alumina. Alumina accounted for approximately 93.1% of the total production volume for this segment in 2021. Chemical alumina products are used in the production of chemical, pharmaceutical, ceramic and construction materials. In the process of refining bauxite into alumina, we produce gallium as a by-product, which is a rare, high-value metal with applications in the electronics and telecommunication industries.

- Our primary aluminum segment, which consists of the procurement of alumina, other raw materials, supplemental materials and electrical power, the production and sale of primary aluminum and aluminum-related products, such as carbon products, aluminum alloy products and other aluminum products. Our principal primary aluminum products are ingots, molten aluminum and aluminum alloys, which accounted for approximately 18.6%, 44.1% and 37.3%, respectively, of our total production volume of primary aluminum in 2021. Our standard 20 kilogram remelt ingots are used for general aluminum fabrication in the construction, electricity, electronics, transportation, packaging, machinery and durable goods industries. We internally produce substantially all the carbon products used at our smelters and sell our remaining carbon products to external customers.

- Our trading segment, which mainly consists of the trading of alumina, primary aluminum, aluminum fabrication products, other non-ferrous metal products, and crude fuels such as coal products, as well as supplemental materials and logistics and transport services to our internal manufacturing plants and external customers. We established our trading business under Chalco Trading as a separate segment in July 2010 as a result of our operational structural adjustment. Since 2014, we have established Chalco Materials, Chalco Logistics and Chalco Trading Group to continuously promote and deepen development of our trading business, jointly constituting our trading segment. Established in 2018, Chalco Trading Group has undertaken the businesses that used to be operated by Chalco Trading.

- Our energy segment, which consists of the research and development, production and operation of energy products, including coal mining and conventional coal-fire power generation as well as renewable energy generation such as wind power and solar power. We are also engaged in new energy equipment production. We established our energy segment in January 2013 as a result of our acquisition of Ningxia Energy in line with our development strategy to partially offset our future energy costs. In 2021, we supplied the majority of the electricity we generated for our own production use, supplied a portion of the coal output to our own electric power plant and sold the remaining portion to external customers. Ningxia Energy supplied the electricity it generated mainly to the state grid in China.

- Our corporate and other operating segment, which consists of corporate and other aluminum-related research, development, and our other activities.

Our consolidated revenue increased by 45.0% from RMB185,990.6 million for the year ended December 31, 2020 to RMB269,748.2 million for the year ended December 31, 2021, primarily due to the year-on-year increase in the prices of alumina and electrolytic aluminum. Our net profit increased significantly from RMB1,599.2 million for the year ended December 31, 2020 to RMB7,789.0 million for the year ended December 31, 2021, primarily because our gross profit increased significantly from RMB12,316.3 million in 2020 to RMB26,478.3 million in 2021.

Factors Affecting Our Results of Operations

We believe that the following factors, which impact our various revenue and expense items (as described below), have had, and will continue to have, a significant effect on the development of our business, financial position and results of operation.

Economic Condition of China and the World

As the major aluminum product market is globalized, the demand for and prices of our products are highly correlated with the general economic condition of China and the world and the performance of the major aluminum and related product markets. In recent years, China’s economy continued to experience growth despite the negative effects of the global financial crisis beginning in the second half of 2008 and economic recession in 2009, as well as general market volatility and changing macroeconomic conditions. However, as China is in the process of transforming its development model, optimizing its economic structure and changing its growth drivers, the growth of China’s economy has slowed down since 2014, with GDP growth from 2014 through 2019 ranging from 6.1% to 6.9%. Furthermore, the outbreak and global spread of the COVID-19 in 2020 and 2021 has adversely affected the global economy and China’s economy and financial market in general. As a result, the compound annual GDP growth rate of China was 5.1% in 2020 and 2021. Please refer to “Item 3. Key Information – D. Risk Factors – Our business may be materially and adversely affected by the COVID-19 pandemic” for further details of the impact of the outbreak of COVID-19.

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The global output of alumina (with chemical alumina products included) in 2021 increased by approximately 4.2% from 2020 to approximately 138.66 million tonnes. The global alumina consumption (with chemical alumina products included) in 2021 increased approximately by 3.6% from 2020 to approximately 137.61 million tonnes. In 2021, the domestic output of alumina (with chemical alumina products included) increased approximately by 5.9% from 2020 to approximately 75.20 million tonnes and the domestic consumption for alumina (with chemical alumina products included) increased by approximately 4.3% from 2020 to approximately 77.99 million tonnes.

The global output of primary aluminum in 2021 increased by approximately 3.8% from 2020 to approximately 67.78 million tonnes. The global consumption of primary aluminum in 2021 increased by approximately 9.1% from 2020 to approximately 69.15 million tonnes. In 2021, the domestic output of primary aluminum decreased by approximately 4.3% from 2020 to approximately 38.90 million tonnes and the domestic consumption of primary aluminum increased by approximately 5.7% from 2020 to approximately 40.55 million tonnes.

Mix and Pricing of Our Products

We are engaged principally in alumina refining, primary aluminum smelting and sales of these products and trading of non-ferrous metal products and other products. In addition, we are engaged in coal mining and power generation. We coordinate substantially all of our sales and marketing activities for our self-produced alumina products and some of our sales and marketing activities for our self-produced primary aluminum products through Chalco Trading Group, taking into account the spot market prices and SHFE prices. In 2021, revenues generated from alumina, primary aluminum, trading and energy segments (after elimination of inter-segment sales) accounted for 6.9%, 23.7%, 66.4% and 2.8%, respectively, of our consolidated total revenues after elimination of inter-segment sales. We apply different policies to price different products. For information on our pricing of different products, please see the section headed “Item 4. Information of the Company – B. Business Overview – Sales and Marketing.”

The sales prices of alumina that our alumina refineries sell internally to Chalco Trading Group are determined based on our budgeted sale prices, spot market prices and the prices of primary aluminum on SHFE. Chalco Trading Group coordinates the external negotiation and execution of sales contracts of our alumina products. The alumina prices in both the domestic and international markets increased in 2021 when compared to that of 2020. The increase in the alumina price in the international market was attributable to the gradual recovery of the demand of alumina after the COVID-19 outbreak in 2020 and the globally strained supply chain due to reduced production capacity. In 2021, the spot price of alumina in the international market reached a high of approximately US$483 per tonne and bottomed out at approximately US$269 per tonne. The average spot price of alumina in the international market was approximately US$330 per tonne, representing an increase of 21.5% from 2020. The spot price of alumina in the domestic market reached a high of RMB4,108 per tonne and bottomed out at RMB2,324 per tonne. The average spot price of alumina in the domestic market was approximately RMB2,799 per tonne, representing an increase of 19.8% from 2020. The increase of the alumina price in the domestic market was primarily attributable to the maintenance of the high price of electrolytic aluminum that drove increased price of alumina, the decrease in supply of alumina in the domestic market due to government inspection of environment and government control of energy and consumption, declining imports of alumina due to a decrease in supply of alumina in the international market, and an increase in prices of raw materials for alumina. Our average selling price of alumina increased by 13.4% from RMB2,465 per tonne in 2020 to RMB2,785 per tonne in 2021.

Like most primary aluminum producers in China, we price our primary aluminum products by reference to the primary aluminum spot prices and futures price on the SHFE. In 2021, the primary aluminum prices in the international market generally increased due to the ease of global liquidity and the gradual recovery of the demand of alumina after the COVID-19 outbreak in 2020. The change of primary aluminum prices in the domestic market in 2021 was attributable to the ease of global liquidity, the unmet demand of primary aluminum due to government control of energy and consumption, electricity power rationing, benefits from the policy of “carbon dioxide peaking and carbon neutrality” and increase in prices of raw materials for primary aluminum. In 2021, three-month aluminum futures prices reached a high of US$3,229 per tonne and a low of US$1,945 per tonne on LME; and a high of RMB24,820 per tonne and a low of RMB14,640 per tonne on SHFE. In 2021, the average price of spot aluminum and three-month aluminum futures at LME were approximately US$2,480 per tonne and US$2,485 per tonne, respectively, representing an increase of 45.5% and 43.3% from that of 2020, respectively. The average three-month aluminum futures prices at SHFE increased by 37.3% from RMB13,807 per tonne in 2020 to RMB18,898 per tonne in 2021 while the average spot prices of primary aluminum at SHFE increased by 34.2% from RMB14,112 per tonne in 2020 to RMB18,953 per tonne in 2021. Our average selling price of primary aluminum increased by 34.8% from RMB14,142 per tonne in 2020 to RMB19,099 per tonne in 2021.

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Price Volatility of Non-ferrous Metal and Coal Products

Since late 2009, as a result of the implementation of our operational structural adjustment, we have been engaged substantially in the trading of outsourced non-ferrous metal products to increase our profit. In 2012, we began to engage in the trading of significant amounts of outsourced coal products to diversify our product portfolio. Although the profit margin of sales of outsourced products is typically lower than that of our self-produced products, we generated substantial revenues and profit from the trading of outsourced products during the past few years due to our significant trading volumes. Our revenue generated from external sales of products purchased from external sources in 2021 was approximately RMB151,105.6 million, representing approximately 84.3% of total revenue from external sales in our trading segment. From time to time, we may enter into futures and option transactions in addition to the simple buy-low-sell-high trading model to hedge against price fluctuations in the non-ferrous metal and coal products market. However, short-term price volatility of these products remains a key factor affecting our operating results, as we need to make the correct prediction concerning the price trends of these products on the markets to ensure substantial revenues through large trading volume. If the market price trend does not match our prediction, we may be forced to sell trading products at low prices or to purchase trading products at high prices, which may adversely affect gross margins and profitability.

Manufacturing Costs

Our cost of revenues consists primarily of the costs of raw materials, overhead cost and electric power cost. Our principal raw material is bauxite. For the years ended December 31, 2019, 2020 and 2021, bauxite supplied by our mines accounted for 37.6%, 46.4% and 63.5%, respectively, of our total bauxite used in the production of alumina. The unit cost of bauxite produced by us is generally lower than the unit cost of bauxite procured from external suppliers. In 2021, the average purchase price of bauxite per tonne from our other suppliers decreased by approximately 6.2% to RMB386.83 while the average cost of bauxite per tonne from our own mines increased by approximately 6.3% to RMB299.03 compared to 2020. In addition, our average purchase price per unit tonne of thermal coal in 2021 increased by approximately 52.4% compared to 2020. As a result, our average cost of alumina per tonne in 2021 increased by approximately 2.5% from that in 2020.

Primary aluminum is one of our major aluminum products and is produced by smelting operations. Smelting operations require a substantial and continuous supply of electricity. Electricity cost is the most significant component of our primary aluminum production cost and accounted for approximately 37.0% of our unit production cost for primary aluminum in 2021. The availability and price of electricity are key considerations in our primary aluminum operations. Interruptions of electricity supply can result in lengthy production shutdowns, increased costs associated with restarting production and waste of production in progress, and prolonged interruptions can cause damage to, or the destruction of, production equipment and facilities. Our average annual electricity price per kWh (including tax) remained relatively stable from 2019 to 2020 and increased by 27.0% from 2020 to 2021.

Given our high proportion of fixed costs, we must generate sufficient sales to absorb our fixed costs to maintain or increase our operating margins. Our acquisitions and production expansion in recent years have significantly increased our costs that are relatively fixed in nature, such as leases and depreciation of property, plant and equipment and employee benefit expenses. If we are able to maintain satisfactory facility utilization rates and productivity, our production capacity expansion will enable us to reduce our unit costs through economies of scale and recover associated increased costs through higher output. In 2021, we continued to focus on lowering production costs and increasing production efficiency through reducing raw material consumption by improving technology and internal management.

Availability and Costs of Financing

We require a significant amount of capital to fund our operations. For example, we need substantial amounts of funds for expanding our operations, purchasing and maintaining equipment and procuring commodities. We have in the past funded our capital expenditures primarily with bank loans and the issuance of medium-term notes and bonds and long-term bonds. The availability of financing is subject to various factors, including our credit history and the prevailing credit policy adopted by the PRC government. Over the years, we have maintained good relationships with the commercial banks in China, which enables us to access bank financing at relatively low costs. Any change of lending policies adopted by the PRC government in the future may, among other things, affect our ability to obtain financing and may in turn adversely affect our operating results.

Our finance costs decreased by 10.8% from 2020 to 2021, primarily because we reduced the scale of our interest-bearing debts and the unit cost of financing decreased in 2021. If we are unable to secure sufficient external funding when required, we may not be able to fund our working capital requirements and necessary capital expenditures, which could adversely affect our business, financial performance and prospects.

In addition, our borrowing costs and access to debt financing depend significantly on our credit ratings. These ratings, including long-term corporate credit ratings and financing bond credit ratings, are assigned by rating agencies, which may lower or withdraw their ratings. Any change in our credit ratings or average interest rate could have negative implications, which may increase our finance costs and affect our financial results.

Regulatory Environment

The PRC government continues to shape the structure and development of the aluminum industry through industry guidelines for energy conservation, safety, environmental and quality. The central and local PRC government will give more support to entities that meet the standards in such industry guidelines. If the PRC government changes its current industry guidelines or the interpretation of those industry guidelines, we may face pressure on profit margins and constraints on our ability to expand our business operations.

Selected Statement of Operation Items

Revenue

Our revenue is primarily generated from sales of alumina, primary aluminum, other non-ferrous metal products and coal products. In addition, we are engaged in coal mining and power generation. The remainder of our revenues was derived from research and development activities and other products and services.

Cost of Sales

Our cost of sales consists primarily of the purchase of inventories in relation to trading activities, cost of raw materials, consumables and electric power used in manufacturing, certain fixed cost and employee benefit expenses. For the years ended December 31, 2019, 2020 and 2021, our cost of sales was RMB179,284.0 million, RMB173,674.2 million and RMB243,269.9 million, respectively, and accounted for 94.3%, 93.4% and 90.2%, respectively, of the total consolidated revenues for those periods.

Operating Expenses

Selling and Distribution Expenses. Our selling and distribution expenses consist primarily of transportation and loading expenses which are indirectly related to product sales and employee benefit expenses for employees in selling and distribution department. Selling and distribution expenses accounted for 7.7%, 4.3% and 2.7% of our total operating expenses for the years ended December 31, 2019, 2020 and 2021, respectively.

General and Administrative Expenses. Our general and administrative expenses consist primarily of employee benefit expenses for directors and officers and employees in the administrative department and, to a lesser extent, taxes other than income tax expenses, depreciation of non-production property, plant and equipment, termination benefit expenses, travelling and entertainment, legal and other professional fees, amortization of right-of-use assets, utilities and office supplies, insurance expense, repairs and maintenance expenses, auditors' remuneration, amortization of intangible assets, and others. General and administrative expenses accounted for 68.6%, 56.9% and 44.9% of our total operating expenses for the years ended December 31, 2019, 2020 and 2021, respectively. Employee benefit expenses, including salaries and bonus, housing fund, staff welfare and other expenses, employment expense in relation to early retirement schemes and termination benefit, comprise a significant component of our general and administrative expenses, accounting for 46.3%, 41.2% and 43.0% of our total general and administrative expenses for the years ended December 31, 2019, 2020 and 2021, respectively.

Research and Development Expenses. Our research and development expenses accounted for 16.2%, 19.6% and 20.4% of our total operating expenses for the years ended December 31, 2019, 2020 and 2021, respectively.

Impairment Loss on Property, Plant and Equipment. Our impairment loss on property, plant and equipment accounted for 4.5%, 5.7% and 20.1% of our total operating expenses for the years ended December 31, 2019, 2020 and 2021, respectively. The increase in impairment loss on property, plant and equipment in 2021 was primarily because some of our assets are not in operation, temporarily idle or not operated with full capacity due to production plan adjustments, the increase in cost of mining resulting from environmental protection requirements and the increase in operating cost including rents.

Impairment Losses on Financial Assets. Our impairment losses on financial assets accounted for 11.9% of our total operating expenses for the year ended December 31, 2021.

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Impairment Losses on Investments in Joint Ventures. We did not incur any impairment losses on investments in joint ventures for the year ended December 31, 2021.

Other Income

Our other income consists primarily of tax rebates and grants on industrial development support from the government. For the year ended December 31, 2021, our other income was RMB148.4 million and accounted for approximately 0.1% of the total consolidated revenues.

Other Losses, net

Our net other losses consisted primarily of losses on disposal of property, plant and equipment and losses from closing out hedging futures. For the year ended December 31, 2021, our net other losses were RMB1,623.5 million and accounted for approximately 0.6% of the total consolidated revenues.

Finance Income

Our finance income consists primarily of interest income. For the year ended December 31, 2021, our finance income was RMB276.0 million and accounted for approximately 0.1% of the total consolidated revenues.

Finance Costs

Our financing costs consist primarily of interest expense on our borrowings and bonds, interest on lease liability and amortization of unrecognized finance expenses. Interest rates on loans related to capital expenditures and working capital set by banks generally follow guidelines issued by the PBOC. The PBOC regulates the interest rates for commercial loans charged by state-owned banks from time to time as part of the PRC government's efforts to regulate the PRC economy. In 2021, we incurred interest expense (net of capitalized interest) of RMB3,520.5 million on our borrowings.

Share of Profits and Losses of Joint Ventures

Our share of profits and losses of joint ventures is the profit attributable to us from our joint ventures, based on our equity interests in such joint ventures. A joint venture is a type of joint arrangement whereby the parties that have joint control of the arrangement have rights to the net assets of the joint venture. Joint control is the contractually agreed sharing of control of an arrangement, which exists only when decisions about the relevant activities require unanimous consent of the parties sharing control.

Share of Profits and Losses of Associates

Our share of profits and losses of associates is the profit attributable to us from our associates, based on our equity interests in such associates. An associate is an entity over which we have significant influence but not control.

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Consolidated Results of Operations

The following table sets forth certain income and expense items as a percentage of our revenues from our consolidated statements of comprehensive income for the periods indicated:

	Year Ended December 31,						
	2019 (Restated)		2020 (Restated)		2021		
	RMB	(%)	RMB	(%)	RMB	US$	(%)
	(in millions, except percentage)						
Revenue	190,215.4	100.0	185,990.6	100.0	269,748.2	42,329.4	100.0
Cost of Sales	(179,284.0)	(94.3)	(173,674.2)	(93.4)	(243,269.9)	(38,174.4)	(90.2)
Gross Profit	10,931.4	5.7	12,316.4	6.6	26,478.3	4,155.0	9.8
Selling and distribution expenses	(447.4)	(0.2)	(315.7)	(0.2)	(314.9)	(49.4)	(0.1)
General and administrative expenses	(3,972.1)	(2.1)	(4,157.7)	(2.2)	(5,204.2)	(816.7)	(1.9)
Research and development expenses	(940.8)	(0.5)	(1,434.1)	(0.8)	(2,362.2)	(370.7)	(0.9)
Impairment loss on property, plant and equipment	(259.4)	(0.1)	(416.8)	(0.2)	(2,328.1)	(365.3)	(0.9)
Impairment losses on financial assets	(171.0)	(0.1)	(979.2)	(0.5)	(1,384.9)	(217.3)	(0.5)
Impairment losses on investments in joint ventures	—	—	—	—	—	—	—
Other income	84.6	<0.1	139.6	0.1	148.4	23.3	0.1
Other (losses)/gains, net	981.7	0.5	903.9	0.5	(1,623.5)	(254.8)	(0.6)
Operating profit	6,207.1	3.3	6,056.4	3.3	13,408.9	2,104.1	5.0
Finance Income	261.2	0.1	227.2	0.1	276.0	43.3	0.1
Finance cost	(4,921.5)	(2.6)	(4,420.5)	(2.4)	(3,942.8)	(618.7)	(1.5)
Share of profits and losses of joint ventures	270.1	0.1	180.5	0.1	164.1	25.8	0.1
Share of profits and losses of associates	48.8	<0.1	145.7	0.1	272.6	42.8	0.1
Profit before income tax	1,865.6	1.0	2,189.3	1.2	10,178.8	1,597.3	3.8
Income tax benefit/(expense)	(631.5)	(0.3)	(590.0)	(0.3)	(2,389.8)	(375.0)	(0.9)
Profit for the year	1,234.1	0.6	1,599.2	0.9	7,789.0	1,222.3	2.9

No customer individually accounted for more than 10% of our total revenue for the year ended December 31, 2021. Sales to Chinalco and its subsidiaries, joint ventures, associates and other related parties accounted for approximately 13.0%, 17.3% and 11.8% of consolidated revenues for the years ended December 31, 2019, 2020 and 2021, respectively. For information on related party transactions, see "Item 7. Major Shareholders and Related Party Transactions – B. Related Party Transactions" and Note 36 to our audited consolidated financial statements.

Year Ended December 31, 2021 Compared with Year Ended December 31, 2020

Revenue

Our revenue increased by 45.0% from RMB185,990.6 million for the year ended December 31, 2020 to RMB269,748.2 million for the year ended December 31, 2021, primarily due to the year-on-year increase in the prices of alumina and electrolytic aluminum.

Cost of Sales

Our cost of sales increased by 40.1% from RMB173,674.2 million for the year ended December 31, 2020 to RMB243,269.9 million for the year ended December 31, 2021, primarily due to the impact of higher prices of raw fuel materials.

Selling and Distribution Expenses

Our selling and distribution expenses were RMB314.9 million for the year ended December 31, 2021, which remained stable compared to RMB315.7 million for the year ended December 31, 2020.

General and Administrative Expenses

Our general and administrative expenses increased by 25.2% from RMB4,157.7 million for the year ended December 31, 2020 to RMB5,204.2 million for the year ended December 31, 2021, primarily due to the increase in staff costs as a result of the phase-out of COVID-19 pandemic social insurance premium relief policy introduced in 2020 and the increase in expenses as a result of expanded operation of our Boffa mine in Guinea and the ancillary alumina plants of Guangxi Huasheng.

Research and Development Expenses

Our research and development expenses increased by 64.7% from RMB1,434.1 million for the year ended December 31, 2020 to RMB2,362.2 million for the year ended December 31, 2021, primarily due to the increase in investment in optimizing the product process, improving the added value of aluminum processing products and developing the mid-to-high-end products.

Other Income

Other income increased by 6.3% from RMB139.6 million for the year ended December 31, 2020 to RMB148.4 million for the year ended December 31, 2021, primarily due to the increase in the government grants recognized as other income.

Other (Losses)/Gains, Net

Our net other losses amounted to RMB1,623.5 million for the year ended December 31, 2021, compared to our net other gains of RMB903.9 million for the year ended December 31, 2020, primarily because we incurred losses of RMB604.7 million and RMB650.7 million from closing out hedging futures and disposal of idle production lines, respectively, during 2021.

Finance Income

Our finance income increased by 21.5% from RMB227.2 million for the year ended December 31, 2020 to RMB276.0 million for the year ended December 31, 2021, primarily due to increase in gains from short-term wealth management products.

Finance Costs

Our finance costs decreased by 10.8% from RMB4,420.5 million for the year ended December 31, 2020 to RMB3,942.8 million for the year ended December 31, 2021, primarily because we reduced the scale of our interest-bearing debts and the unit cost of financing decreased in 2021.

Share of Profits and Losses of Joint Ventures

Our profit in our share of profits and losses of joint venture decreased by 9.1% from RMB180.5 million for the year ended December 31, 2020 to RMB164.1 million for the year ended December 31, 2021. This was primarily attributable to the decrease in the profitability of a coal joint venture and an electricity generation joint venture.

Share of Profits and Losses of Associates

Our profit in our share of profits and losses of associates increased by 87.0% from RMB145.7 million for the year ended December 31, 2020 to RMB272.6 million for the year ended December 31, 2021. This was primarily due to the increase in the profitability of our two electrolytic aluminum associates.

Income Tax

Our income tax expense increased significantly from RMB590.0 million for the year ended December 31, 2020 to RMB2,389.8 million for the year ended December 31, mainly due to our significant year-on-year increase in pre-tax corporate profits.

Results of Operations

As a result of the foregoing, our net profit increased significantly from RMB1,599.2 million for the year ended December 31, 2020 to RMB7,789.0 million for the year ended December 31, 2021.

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Year Ended December 31, 2020 Compared with Year Ended December 31, 2019

Revenue

Our revenue decreased by 2.2% from RMB190,215.4 million for the year ended December 31, 2019 to RMB185,990.6 million for the year ended December 31, 2020, primarily due to the decrease in our trading business.

Cost of Sales

Our cost of sales decreased by 3.1% from RMB179,284.0 million for the year ended December 31, 2019 to RMB173,674.2 million for the year ended December 31, 2020, primarily due to the decrease in our trading business.

Selling and Distribution Expenses

Our selling and distribution expenses decreased by 29.4% from RMB447.4 million for the year ended December 31, 2019 to RMB315.7 million for the year ended December 31, 2020, primarily due to the decrease in our domestic transportation expenses of products.

General and Administrative Expenses

Our general and administrative expenses increased by 4.7% from RMB3,972.1 million for the year ended December 31, 2019 to RMB4,157.7 million for the year ended December 31, 2020, primarily due to the increase in the land use tax.

Research and Development Expenses

Our research and development expenses increased by 52.4% from RMB940.8 million for the year ended December 31, 2019 to RMB1,434.1 million for the year ended December 31, 2020, primarily due to the increase in investment in optimizing the electrolytic process of primary aluminum, improving the added value of aluminum fabrication products and developing the mid-to-high-end products.

Other Income

Other income increased by 64.9% from RMB84.6 million for the year ended December 31, 2019 to RMB139.6 million for the year ended December 31, 2020, primarily due to the increases in the government grants recorded under other income.

Other Gains, Net

Our net other gains decreased by 7.9% from RMB981.7 million for the year ended December 31, 2019 to RMB903.9 million for the year ended December 31, 2020, primarily because we had gains on disposal of certain subsidiaries, associates and business in 2019 while we did not have such disposals in 2020.

Finance Income

Our finance income decreased by 13.0% from RMB261.2 million for the year ended December 31, 2019 to RMB227.2 million for the year ended December 31, 2020, primarily due to the decrease in interest income resulting from the decrease in the wealth management products held by us.

Finance Costs

Our finance costs decreased by 10.2% from RMB4,921.5 million for the year ended December 31, 2019 to RMB4,420.5 million for the year ended December 31, 2020, primarily because we reduced the scale of our interest-bearing debts and utilized financings with lower interest rates.

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Share of Profits and Losses of Joint Ventures

Our profit in our share of profits and losses of joint venture decreased by 33.2% from RMB270.1 million for the year ended December 31, 2019 to RMB180.5 million for the year ended December 31, 2020. This was primarily attributable to the decrease in the profitability of one of our joint ventures, which is an alumina refinery, as a result of the decrease in the alumina price in 2020.

Share of Profits and Losses of Associates

Our profit in our share of profits and losses of associates increased significantly from RMB48.8 million for the year ended December 31, 2019 to RMB145.7 million for the year ended December 31, 2020. This was primarily because we had new associates in December 2019 and the profits of such associates increased in 2020 due to the increase in the primary aluminum price.

Income Tax

Our income tax expense decreased by 6.6% from RMB631.5 million for the year ended December 31, 2019 to RMB590.0 million for the year ended December 31, 2020. This was mainly the adjustment on temporary differences for comprehensive tax rate in accordance with the latest preferential tax policies for the development of the western region.

Results of Operations

As a result of the foregoing, our net profit increased by 29.6% from RMB1,234.1 million for the year ended December 31, 2019 to RMB1,599.2 million for the year ended December 31, 2020.

Discussion of Segment Operations

We account for our operations on a segmental basis; that is, separately preparing the accounting for our alumina, primary aluminum, trading, energy and corporate and other operating segments. Unless otherwise indicated, also included in these segments are other revenues derived from activities such as supplying electricity, gas, heat and water to our affiliates, selling scrap and other materials and providing services including transportation and research and development to third parties. For additional information relating to our business segments and segment presentation, see Note 5 to our consolidated financial statements.

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The following table sets forth a breakdown of our revenues by segment and the contribution of external sales and inter-segment sales for the periods indicated:

	Year Ended December 31,					
	2019 (Restated)	2020 (Restated)	2021	2021	2021	2021
	RMB	*RMB*	*RMB*	*US$*	*%*	*%*
			(in millions, except percentage)			
Revenue						
Alumina:						
External sales	14,326.6	12,941.6	18,564.2	2,913.1	5.2	6.9
Inter-segment sales	29,605.2	29,436.9	37,981.6	5,960.1	10.6	
Total	**43,931.8**	**42,378.4**	**56,545.8**	**8,873.2**	**15.8**	
Primary aluminum:						
External sales	37,394.6	40,430.6	63,987.1	10,041.0	17.9	23.7
Inter-segment sales	11,694.4	11,458.6	8,657.1	1,358.5	2.4	
Total	**49,089.0**	**51,889.2**	**72,644.2**	**11,399.5**	**20.3**	
Trading						
External sales	131,058.5	125,334.2	179,160.2	28,114.1	50.5	66.4
Inter-segment sales	27,877.2	30,058.1	41,287.7	6,479.0	11.5	
Total	**158,935.7**	**155,392.3**	**220,447.9**	**34,593.1**	**61.6**	
Energy						
External sales	7,109.8	6,940.4	7,674.6	1,204.3	2.1	2.8
Inter-segment sales	236.1	243.8	240.6	37.8	0.1	
Total	**7,345.9**	**7,184.2**	**7,915.2**	**1,242.1**	**2.2**	
Corporate and others						
External sales	325.9	343.8	362.0	56.8	0.1	0.1
Inter-segment sales	167.1	105.8	121.7	19.1	<0.1	
Total	**493.0**	**449.6**	**483.7**	**75.9**	**0.1**	
Total Revenues before inter-segment eliminations	259,795.4	257,293.7	358,036.8	56,183.8	100	
Eliminations of inter-segment sales	(69,580.0)	(71,303.2)	(88,288.6)	(13,854.4)	(24.7)	
Consolidated total revenues	**190,215.4**	**185,990.5**	**269,748.2**	**42,329.4**	**75.3**	**100.0**

The following table sets forth segment results before income tax by segment for the periods indicated:

	Year Ended December 31,			
	2019	2020	2021	2021
	RMB	*RMB*	*RMB*	*US$*
		(in millions)		
Alumina:				
Revenues	43,931.8	42,378.4	56,545.8	8,873.3
Cost and expenses(1)	(43,340.3)	(40,943.3)	(52,496.7)	(8,237.9)
Segment results(2)	**591.5**	**1,435.1**	**4,049.1**	**635.4**
Primary aluminum:				
Revenues	49,089.0	51,889.2	72,644.2	11,399.5
Cost and expenses(1)	(48,401.8)	(49,866.0)	(65,242.2)	(10,238.0)
Segment results(2)	**687.2**	**2,023.2**	**7,402.0**	**1,161.5**
Trading:				
Revenues	158,935.7	155,392.3	220,447.9	34,593.1
Cost and expenses(1)	(157,977.7)	(154,810.2)	(219,217.1)	(34,399.9)
Segment results(2)	**958.0**	**582.1**	**1,230.8**	**193.2**
Energy:				
Revenues	7,345.9	7,184.2	7,915.2	1,242.1
Cost and expenses(1)	(6,942.4)	(7,261.4)	(8,150.0)	(1,278.9)
Segment results(2)	**403.5**	**(77.2)**	**(234.8)**	**(36.8)**
Corporate and others				
Revenues	493.0	449.6	483.7	75.9
Cost and expenses(1)	(1,480.7)	(2,154.80)	(2,333.5)	(366.2)
Segment results(2)	**(987.7)**	**(1,705.2)**	**(1,849.8)**	**(290.3)**
Elimination(3)	213.1	(68.8)	(418.5)	(65.7)
Total profit before income tax	**1,865.6**	**2,189.2**	**10,178.8**	**1,597.3**

(1) Consist of cost of sales, operating expenses, other income, other gains, finance income, finance costs and others attributable to each segment.
(2) Segment results refer to profit before income tax.
(3) Elimination refers to the aggregate inter-segment eliminations of segment results of each segment.

Year Ended December 31, 2021 Compared with Year Ended December 31, 2020

Alumina Segment

Revenues. Total revenue generated by the alumina segment increased by 33.4% from RMB42,378.4 million for the year ended December 31, 2020 to RMB56,545.8 million for the year ended December 31, 2021, primarily due to an increase by 11% in production volume as a result of the expanded operation of our Boffa mine in Guinea and the ancillary alumina plants of Guangxi Huasheng in 2021, as well as a year-on-year increase by 18% in the price of alumina.

Revenue from external sales of the alumina segment increased by 43.4% from RMB12,941.6 million for the year ended December 31, 2020 to RMB18,564.2 million for the year ended December 31, 2021, primarily due to an increase by 19% in the average external selling prices for our self-produced alumina and an increase by 18% in the volume of external sales of the alumina in 2021 as compared to that in 2020.

Revenue from inter-segment sales of the alumina segment increased by 29.0% from RMB29,436.9 million for the year ended December 31, 2020 to RMB37,981.6 million for the year ended December 31, 2021, primarily due to an increase by 15% in the internal selling price of our self-produced alumina and an increase by 6% in the volume of internal sales of the alumina.

Cost and expenses. The total cost and expenses for our alumina segment increased by 28.2% from RMB40,943.3 million for the year ended December 31, 2020 to RMB52,496.7 million for the year ended December 31, 2021, primarily due to increase in costs as a result of (i) an increase by 3% in the prices of raw materials, (ii) an increase by 12% in production volume of alumina as a result of operation of Guangxi Huasheng, which is in line with an increase by 64% in production volume of bauxite as a result of expanded operation of our Boffa mine in Guinea, and (iii) a significant increase in loss on disposal of assets and impairment loss in 2021 as compared to that in 2020.

Segment results. The segment profit for our alumina segment increased significantly from RMB1,435.1 million for the year ended December 31, 2020 to RMB4,049.1 million for the year ended December 31, 2021, primarily due to the increase in production volume and gross profit as a result of the expanded operation of our Boffa mine in Guinea and the ancillary alumina plants of Guangxi Huasheng, as well as the year-on-year increase in the gross profit of our alumina products.

Primary Aluminum Segment

Revenues. Total revenue generated by the primary aluminum segment increased by 40.0% from RMB51,889.1 million for the year ended December 31, 2020 to RMB72,644.2 million for the year ended December 31, 2021, primarily due to the year-on-year increase in the price of primary aluminum.

Revenue from external sales of the primary aluminum segment increased by 58.2% from RMB40,440.6 million for the year ended December 31, 2020 to RMB63,987.1 million for the year ended December 31, 2021, primarily due to an increase by 34.8% in the average external selling prices for our self-produced primary aluminum and an increase by 2.7% in the volume of external sales of primary aluminum in 2021 as compared to that in 2020.

Revenue from inter-segment sales of primary aluminum segment decreased by 24.4% from RMB11,458.5 million for the year ended December 31, 2020 to RMB8,657.1 million for the year ended December 31, 2021, primarily due to a decrease by 36% in the volume of our self-produced primary aluminum supplied with our own smelters in 2021 as compared to that in 2020.

Cost and expenses. The total cost and expenses for our primary aluminum segment increased by 30.8% from RMB49,865.9 million for the year ended December 31, 2020 to RMB65,242.2 million for the year ended December 31, 2021, primarily due to an increase by 21% in the price of alumina, the main raw material of primary aluminum, and an increase by 25% in the price of electricity.

Segment results. We had a segment profit of RMB7,402.0 million for the year ended December 31, 2021, increasing significantly from a segment profit of RMB2,023.2 million for the year ended December 31, 2020. This was mainly due to the year-on-year increase in the gross profit of our primary aluminum products.

Trading Segment

Revenues. Total revenue generated by the trading segment increased by 41.9% from RMB155,392.4 million for the year ended December 31, 2020 to RMB220,447.9 million for the year ended December 31, 2021, primarily due to an increase by 20% and 35% in the average selling prices for alumina and primary aluminum, respectively, an increase by 43% in the average external selling prices for copper and an increase by 49% in the volume of external sales of copper in 2021 as compared to that in 2020.

Revenue from external sales of the trading segment increased by 42.9% from RMB125,334.2 million for the year ended December 31, 2020 to RMB179,160.2 million for the year ended December 31, 2021, primarily due to an increase by 35% and 6% in the average external selling prices and the volume of external sales of primary aluminum, respectively and an increase by 43% and 49% in the average external selling prices and the volume of external sales of copper, respectively, in 2021 as compared to that in 2020.

Revenue from internal sales of the trading segment increased by 37.4% from RMB30,058.1 million for the year ended December 31, 2020 to RMB41,287.7 million for the year ended December 31, 2021, primarily due to an increase by 19% in the internal selling price for our alumina, and an increase by 79% in the revenue of internal sales of raw materials and fuel in 2021 as compared to that in 2020.

Cost and expenses. The total cost and expenses for our trading segment increased by 41.6% from RMB154,810.3 million for the year ended December 31, 2020 to RMB219,217.1 million for the year ended December 31, 2021, primarily due to an increase by 20% and 35% in the average procurement cost of alumina and primary aluminum, respectively, and increased procurement cost corresponding to an increase by 43% and 49% in the average external selling prices and the volume of external sales of copper, respectively, in 2021 as compared to that in 2020.

Segment results. Our segment profit increased significantly from RMB582.1 million for the year ended December 31, 2020 to RMB1,230.8 million for the year ended December 31, 2021. This was mainly due to the year-on-year increase in the gross profit of our alumina and primary aluminum products.

Energy Segment

Revenues. Total revenue generated by the energy segment increased by 10.2% from RMB7,184.2 million for the year ended December 31, 2020 to RMB7,915.2 million for the year ended December 31, 2021, primarily due to the year-on-year increase in coal price.

Revenue from external sales of the energy segment increased by 10.6% from RMB6,940.4 million for the year ended December 31, 2020 to RMB7,674.6 million for the year ended December 31, 2021, primarily due to the year-on-year increase in coal price.

Revenue from internal sales of the energy segment was RMB240.6 million for the year ended December 31, 2021, which remained stable compared to RMB243.8 million for the year ended December 31, 2020.

Cost and expenses. The total cost and expenses for our energy segment increased by 8.1% from RMB7,107.0 million for the year ended December 31, 2020 to RMB7,680.4 million for the year ended December 31, 2021, primarily due to an increase in the procurement costs for certain thermal power companies resulting from increased price of coal.

Segment results. Our segment loss increased significantly from RMB77.2 million for the year ended December 31, 2020 to RMB234.8 million for the year ended December 31, 2021, primarily attributable to the losses of our non-controlling thermal power companies.

Corporate and Other Operating Segment

Revenues. Revenue from the corporate and other operating segment increased by 7.6% from RMB449.6 million for the year ended December 31, 2020 to RMB483.7 million for the year ended December 31, 2021, primarily due to the expanded business of Zhengzhou Institute in this segment.

Segment results. We recorded a segment loss of RMB1,849.8 million for the year ended December 31, 2021, representing an increase of 8.5% from a segment loss of RMB1,705.2 million for the year ended December 31, 2020. This was mainly attributable to the loss of RMB307.1 million resulting from hedging business in 2021 compared to that in 2020.

Year Ended December 31, 2020 Compared with Year Ended December 31, 2019

Alumina Segment

Revenues. Total revenue generated by the alumina segment decreased by 3.5% from RMB43,931.8 million for the year ended December 31, 2019 to RMB42,378.4 million for the year ended December 31, 2020, primarily due to the year-on-year decrease in the price of alumina.

Revenue from external sales of the alumina segment decreased by 9.7% from RMB14,326.6 million for the year ended December 31, 2019 to RMB12,941.6 million for the year ended December 31, 2020, primarily due to the year-on-year decrease in the price of alumina.

Revenue from inter-segment sales of the alumina segment slightly decreased by 0.6% from RMB29,605.3 million for the year ended December 31, 2019 to RMB29,436.9 million for the year ended December 31, 2020, primarily due to a decrease by 10.2% in the internal sale price of our self-produced alumina in 2020 as compared to that in 2019, partially offset by an increase by 3.4% in the volume of our self-produced alumina supplied with our own smelters in 2020 as compared to that in 2019.

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Cost and expenses. The total cost and expenses for our alumina segment decreased by 5.5% from RMB43,340.3 million for the year ended December 31, 2019 to RMB40,943.3 million for the year ended December 31, 2020, primarily due to the decrease in the cost of alkali used in the alumina refining.

Segment results. The segment profit for our alumina segment increased significantly from RMB591.5 million for the year ended December 31, 2019 to RMB1,435.1 million for the year ended December 31, 2020, primarily due to the decrease in the cost of alkali used in the alumina refining.

Primary Aluminum Segment

Revenues. Total revenue generated by the primary aluminum segment increased by 5.7% from RMB49,089.0 million for the year ended December 31, 2019 to RMB51,889.1 million for the year ended December 31, 2020, primarily due to the increase in the price of primary aluminum.

Revenue from external sales of the primary aluminum segment increased by 8.1% from RMB37,394.6 million for the year ended December 31, 2019 to RMB40,430.6 million for the year ended December 31, 2020, primarily due to an increase by 2.2% in the average external selling prices for our self-produced primary aluminum and the increase by 35.5% in the sales volume of carbon anodes in 2020, as compared to those in 2019.

Revenue from inter-segment sales of primary aluminum segment decreased by 2.0% from RMB11,694.4 million for the year ended December 31, 2019 to RMB11,458.5 million for the year ended December 31, 2020, remaining relatively stable.

Cost and expenses. The total cost and expenses for our primary aluminum segment increased by 3.0% from RMB48,401.8 million for the year ended December 31, 2019 to RMB49,865.9 million for the year ended December 31, 2020, primarily due to the decrease by approximately RMB260 million in the gains derived from disposal of capacity quotas of primary aluminum in 2020 and the increase by 35.5% in the sales volume of carbon anodes in 2020, as compared to that in 2019.

Segment results. We had a segment profit of RMB2,023.2 million for the year ended December 31, 2020, increasing significantly from a segment profit of RMB687.2 million for the year ended December 31, 2019. This was mainly due to the increase in the price of primary aluminum.

Trading Segment

Revenues. Total revenue generated by the trading segment decreased by 2.2% from RMB158,935.7 million for the year ended December 31, 2019 to RMB155,392.4 million for the year ended December 31, 2020, primarily due to the decrease by 70.3% in revenue from external trading of zinc ingots and the decrease by 51.7% in revenue from external trading of coking coal in 2020, as compared to those in 2019, partially offset by the increase by 15.1% in revenue from external trading of aluminum ingots in 2020, as compared to that in 2019.

Revenue from external sales of the trading segment decreased by 4.4% from RMB131,058.5 million for the year ended December 31, 2019 to RMB125,334.2 million for the year ended December 31, 2020, primarily due to the decrease by 70.3% in revenue from external trading of zinc ingots and the decrease by 51.7% in revenue from external trading of coking coal in 2020, as compared to those in 2019, partially offset by the increase by 15.1% in revenue from external trading of aluminum ingots in 2020, as compared to that in 2019.

Revenue from internal sales of the trading segment increased by 7.8% from RMB27,877.2 million for the year ended December 31, 2019 to RMB30,058.1 million for the year ended December 31, 2020, primarily due to the increase in the internal trading of alumina and bauxite.

Cost and expenses. The total cost and expenses for our trading segment decreased by 2.0% from RMB157,977.7 million for the year ended December 31, 2019 to RMB154,810.3 million for the year ended December 31, 2020, primarily due to the decrease by 70.7% in the cost for trading of zinc ingots and the decrease by 58.4% in the cost for trading of coking coal in 2020, as compared to those in 2019, partially offset by the increase by 16.2% in the cost for trading of aluminum ingots in 2020, as compared to that in 2019.

Segment results. Our segment profit decreased by 39.2% from RMB958.0 million for the year ended December 31, 2019 to RMB582.1 million for the year ended December 31, 2020. This was mainly due to the decrease in the import volume of coking coal as affected by the COVID-19 pandemic.

Energy Segment

Revenues. Total revenue generated by the energy segment decreased by 2.2% from RMB7,346.0 million for the year ended December 31, 2019 to RMB7,184.2 million for the year ended December 31, 2020, primarily due to the decrease in coal prices.

Revenue from external sales of the energy segment decreased by 2.4% from RMB7,109.8 million for the year ended December 31, 2019 to RMB6,940.4 million for the year ended December 31, 2020, primarily due to the decrease in coal prices.

Revenue from internal sales of the energy segment increased from RMB236.1 million for the year ended December 31, 2019 to RMB243.8 million for the year ended December 31, 2020, remaining relatively stable.

Cost and expenses. The total cost and expenses for our energy segment increased by 2.4% from RMB6,942.5 million for the year ended December 31, 2019 to RMB7,107.0 million for the year ended December 31, 2020, primarily because we had gains on disposal of associates while we did not have such disposal in 2020.

Segment results. We recorded a segment loss of RMB77.2 million for the year ended December 31, 2020, whereas we had a segment profit of RMB403.5 million for the year ended December 31, 2019. This was primarily due to the decrease in the price of the coal during the year. In addition, we had gains on disposal of associates in 2019 while we did not have such disposal in 2020.

Corporate and Other Operating Segment

Revenues. Revenue from the corporate and other operating segment decreased by 8.8% from RMB492.9 million for the year ended December 31, 2019 to RMB449.6 million for the year ended December 31, 2020, primarily due to the decrease in business of an engineering company in this segment.

Segment results. We recorded a segment loss of RMB1,705.2 million for the year ended December 31, 2020, representing an increase of 72.6% from a segment loss of RMB987.7 million for the year ended December 31, 2019. This was mainly because we had gains from our investment in Yunnan Aluminum and Yixin Aluminum in 2019 and we made provision for impairment losses of certain long aging receivables in 2020.

B. Liquidity and Capital Resources

Historically, our primary sources of funding have been cash generated from operating activities, prepayments and deposits from customers, bank and other loans and proceeds from equity or notes and bonds offerings. Our primary uses of funds have been working capital for production, capital expenditures and repayments of short-term, medium-term and long-term borrowings.

As of December 31, 2021, our current assets amounted to RMB48,714.0 million, representing an increase of 5.3% from RMB46,268.6 million as of December 31, 2020, primarily due to the increase in monetary funds resulting from the increase in cash inflows from operations. As of December 31, 2021, our restricted cash and time deposits and cash and cash equivalents balance amounted to RMB19,178.0 million, representing an increase of 78.8% from RMB10,727,5 million as of December 31, 2020. As of December 31, 2021, our trade and notes receivable amounted to RMB6,904.9 million, representing a decrease of 25.9% from RMB9,313.6 million as of December 31, 2020.

As of December 31, 2021, our current liabilities amounted to RMB52,180.8 million, representing a decrease of 16.7% from RMB62,633.0 million as of December 31, 2020. This is mainly due to our efforts to optimize the maturity profile of the liabilities and minimize the scale of short-term interest-bearing loans and borrowings.

As of December 31, 2021, our net current liabilities amounted to RMB3,466.7 million, representing a decrease of 78.8% from RMB16,364.4 million as of December 31, 2020. As of December 31, 2021, our current ratio (current assets/current liabilities) was 0.93, compared with 0.74 as of December 31, 2020. Our quick ratio ((current assets – inventories – prepayments)/current liabilities) was 0.56 as of December 31, 2021, compared with 0.41 as of December 31, 2020.

We have considered our available sources of funds as follows:

- Our expected net cash inflows from operating activities in 2022;
- As of December 31, 2021, we had total banking facilities of approximately RMB128,100 million, of which RMB36,056 million had been utilized and unutilized banking facilities amounted to RMB92,044 million as of December 31, 2021, among which, banking facilities of approximately RMB25,530 million will remain unexpired over the 12 months from December 31, 2021. We are confident that all banking facilities can be renewed upon their expiration based on our past experience with banks and our good credit standing;
- Bond facilities registered with National Association of Financial Market Institutional Investors but not utilized; and
- Other available sources of financing from banks and other financial institutions based on our good credit history.

We believe that we have adequate resources to continue in operational existence for the foreseeable future not less than 12 months from December 31, 2021. The Board therefore continues to adopt the going concern basis in preparing our financial statements included in this annual report.

Cash Flows and Working Capital

The following table sets forth a condensed summary of our statement of cash flows for the periods indicated:

	Year Ended December 31,			
	2019 (Restated)	**2020** (Restated)	**2021**	**2021**
	RMB	*RMB*	*RMB*	*US$*
		(in millions)		
Net cash flows generated from operating activities	12,505.9	14,907.5	28,230.4	4,430.0
Net cash flows (used in)/generated from investing activities	(13,395.8)	1,932.8	744.3	116.8
Net cash flows used in financing activities	(10,474.0)	(15,773.4)	(18,478.3)	(2,899.6)
Net increase/(decrease) in cash and cash equivalents	(11,364.0)	1,066.9	9,007.8	1,413.5

Net Cash Flows Generated from Operating Activities

For the year ended December 31, 2021, we had net cash generated from operating activities of RMB28,230.4 million, which was primarily attributable to our profit before income tax of RMB10,178.8 million, adjusted for non-cash and non-operating items of RMB18,062.8 million, inflows of RMB2,273.9 million for changes in working capital and outflows of income tax of RMB2,285.1 million. The positive adjustment for non-cash and non-operating items primarily consisted of depreciation of property, plant and equipment of RMB7,375.6 million, finance cost of RMB3,846.1 million and impairment losses on property, plant and equipment of RMB2,328.1 million. The inflows from changes in working capital primarily consisted of (i) an increase in trade and notes payables of RMB1,318.5 million, (ii) an increase in other payables and accrued liabilities of RMB1,702.8 million and (iii) a decrease in inventories of RMB727.4 million, and partially offset by an increase in trade and notes receivables of RMB1,295.0 million.

For the year ended December 31, 2020, we had net cash generated from operating activities of RMB14,907.5 million, which was primarily attributable to our profit before income tax of RMB2,189.3 million, adjusted for non-cash and non-operating items of RMB14,593.7 million, outflows of RMB1,070.3 million for changes in working capital and outflows of income tax of RMB805.2 million. The positive adjustment for non-cash and non-operating items primarily consisted of depreciation of property, plant and equipment of RMB7,161.5 million, finance cost of RMB4,420.4 million and impairment loss of inventory of RMB1,321.4 million. The outflows from changes in working capital primarily consisted of (i) an increase in trade and notes receivables of RMB4,524.8 million and (ii) an increase in inventories of RMB1,667.6 million, and partially offset by (i) an increase in trade and notes payables of RMB3,004.9 million and (ii) an increase in other payables and accrued liabilities of RMB1,884.3 million.

For the year ended December 31, 2019, we had net cash generated from operating activities of RMB12,505.8 million, which was primarily attributable to our profit before income tax of RMB1,865.6 million, adjusted for non-cash and non-operating items of RMB13,739.7 million, outflows of RMB2,544.8 million for changes in working capital and outflows of income tax of RMB554.6 million. The positive adjustment for non-cash and non-operating items primarily consisted of depreciation of property, plant and equipment of RMB7,106.8 million, finance cost of RMB4,921.5 million, impairment loss of inventory of RMB1,163.3 million and depreciation of right-of-use assets of RMB1,075.8 million. The outflows from changes in working capital consisted primarily of (i) a decrease in trade and notes payables of RMB1,400.3 million and (ii) an increase in trade and notes receivables of RMB1,173.4 million, and partially offset by (i) a decrease in restricted cash of RMB859.5 million and (ii) a decrease in other non-current assets of RMB547.9 million.

Net Cash Flows (Used in)/Generated from Investing Activities

We recorded net cash flows used in investing activities of RMB744.3 million for the year ended December 31, 2021 while we recorded net cash flows generated from investing activities of RMB1,932.8 million for the year ended December 31, 2020, primarily due to the increased purchase of structural deposits, losses on futures margin and decreased proceeds from disposal of assets.

We recorded net cash flows used in investing activities of RMB13,395.8 million for the year ended December 31, 2019. The net cash flows generated from investing activities in 2020 were primarily due to the decrease in the financial products held by us and the decrease in our investment in project construction.

Net Cash Flows Used in Financing Activities

The net cash flows used in financing activities increased by 17.1% from RMB15,773.4 million for the year ended December 31, 2020 to RMB18,478.3 million for the year ended December 31, 2021, primarily due to the increase in our net debt repayment in 2021. Our net cash used in financing activities for the year ended December 31, 2021, consisted primarily of repayments of short-term and long-term loans of RMB40,560.0 million, repayments of bonds and notes of RMB21,537.4 million and repayment of senior perpetual securities of RMB5,386.3 million, partially offset by drawdown of short-term and long-term loans of RMB29,542.5 million and proceeds from issuance of short-term bonds and medium-term notes (net of issuance costs) of RMB24,845.1 million.

The net cash flows used in financing activities increased by 50.6% from RMB10,474.0 million for the year ended December 31, 2019 to RMB15,773.4 million for the year ended December 31, 2020, primarily due to the year-on-year increase in net repayment of debts by the Company during the year. Our net cash used in financing activities for the year ended December 31, 2020, consisted primarily of repayments of short-term and long-term loans of RMB43,111.5 million, repayments of bonds and notes of RMB30,638.8 million and repayment of gold leasing arrangements of RMB6,921.9 million, partially offset by drawdown of short-term and long-term loans of RMB46,021.4 million and proceeds from issuance of short-term bonds and medium-term notes(net of issuance costs) of RMB25,900.0 million.

Loans and Borrowings

During the past years, we engaged in debt financing to fund our operations and business expansion. As of December 31, 2020 and 2021, our gearing ratio (net debts/total capital attributable to owners of the parent as defined in Note 37.3 to our audited consolidated financial statements) was approximately 67% and 63%, respectively.

	As of December 31,		
	2020 (Restated)	2021	2021
	RMB	*RMB*	*US$*
		(in millions)	
Short-term loans and borrowings			
Short-term bank and other loans	20,738.0	9,219.3	1,446.7
Short-term bonds, unsecured	2,411.3	5,440.4	853.7
Current portion of lease liabilities	828.3	987.7	155.0
Current portion of medium-term notes	7,100.7	2,999.6	470.7
Current portion of long-term bank and other loans	3,629.0	5,859.1	919.4
Sub-total	34,707.3	24,506.1	3,845.5
Long-term loans and borrowings			
Lease liabilities	7,086.2	12,594.5	1,976.4
Long-term bank and other loans	43,014.6	42,125.2	6,610.4
Medium-term notes and bonds and long-term bonds and private placement notes	18,975.4	19,222.6	3,016.4
Less:			
Current portion of lease liabilities	(828.3)	(987.7)	(155.0)
Current portion of medium-term notes and long-term bonds	(7,100.7)	(2,999.6)	(470.7)
Current portion of long-term bank and other loans	(3,629.0)	(5,859.1)	(919.4)
Sub-total	57,518.2	64,095.9	10,058.1
Total borrowings	92,225.5	88,602.0	13,903.6
Less: Bank balances and cash	10,727.5	19,178.0	3,009.4
Net	81,498.0	69,424.0	10,894.2

Bank and Other Loans

The weighted average annual interest rate of short-term bank and other loans for the year end December 31, 2021 was 3.03%. Our short-term bank and other loans will mature within one year.

The weighted average annual interest rate of long-term bank and other loans for the years ended December 31, 2021 was 4.55%. The following table sets forth the aggregate maturities of our outstanding long-term bank and other loans as of December 31, 2021. The following table sets forth the amounts of the contractual undiscounted cash flows:

	As of December 31, 2021	
	RMB	*US$*
	(in millions)	
Within 1 year	5,859.1	919.4
Between 1 and 2 years	11,837.7	1,857.6
Between 2 and 5 years	9,771.4	1,533.3
Over 5 years	14,657.0	2,300.0
Total	42,125.2	6,610.3

As of December 31, 2021, we had secured long-term and short-term loans of RMB11,521.3 million, guaranteed long-term loans of RMB3,132.5 million, and unsecured long-term and short-term loans of RMB36,690.7 million. Among these secured loans, long-term loans and borrowings amounting to RMB9,484 million (current portion of RMB1,525 million and non-current portion of RMB7,959 million) were secured by the contractual right to charge users for electricity generated in the future. In addition, we also pledged various assets primarily including property, plant and equipment to secure our loans.

As of December 31, 2021, we had foreign currency denominated loans with a principal amount of RMB11 million in Japanese Yen and RMB1,333 million in U.S. dollars.

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Notes and Bonds

As of December 31, 2021, we had no outstanding long-term bonds.

The following table sets forth the face value, maturity, effective interest rate and outstanding amount of our outstanding medium-term notes and bonds as of December 31, 2021:

	Face value/maturity	Effective interest rate	December 31, 2021
	(RMB in thousands, except for the face values of Hong Kong meidum-term bonds)		
2019 Medium-term notes	2,000,000/2024	4.31 %	1,989,090
2020 Medium-term notes	900,000/2023	3.04 %	898,866
2021 Medium-term notes	1,000,000/2024	3.21 %	997,028
2018 Medium-term bonds	900,000/2023	5.06 %	899,323
2018 Medium-term bonds	1,600,000/2023	4.57 %	1,597,988
2019 Medium-term bonds	2,000,000/2022	3.84 %	1,999,809
2019 Medium-term bonds	2,000,000/2029	4.57 %	1,997,440
2019 Medium-term bonds	1,000,000/2022	3.52 %	999,790
2020 Medium-term bonds	500,000/2025	3.31 %	499,876
2020 Medium-term bonds	1,000,000/2023	3.07 %	999,787
2021 Hong Kong Medium-term bonds	500,000US$/2024	1.74 %	3,173,180
2021 Hong Kong Medium-term bonds	500,000US$/2026	2.24 %	3,170,409
Total			**19,222,586**

The following table sets forth face value, maturity, effective interest rate and outstanding amount of our outstanding short-term bonds as of December 31, 2021:

	Face value /maturity	Effective interest rate	December 31, 2021
	(RMB in thousands)		
short-term bonds	400,000/2022	2.70 %	406,036
short-term bonds	2,000,000/2022	2.59 %	2,022,571
short-term bonds	1,000,000/2022	2.55 %	1,006,240
short-term bonds	2,000,000/2022	2.80 %	2,005,567
Total			**5,440,414**

Senior Perpetual Capital Securities

Please refer to "Item 4. Information on the Company – A. History and Development of the Company – Senior Perpetual Capital Securities Offering" for further details.

Restriction on Cash Dividends

Our PRC subsidiaries are required to set aside a certain amount of their retained profits each year, if any, to fund certain statutory reserves and these reserves may not be distributed as cash dividends. In addition, when our subsidiaries incur debts on their own behalf, the instruments governing the debt may restrict their ability to pay dividends or make other distributions to us. Our directors are of the view that we will continue to be able to meet our borrowing payment obligations as they fall due from cash generated from our operating activities.

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Capital Expenditures and Capital Commitments

The following table sets forth our capital expenditures for the years ended 2019, 2020 and 2021, and the capital expenditures of each segment as a percentage of our total capital expenditures for the periods indicated:

	Year Ended December 31					
	2019		2020		2021	
	RMB	*%*	*RMB*	*%*	*RMB*	*%*
			(in millions, except percentage)			
Alumina	6,699.4	56.9	2,319.4	50.1	2,218.2	47.7
Primary aluminum	3,330.7	28.3	1,072.6	23.2	1,118.7	24.0
Trading	134.7	1.1	329.4	7.1	17.6	0.4
Energy	1,449.6	12.3	881.8	19.1	948.8	20.4
Corporate and others	166.0	1.4	25.4	0.5	349.5	7.5
Total	**11,780.4**	**100.0**	**4,628.6**	**100.0**	**4,652.8**	**100.0**

In 2021, we spent approximately RMB4,652.8 million of our capital expenditures (excluding equity interest investments) primarily in investments in construction, transformation and upgrading of projects, energy saving and consumption reduction, environmental governance, resources acquisition and technological research and development. Our total capital expenditures increased slightly from 2020 to 2021.

We expect our estimated capital expenditures in 2022 to be a total of approximately RMB6.8 billion, primarily for infrastructure and technology upgrading.

As of December 31, 2021, our Group's contractual but not provided capital commitment to fixed assets investment amounted to RMB1,375.4 million.

As of December 31, 2021, our commitments to make capital contribution to our associates and joint ventures amounted to RMB441.8 million, comprised of the capital contributions of RMB400 million to Chinalco Overseas Development Co., Ltd., RMB8 million to Loudi Zhongyu New Materials Co., Ltd., RMB28 million to Shanxi Qinlv Taiyue New Materials Co., Ltd. and RMB6 million to Chinalco Tendering Company Limited, respectively.

We expect to use primarily operating cash flow in meeting such commitments with the shortfall to be satisfied by proceeds of bank loans, short-term and medium-term bonds and medium-term notes.

Off-Balance-Sheet Arrangements

There are no off-balance sheet arrangements material to investors that have or are reasonably likely to have a current or future effect on our financial condition, our changes in financial condition, revenue or expenses, results of operations, liquidity, capital expenditures or capital resources.

Material Cash Requirements

Our material cash requirements as of December 31, 2021 and any subsequent interim period primarily include our capital expenditures, lease liabilities, loans and interest payables, financial liabilities at fair value through profit or loss, financial liabilities included in other payables and accrued liabilities, excluding accrued interest, financial liabilities included in other non-current liabilities and trade and notes payables.

Our lease liabilities primarily relate to consideration for certain properties leased by us from Chinalco for the period commencing January 1, 2022.

Our loans and interest payables primarily consist of long-term bank and other loans, medium-term notes and bonds, short-term bonds and short-term bank and other loans.

The trade and notes payables are non-interest bearing and are normally settled within one year.

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We intend to fund our existing and future material cash requirements with our existing cash and cash equivalents, bank loans, the issuance of medium-term notes and bonds and long-term bonds and other financing alternatives. We will continue to make cash commitments, including capital expenditures, to support the growth of our business.

The following table summarizes our contractual obligations and commercial commitments for the periods indicated as of December 31, 2021:

	Payment due by period				
	Total	**Within 1 year**	**1 to 2 years**	**2 to 5 years**	**Thereafter**
			(RMB in millions)		
Lease liabilities, including current portion	22,806.0	1,590.2	1,473.7	4,347.7	15,394.4
Long-term bank and other loans, including current portion	42,125.2	5,859.1	11,837.7	9,771.4	14,657.0
Medium-term notes and bonds, including current portion	19,275.7	3,000.0	4,400.0	9,875.7	2,000.0
Short-term bonds	5,400.0	5,400.0	—	—	—
Short-term bank and other loans	9,219.3	9,219.3	—	—	—
Interest payables for loans and borrowings	10,390.6	2,620.9	2,147.8	3,941.5	1,680.4
Financial liabilities at fair value through profit or loss	68.9	68.9	—	—	—
Financial liabilities included in other payables and accrued liabilities, excluding accrued interest	6,497.8	6,497.8	—	—	—
Financial liabilities included in other non-current liabilities	1,469.3	234.9	202.2	147.0	885.2
Trade and notes payables	15,505.4	15,505.4	—	—	—
Subtotal	**132,758.2**	**49,996.5**	**20,061.4**	**28,083.3**	**34,617.0**
Capital commitments on property, plant and equipment	1,375.4	N/A	N/A	N/A	N/A
Commitments for capital contribution	441.8	N/A	N/A	N/A	N/A
Total	**134,575.4**				

Other than as discussed above, we did not have any significant capital and other commitments, long-term obligations or guarantees as of December 31, 2021.

C. Research and Development

For the years ended December 31, 2019, 2020 and 2021, we have had a department responsible for organizing and coordinating the research and development efforts of the Company, and the Zhengzhou Institute, the only professional research institute in China dedicated to the research and development of aluminum smelting technologies, has been responsible for taking the lead in the research and development of important and key technologies for our operations and providing technology services for our plants. The technology centers at our plants focus on providing solutions for specific issues of each plant and applying our developed technologies. Each of the plants also has opportunities to participate in operational testing and pilot industrialization relating to research and development of important and key technologies. We also collaborate with universities and other research institutions in China on some of our complicated projects.

D. Trend Information

Other than as disclosed elsewhere in this annual report, we are not aware of any trends, uncertainties, demands, commitments or events for the period from January 1, 2021 to December 31, 2021, that are reasonably likely to have a material effect on our revenue, profitability, liquidity or capital resources, or that caused the disclosed financial information to be not necessarily indicative of future operating results or financial conditions.

E. Critical Accounting Policies and Estimates

We prepare our consolidated financial statements in accordance with IFRS as issued by the International Accounting Standards Board, which requires the use of certain critical accounting estimates. It also requires management to exercise its judgment in the process of applying the accounting policies. The areas in our financial reporting involving a higher degree of judgment or complexity, or areas where assumptions and estimates are significant to the consolidated financial statements, are disclosed in Note 3 to our consolidated financial statements. We have established procedures and processes to facilitate the making of such judgments in the preparation of our consolidated financial statements. Management has used the best information available but actual performance may differ from our management's estimates and future changes in key variables could change future reported amounts in our consolidated financial statements.

Property, Plant and Equipment

Property, plant and equipment, other than construction in progress ("CIP"), are stated at cost less accumulated depreciation and any impairment losses. When an item of property, plant and equipment is classified as held for sale or when it is part of a disposal group classified as held for sale, it is not depreciated and is accounted for in accordance with IFRS 5. The cost of an item of property, plant and equipment comprises its purchase price and any directly attributable costs of bringing the asset to its working condition and location for its intended use.

Subsequent costs are included in the asset's carrying amount or recognized as a separate asset, as appropriate, only when it is probable that future economic benefits associated with the item will flow to the group and the cost of the item can be measured reliably. The carrying amount of any component accounted for as a separate asset is derecognized when replaced. All other repairs and maintenance are charged to profit or loss during the reporting period in which they are incurred.

We calculate depreciation using the straight-line method to allocate their cost or revalued amounts, net of their residual values, over their estimated useful lives as follows:

Buildings and infrastructure	8-45 years
Machinery	3-30 years
Transportation facilities	6-10 years
Office and other equipment	3-10 years

We reviewed and adjusted the assets' depreciation method, residual values and useful lives, if appropriate, at least at each financial year end.

Construction in progress ("CIP") represents buildings under construction, which is stated at cost less any impairment losses, and is not depreciated. Cost comprises the direct costs of construction and capitalized borrowing costs on related borrowed funds during the period of construction. CIP is reclassified to the appropriate categories of property, plant and equipment when completed and ready for use.

Gains and losses on disposals are determined by comparing proceeds with carrying amount. These are included in profit or loss.

Goodwill

Goodwill is measured as described in Note 2.3 to our consolidated financial statements. Goodwill on acquisitions of subsidiaries is included in intangible assets. Goodwill is not amortized but it is tested for impairment annually, or more frequently if events or changes in circumstances indicate that it might be impaired, and is carried at cost less accumulated impairment losses. Gains and losses on the disposal of an entity include the carrying amount of goodwill relating to the entity sold.

Goodwill is allocated to cash-generating units for the purpose of impairment testing. The allocation is made to those cash-generating units or groups of cash-generating units that are expected to benefit from the business combination in which the goodwill arose. The units or groups of units are identified at the lowest level at which goodwill is monitored for internal management purposes, being the operating segments.

Intangible assets - mining rights and mineral exploration rights

Our mineral exploration rights and mining rights relate to coal, bauxite and other mines.

(i) Recognition

Except for mineral exploration rights and mining rights acquired in a business combination, mineral exploration rights and mining rights are initially recorded at the cost which includes the acquisition consideration, qualifying exploration and other direct costs. The mineral exploration rights are stated at cost less any impairment, and the mining rights are stated at cost less any amortization and impairment.

(ii) Reclassification

Mineral exploration rights are converted to mining rights when obtain mining rights certification, or technical feasibility and commercial viability of extracting a mineral resource are demonstrable, and are subject to amortization when commercial production has commenced.

We assess the stage of each mine under construction to determine when a mine moves into the production stage. The criteria used to assess the start date are determined based on the unique nature of each mine construction project. We consider various relevant criteria, such as completion of a reasonable period of testing of the mine and equipment, ability to produce in saleable form (within specifications) and ability to sustain ongoing production to assess when a mine is substantially complete and ready for its intended use.

(iii) Amortization

Mining rights other than coal mining rights are amortized on a straight-line basis over a shorter period of the mining right valid period and expected mining life. Estimated mineable periods of the majority of the mining rights range from 3 to 30 years.

Coal mining rights are amortized on a unit-of-production basis over the economically recoverable reserves evaluated based on the reserves estimated in accordance with the standards of the mine concerned.

(iv) Impairment

An impairment review is performed when there are indicators that the carrying amount of the mineral exploration rights and mining rights may exceed their recoverable amounts. To the extent that this occurs, the excess is fully provided as an impairment loss.

Leases

Leases are recognized as a right-of-use asset and a corresponding liability at the date at which the leased asset is available for use by the Group.

Contracts may contain both lease and non-lease components. We allocate the consideration in the contract to the lease and non-lease components based on their relative stand-alone prices. However, for leases of real estate for which we are a lessee, it has elected not to separate lease and non-lease components and instead accounts for these as a single lease component.

Lease terms are negotiated on an individual basis and contain a wide range of different terms and conditions. The lease agreements do not impose any covenants other than the security interests in the leased assets that are held by the lessor. Leased assets may not be used as security for borrowing purposes.

Assets and liabilities arising from a lease are initially measured on a present value basis. Lease liabilities include the net present value of the following lease payments:

- fixed payments (including in-substance fixed payments), less any lease incentives receivable;

- variable lease payments that are based on an index or a rate, initially measured using the index or rate as of the commencement date;
- amounts expected to be payable by us under residual value guarantees;
- the exercise price of a purchase option if we are reasonably certain to exercise that option, and
- payments of penalties for terminating the lease, if the lease term reflects us exercising that option.

Lease payments to be made under reasonably certain extension options are also included in the measurement of the liability.

The lease payments are discounted using the interest rate implicit in the lease. If that rate cannot be readily determined, which is generally the case for leases in the Group, the lessee's incremental borrowing rate is used, being the rate that the individual lessee would have to pay to borrow the funds necessary to obtain an asset of similar value to the right-of-use asset in a similar economic environment with similar terms, security and conditions.

To determine the incremental borrowing rate, we:

- where possible, use recent third-party financing received by the individual lessee as a starting point, adjusted to reflect changes in financing conditions since third party financing was received;
- use a build-up approach that starts with a risk-free interest rate adjusted for credit risk for leases held by the Group, which does not have recent third-party financing, and,
- make adjustments specific to the lease, such as term, country, currency and security.

If a readily observable amortizing loan rate is available to the individual lessee (through recent financing or market data) which has a similar payment profile to the lease, then our entities use that rate as a starting point to determine the incremental borrowing rate.

We are exposed to potential future increases in variable lease payments based on an index or rate, which are not included in the lease liability until they take effect. When adjustments to lease payments based on an index or rate take effect, the lease liability is reassessed and adjusted against the right-of-use asset.

Lease payments are allocated between principal and finance cost. The finance cost is charged to profit or loss over the lease period so as to produce a constant periodic rate of interest on the remaining balance of the liability for each period.

Right-of-use assets are measured at cost comprising the following:

- the amount of the initial measurement of lease liability;
- any lease payments made at or before the commencement date less any lease incentives received;
- any initial direct costs, and
- restoration costs.

Right-of-use assets are generally depreciated over the shorter of the asset's useful life and the lease term on a straight-line basis as follows:

Buildings	2–20 years
Machinery	2–10 years
Land use rights	10–50 years

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If we are reasonably certain to exercise a purchase option, the right-of-use asset is depreciated over the underlying asset's useful life. While we revalue our land and buildings that are presented within property, plant and equipment, we have chosen not to do so for the right-of-use buildings held by us.

Payments associated with short-term leases of equipment and vehicles and all leases of low-value assets are recognized on a straight-line basis as an expense in profit or loss. We apply the short-term lease recognition exemption to our short-term leases of machinery and equipment (that is those leases that have a lease term of 12 months or less from the commencement date and do not contain a purchase option). We also apply the recognition exemption for leases of low-value assets to leases of office equipment that are considered to be of low value (i.e. below RMB30,000).

Rental income is recognized on a time proportion basis over the lease terms. Variable lease payments that do not depend on an index or a rate are recognized as income in the accounting period in which they are incurred.

Impairment of financial assets

We recognize an allowance for expected credit losses ("ECLs") for all debt instruments not held at fair value through profit or loss. ECLs are based on the difference between the contractual cash flows due in accordance with the contract and all the cash flows that we expect to receive, discounted at an approximation of the original effective interest rate. The impact of COVID-19 on GDP and other key indicators have been considered when determining the severity and likelihood of downside economic scenarios that are used to estimate ECL under IFRS 9 in 2021.

Impairment of non-financial assets

Goodwill and intangible assets that have an indefinite useful life are not subject to amortization and are tested annually for impairment, or more frequently if events or changes in circumstances indicate that they might be impaired. Other assets are tested for impairment whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. An impairment loss is recognized for the amount by which the asset's carrying amount exceeds its recoverable amount. The recoverable amount is the higher of an asset's fair value less costs of disposal and value in use. For the purposes of assessing impairment, assets are grouped at the lowest levels for which there are separately identifiable cash inflows which are largely independent of the cash inflows from other assets or groups of assets (cash-generating units). Non-financial assets other than goodwill that suffered an impairment are reviewed for possible reversal of the impairment at the end of each reporting period.

Inventories

Raw materials and stores, work in progress and finished goods are stated at the lower of cost and net realizable value. Cost comprises direct materials, direct labor and an appropriate proportion of variable and fixed overhead expenditure, the latter being allocated on the basis of normal operating capacity. Costs are assigned to individual items of inventory on the basis of weighted average costs. Costs of purchased inventory are determined after deducting rebates and discounts. Net realizable value is the estimated selling price in the ordinary course of business less the estimated costs of completion and the estimated costs necessary to make the sale.

Current and deferred income tax

The income tax expense or credit for the period is the tax payable on the current period's taxable income based on the applicable income tax rate for each jurisdiction adjusted by changes in deferred tax assets and liabilities attributable to temporary differences and to unused tax losses.

Current income tax

The current income tax charge is calculated on the basis of the tax laws enacted or substantively enacted at the end of the reporting period in the countries where we and our subsidiaries and associates operate and generate taxable income. Our management periodically evaluates positions taken in tax returns with respect to situations in which applicable tax regulation is subject to interpretation and considers whether it is probable that a taxation authority will accept an uncertain tax treatment. We measure our tax balances either based on the most likely amount or the expected value, depending on which method provides a better prediction of the resolution of the uncertainty.

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Deferred income tax

Deferred income tax is provided in full, using the liability method, on temporary differences arising between the tax bases of assets and liabilities and their carrying amounts in the consolidated financial statements. However, deferred tax liabilities are not recognized if they arise from the initial recognition of goodwill. Deferred income tax is also not accounted for if it arises from initial recognition of an asset or liability in a transaction other than a business combination that at the time of the transaction affects neither accounting nor taxable profit or loss. Deferred income tax is determined using tax rates (and laws) that have been enacted or substantively enacted by the end of the reporting period and are expected to apply when the related deferred income tax asset is realized or the deferred income tax liability is settled.

Deferred tax assets are recognized only if it is probable that future taxable amounts will be available to utilize those temporary differences and losses.

Deferred tax liabilities and assets are not recognized for temporary differences between the carrying amount and tax bases of investments in foreign operations where we are able to control the timing of the reversal of the temporary differences and it is probable that the differences will not reverse in the foreseeable future.

Deferred tax assets and liabilities are offset where there is a legally enforceable right to offset current tax assets and liabilities and where the deferred tax balances relate to the same taxation authority. Current tax assets and tax liabilities are offset where the entity has a legally enforceable right to offset and intends either to settle on a net basis, or to realize the asset and settle the liability simultaneously.

Current and deferred tax is recognized in profit or loss, except to the extent that it relates to items recognized in other comprehensive income or directly in equity. In this case, the tax is also recognized in other comprehensive income or directly in equity, respectively.

Revenue recognition

Revenue from contracts with customers

Revenue from contracts with customers is recognized when control of goods or services is transferred to the customers at an amount that reflects the consideration to which we expect to be entitled in exchange for those goods or services.

When the consideration in a contract includes a variable amount, the amount of consideration is estimated to which we will be entitled in exchange for transferring the goods or services to the customer. The variable consideration is estimated at contract inception and constrained until it is highly probable that a significant revenue reversal in the amount of cumulative revenue recognized will not occur when the associated uncertainty with the variable consideration is subsequently resolved.

When the contract contains a financing component which provides the customer with a significant benefit of financing the transfer of goods or services to the customer for more than one year, revenue is measured at the present value of the amount receivable, discounted using the discount rate that would be reflected in a separate financing transaction between us and the customer at contract inception. When the contract contains a financing component which provides us a significant financial benefit for more than one year, revenue recognized under the contract includes the interest expense accreted on the contract liability under the effective interest method. For a contract where the period between the payment by the customer and the transfer of the promised goods or services is one year or less, the transaction price is not adjusted for the effects of a significant financing component, using the practical expedient in IFRS 15.

(a) Sale of industrial products

Revenue from the sale of industrial products (including sales of scrap and other materials) is recognized at the point in time when control of the asset is transferred to the customer, generally on delivery of the industrial products. Revenue from electricity is recognized upon transmission of electricity based on the confirmation from the power grid.

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(b) Rendering of services

We provide transportation and other service and the revenue from services is recognized over time, using an input method to measure progress towards complete satisfaction of the service, because the customer simultaneously receives and consumes the benefits provided by the Group.

New IFRS Pronouncements

For a detailed discussion of new accounting pronouncements, please see Notes 2.1.4 and 2.1.5 to our audited consolidated financial statements.

Item 6. Directors, Senior Management and Employees

A. Directors and Senior Management

Directors

The seventh session of our Board currently consists of nine directors, including four executive directors, two non-executive directors and three independent non-executive directors. In accordance with our Articles of Association, our affairs are managed by our Board. The business address of each of our directors is No. 62 North Xizhimen Street, Hai Dian District, Beijing, People's Republic of China, 100082.

We follow our home country practice in relation to the composition of our Board in reliance on the exemption provided under Section 303A.00 of the NYSE Corporate Governance Rules available to foreign private issuers. Our home country practice does not require a majority of directors of a listed company to be independent directors. As such, the majority of our directors are not independent within the meaning of NYSE Corporate Governance Rules.

The table and discussion below set forth information concerning our directors who served on our Board during the year ended December 31, 2021, and up to date of this annual report.

Name	Age	Positions with the Company
Executive Directors(1)		
Liu Jianping(2)	54	Executive Director and Chairman of the Board
Zhu Runzhou	57	Executive Director and President
Ou Xiaowu(3)	57	Executive Director and Secretary of the Discipline Inspection Committee
Jiang Tao(4)	47	Executive Director and Vice President
Non-executive Directors(5)		
Zhang Jilong(6)	58	Non-executive Director
Ao Hong(7)	60	Non-executive Director (resigned)
Wang Jun	56	Non-executive Director
Independent Non-executive Directors(8)		
Qiu Guanzhou(9)	73	Independent Non-executive Director
Yu Jinsong(9)	68	Independent Non-executive Director
Chan Yuen Sau Kelly(9)	51	Independent Non-executive Director
Chen Lijie(10)	67	Independent Non-executive Director (expired)
Hu Shihai(10)	67	Independent Non-executive Director (expired)
Lie-A-Cheong Tai Chong, David(10)	62	Independent Non-executive Director (expired)

(1) As of the date of this annual report, we had four executive directors.
(2) On June 29, 2021, Mr. Liu Jianping was elected as executive director of the seventh session of the Board at the 2020 annual general meeting of the Company. On the same day, Mr. Liu Jianping was elected as the chairman of the seventh session of the Board.
(3) On June 29, 2021, Mr. Ou Xiaowu was elected as executive director of the seventh session of the Board at the 2020 annual general meeting of the Company.
(4) On June 29, 2021, Mr. Jiang Tao was elected as executive director of the seventh session of the Board at the 2020 annual general meeting of the Company. On August 24, 2021, the appointment of Mr. Jiang Tao as the vice president of the Company was approved at the 22nd meeting of the seventh session of the Board.
(5) As of the date of this annual report, we had two non-executive directors.

(6) On June 29, 2021, Mr. Zhang Jilong was elected as non-executive director of the seventh session of the Board at the 2020 annual general meeting of the Company.
(7) On June 7, 2021, Mr. Ao Hong proposed to resign as a non-executive director of the Company and from all other positions in each of the special committees under the Board, with effect upon the election of a new non-executive director at the 2020 annual general meeting of the Company on June 29, 2021.
(8) As of the date of this annual report, we had three independent non-executive directors.
(9) On June 29, 2021, Mr. Qiu Guanzhou, Mr. Yu Jinsong and Ms. Chan Yuen Sau Kelly were elected as independent non-executive directors of the seventh session of the Board at the 2020 annual general meeting of the Company.
(10) Ms. Chen Lijie, Mr. Hu Shihai and Mr. Lie-A-Cheong Tai Chong, David, reached the maximum term for consecutive appointment and no longer served as the independent nonexecutive directors and all other positions in each of the special committees under the Board upon election of new independent non-executive directors at the 2020 annual general meeting of the Company.

Executive Director

Liu Jianping, aged 54, is currently the chairman and an executive director of the Company. Mr. Liu also serves as the director and deputy secretary of the Communist Party Committee of Chinalco. Mr. Liu graduated from Renmin University of China with a master's degree in economics majoring in commodities. Mr. Liu has extensive experience in human resources and corporate management, etc. He successively worked in the department of restructuring, laws and regulations of National Food and Strategic Reserve Administration, the department of personnel of National Food and Strategic Reserve Administration, the department of personnel, the organization department of the CPC Central Committee and the First Bureau of Management of Enterprise Leaders of the State-owned Assets Supervision and Administration Commission of China Grain Reserve Group Ltd. Company. He successively served as the deputy head and head of the department of personnel (bureau of retired veteran cadres) of Chinalco, the head of the human resources department (veteran cadre work department) of Chinalco, the general manager of the human resource department of the Company, the assistant to the general manager of Chinalco, a member of the Communist Party Committee, deputy general manager and general manager of copper business department of Chinalco, the chairman and president of China Copper Co., Ltd., the chairman of Yunnan Copper (Group) Co., Ltd., and the deputy general manager, a member of the Communist Party Committee and the safety director of Chinalco.

Zhu Runzhou, aged 57, is currently an executive director and president of the Company. Mr. Zhu graduated from Wuhan University, majoring in software engineering, with a master's degree in engineering. He is a professor-level senior engineer. Mr. Zhu successively served as the deputy chief engineer of Gansu Jingyuan Power Plant, the chairman of Baiyin Huadian Water Supply Co., Ltd., head of Guodian Guizhou Kaili Power Plant, director of the preparatory office of the technical transformation program of Guodian in Duyun City, deputy general manager of Guodian Guizhou Branch, deputy general manager of Guodian Yunnan Branch and general manager of Guodian Power Xuanwei Power Generation Co., Ltd., general manager of Guodian Guangxi Branch, deputy general manager of the energy management department of the Company and deputy general manager of Chalco Energy, a director, general manager and chairman of Ningxia Energy, and the general manager of Chalco Xinjiang Aluminum Power Co., Ltd, and an executive director and vice president of the Company.

Ou Xiaowu, aged 57, is currently an executive director and the secretary of the Party Committee and secretary of the Discipline Inspection Committee of the Company. Mr. Ou graduated from Xiamen University with a bachelor's degree in economics majoring in planning and statistics and is a senior auditor. Mr. Ou has extensive experience in auditing and financial management. He successively served as the deputy head and head of 2nd division and head of 1st division of the audit department in China Nonferrous Metals Industry Corporation, the deputy head of the finance department and audit department of China Copper Lead Zinc Group Corporation, the deputy general manager of Guizhou Branch of Aluminum Corporation of China Limited, the deputy head and head of the finance department (audit department) and chief financial officer of the copper business department of Chinalco, a director and chief financial officer of China Copper Co., Ltd., the general manager of the finance department and audit department of the Company, and a deputy chief auditor and general manager of the audit department of Chinalco. Mr. Ou also served as a supervisor of China Copper Co., Ltd. and China Aluminum Group High-end Manufacturing Co., Ltd., the chairman of the supervisory committee of Qinghai Yellow River Hydropower Renewable Aluminum Co., Ltd., and a supervisor of Chalco Energy Co., Ltd. and a supervisor of the Company. Currently, Mr. Ou serves as a supervisor of China Aluminum International Engineering Corporation Limited and the chairman of the supervisory committee of Qinghai Yellow River Hydropower Renewable Aluminum Co., Ltd.

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Jiang Tao, aged 47, is currently an executive director and the vice president of the Company. Mr. Jiang graduated from Northeastern University with a doctor's degree in engineering majoring in nonferrous metals metallurgy, and is an excellent senior engineer. Mr. Jiang has extensive experience in corporate management and production skills. He successively served as the deputy manager of the department of production and operation, deputy head of Second Alumina Plant, deputy head and head of Alumina Plant, assistant to the general manager and head of Second Alumina Plant of Chalco Shandong, the standing member of the Party Committee of Shandong Aluminum Co., Ltd and deputy general manager of Chalco Shandong, the deputy secretary of the Party Committee of Shandong Aluminum Co., Ltd and the director and general manager of Chalco Shandong and director and the general manager of Chalco Shandong, the secretary of the Party Committee and executive director of Zhongzhou Aluminum, and the executive director of Zhongzhou Aluminum Plant.

Non-Executive Directors

Zhang Jilong, aged 58, is currently a non-executive director of the Company. Mr. Zhang graduated from Central South University with a doctor's degree in engineering majoring in mining engineering, and is an excellent senior engineer. Mr. Zhang has extensive experience in scientific and technological research and development, and corporate management, etc. He successively served as the deputy head of breakthrough and development division of the science and technology development of China Nonferrous Metals Industry Corporation, the deputy head and head of science and technology division of department of planning and development of the State Bureau of Nonferrous Metal Industry, the head of science and technology division of the department of production skills of Chinalco, the deputy general manager of science and technology research and product development center and the manager of comprehensive department of the Company, the deputy head and head of science and technology department (military office) of Chinalco and the deputy manager of science and technology research center and product development center of the Company, the head of the department of science and technology management of Chinalco and the deputy dean of Chinalco Research Institute of Science and Technology, the general manager of science and technology management division of the Company, the general manager, secretary of the Party Committee and chairman of Xinan Aluminum (Group) Co., Ltd., the general manager of aluminum processing department of Chinalco, the director of Chinalco Ruimin Co., Ltd. and the general manager of aluminum processing division of Chinalco.

Wang Jun, aged 56, is currently a non-executive director of the Company. Graduated from Huazhong Institute of Engineering with a degree of industrial and civil construction, he is an engineer. He has extensive experience in financial and corporate management. Mr. Wang formerly served as the engineer in the engineering department of Babcock & Wilcox Beijing Company Ltd., deputy manager of the real estate development department of China Yanxing Company, senior deputy manager of equity management department, and senior manager of the business management department, senior manager, deputy general manager, general manager of custody and settlement department in China Cinda Asset Management Co., Ltd. and general manager of the equity management department of China Cinda Asset Management Co. Ltd. Mr. Wang currently serves as the business director of China Cinda Asset Management Co., Ltd. and also serves as a director of China Nuclear Engineering Corporation Limited.

Independent Non-Executive Directors

Qiu Guanzhou, aged 73, is currently an independent non-executive director of the Company. Mr. Qiu is an academician of Chinese Academy of Engineering, currently serving as a professor and tutor of doctoral students in Central South University. Mr. Qiu graduated from Central South University of Technology majoring in mineral processing engineering with a doctoral degree and is a famous mineral engineer. Mr. Qiu previously served as the vice-principal of Central South University of Technology (Central South University). Mr. Qiu has dedicated himself to the research of processing and utilizing low-grade, complex and refractory metallic mineral resources in China for a long time, and has obtained significant achievements in flotation separation of fine and sulphide minerals and direct reduction of iron ore, especially the outstanding contributions made in the aspect of biohydrometallurgy in low-grade sulphide ore. He was awarded as a national science and technology expert with outstanding contributions. Mr. Qiu has published many science papers and treatises, and obtained several national technological inventions and scientific and technological advancement awards. He served as the academic leader of the innovative research group under the National Natural Science Foundation of China in 2003. In 2004 and 2009, he consecutively served as the chief scientist for biometallurgy project of the National 973 Project twice. He was the president of the 19th International Biohydrometallurgy Symposium in 2011 and was elected as the vice president of International Biohydrometallurgy Society. Currently, Mr. Qiu also serves as the independent director of Lomon Billions Group Co., Ltd., the independent director of Guangdong Hongda Blasting Co., Ltd. and the executive director and manager of Hunan Bio Lab Technology Co., Ltd.

Yu Jinsong, aged 68, is currently an independent non-executive director of the Company. Mr. Yu is a doctor of law, currently a professor and tutor of doctoral students at Renmin University of China, and the head of the Institute of International Law (academic part-time job). Mr. Yu focuses on research about international economic law, particularly international investment law and transnational corporation law. He has published dozens of academic papers in multiple major academic journals and several academic works, and obtained multiple national and provincial awards for achievements in teaching and research. Mr. Yu has successively served as an arbitrator of China International Economic and Trade Arbitration Commission, a mediator and arbitrator (2004-2016) of the International Centre for Settlement of Investment Disputes of the World Bank, a vice chairman of the Chinese Society of International Law and a counselor of the International Law Advisory Committee of Ministry of Foreign Affairs. Currently, Mr. Yu also serves as an independent director of Zhongshan Broad-Ocean Motor Co., Ltd. and Zhejiang Zhongxin Fluoride Chemicals Co., Ltd.

Chan Yuen Sau Kelly, aged 51, is currently an independent non-executive director of the Company and a Justice of the Peace. Ms. Chan is a fellow of the Association of Chartered Certified Accountants (ACCA), the Hong Kong Institute of Certified Public Accountants (HKICPA), and the Hong Kong Institute of Directors (HKIoD). She is also a Bachelor of Accounting (Honours) of City University of Hong Kong. Ms. Chan has nearly three decades of working experience in finance and accounting and practical experience in fields such as corporate governance, risk management, business process reorganization, auditing, etc. Ms. Chan has successively served as a manager of auditing and management consultancy at Deloitte & Touche, the financial and administrative head in Hong Kong and Macau of Heineken, and the chief financial officer of Moet Hennessy Diageo. Ms. Chan currently serves as the managing director of Peony Consulting Services Company, the Program Director of Asia Chief Financial Officer Council of The Conference Board, the immediate past president of Association of Women Accountants (Hong Kong), the chairperson of TR at CUHK Ltd. and Employees' Compensation Insurance Levies Management Board, a member of the Air Transport Licensing Authority, a member of the board of The Chinese University of Hong Kong, a member of the Education Commission, a member of the Harbourfront Commission and a member of the Quality Education Fund Steering Committee. Currently, Ms. Chan also serves as an independent non-executive director of Morimatsu International Holdings Company Limited.

Supervisors

Our supervisors are elected to represent our employees and shareholders and serve a term of three years or until the election of their respective successors, whichever is earlier. Our supervisors currently comprise Mr. Ye Guohua, Ms. Shan Shulan, Ms. Lin Ni, Mr. Yue Xuguang and Ms. Xu Shuxiang.

The table and discussion below set forth certain information concerning our supervisors who served on our supervisory committee during the year ended December 31, 2021, and up to the date of this annual report.

Name(1)	Age	Positions with the Company
Ye Guohua	53	Chairman of Supervisory Committee
Shan Shulan	50	Supervisor
Yue Xuguang	58	Supervisor
Lin Ni(2)	48	Supervisor
Guan Xiaoguang(3)	51	Supervisor (resigned)
Xu Shuxiang(4)	44	Supervisor

(1) As of the date of this annual report, we had five supervisors.
(2) On June 29, 2021, Ms. Lin Ni was elected as a shareholder representative supervisor of the Company at the 2020 annual general meeting of the Company.
(3) On March 18, 2022, Mr. Guan Xiaoguang resigned as a supervisor of the Company.
(4) On March 18, 2022, Ms. Xu Shuxiang was elected as an employee representative supervisor of the Company at the seventh session of the Supervisory Committee of the Company.

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Ye Guohua, aged 53, is currently the chairman of the Supervisory Committee of the Company and served as the chief accountant and a member of the Communist Party Committee of Chinalco. Mr. Ye graduated from Shanghai University of Finance and Economics, majoring in accounting, with a bachelor’s degree in economics and is a senior accountant. Mr. Ye has extensive experience in financial management and accounting. He has successively served as the director of accounting department of the refinery of Shanghai Gaoqiao Petrochemical Company, the deputy chief accountant and head of accounting department of Sinopec Shanghai Gaoqiao Branch, the chief financial officer, executive director, a member of the Party Committee, deputy general manager of Sinopec Shanghai Petrochemical Company Limited, the director of accounting department of China Petroleum & Chemical Group Corporation, the chairman of Century Bright International Investment Company, the chairman of Sinopec Insurance Limited, the vice chairman of Taiping & Sinopec Financial Leasing Co., Ltd., a director of Sinopec Finance Co., Ltd., and a director of Sinopec Oilfield Service Corporation. Mr. Ye currently is also the chairman of Chinalco High-end Manufacturing Co., Ltd.

Shan Shulan, aged 50, is currently a supervisor of the Company and serves as the general manager of the Finance Property Department of Chinalco. Ms. Shan graduated from Beijing Institute of Light Industry, majoring in industrial corporate management, with a bachelor degree in engineering. She is a certified public accountant and statistician. Ms. Shan has extensive experience in accounting, finance management and other fields. She has successively served as an economic analyst at the economic research office of Beijing Glass Instruments Plant, the financial manager of Beijing CEMFIL Glass Fiber Co. Ltd. under Saint-Gobain in China, the financial manager for Beijing region of Carrefour (China) Co., Ltd., the financial manager for China region of Baker Hughes Centrilift, the financial manager for China region of Microsoft Research Asia (China), and the business director and deputy head of budget division and the head of budget assessment division of the finance department of Chinalco. Ms. Shan also currently serves as the director of Chinalco Capital Holdings Co., Ltd., the director of Chinalco Finance Co., Ltd. and the supervisor of Chinalco Research Institute of Science and Technology Co., Ltd.

Yue Xuguang, aged 58, is currently a supervisor of the Company. Mr. Yue graduated from Kunming Institute of Technology with a bachelor degree in engineering majoring in mineral census and exploration. He is a senior economist. He has rich experience in human resources management. Mr. Yue has successively served as the deputy head of the coordination division of the labor insurance bureau and the head of the labor management division of the personnel and education department of China Nonferrous Metals Industry Corporation, the deputy head of the general division of the personnel office of the State Bureau of Nonferrous Metal Industry (enjoying the head-level treatment), the deputy head of the personnel department of Chinalco, the head of the labor division of the personnel department of Chinalco, the manager of the remuneration management division of the human resources department of the Company, the head of the general division of the general office of Chinalco, the manager of the general division of the capital operating department of the Company, the deputy general manager and general manager of the human resources department of the Company, the deputy head (departmental head level) of the human resources department (veteran cadre work department) of Chinalco, the secretary of the party committee and deputy general manager of Chinalco Asset Operation and Management Co., Ltd. and the general manager of the human resources department of the Company.

Lin Ni, aged 48, is currently a supervisor of the Company and also serves as the deputy general manager (in charge) of the audit department of Chinalco. Ms. Lin graduated from Shandong Economics University with a bachelor degree in economics majoring in international accounting. She is a senior auditor. Ms. Lin has extensive experience in the fields of auditing and accounting. She has successively served as the head of the 2nd division and the 1st division of the audit department of Chinalco, the deputy head of the audit department of Chinalco and the deputy general manager of the audit department of Chinalco. Ms. Lin currently also serves as the supervisor of Chinalco Asset Operation and Management Co., Ltd.

Xu Shuxiang, aged 44, is currently a supervisor of the Company and a senior business manager of the operation optimization division of the production quality department of the Company. Ms. Xu graduated from Northeastern University with a master’s degree in engineering majoring in non-ferrous metallurgy and has extensive experience in metal smelting, energy conservation management, safety and environmental protection management, etc. Ms. Xu has successively served as the business head of the assets operation department of Chinalco, the business head of the general division of the enterprise management department (safety and environmental protection department) of Chinalco, the business head of the general division of the safety and environmental protection health department of Chinalco, the business manager of the general division of the safety and environmental protection health department of the Company, the senior business manager of the energy conservation management division of the safety and environmental protection health department of Chinalco, the deputy manager of the safety and environmental protection health division of the enterprise management department of the Company and the senior business manager of the general division of the enterprise management department of the Company.

Senior Management

The table and discussion below set forth certain information concerning other members of senior management during the year ended December 31, 2021, and up to the date of this annual report.

Name	Age	Positionse with the Company
Wu Maosen	58	Vice President
Ge Xiaolei (1)	56	Chief Financial Officer and Secretary to the Board

(1) On March 22, 2022, the appointment of Mr. Ge Xiaolei as the chief financial officer and the secretary to the Board was approved at the 26th meeting of the seventh session of the Board.

Wu Maosen, aged 58, is currently a vice president of the Company. Mr. Wu graduated from Dalian Railway College with a bachelor's degree in engineering, majoring in welding technology and equipment. He is a senior engineer with excellent performance. Mr. Wu has extensive experience in corporate management. He has successively served as the deputy head of the alumina branch, the deputy head of the overhauling branch and the director of the transport department of Shanxi Aluminum Plant, the assistant to the general manager of our Shanxi branch, the deputy commander-in-chief of the engineering and construction command department of Chalco Shanxi, a deputy general manager of Shanxi Huaze, the deputy head and head of Shanxi Aluminum Plant, a director and a general manager and the secretary of the Party Committee of Qinghai Huanghe Hydropower Regeneration Aluminum Co., Ltd., the secretary of the Party Committee, an executive director and general manager of Chalco Asset Operation and Management Company and successively served as an executive director of Chalco Shanghai, an executive director and the general manager of Chalco Industrial Development Co., Ltd., the chairman of the board of Huaxi Aluminum, the chairman of the board and the general manager of Chalco Investment and Development Co., Ltd., the deputy team- leader of the team aiming at making up deficits and shaking off dilemma, transforming and upgrading of our Shanxi branch and Shanxi Aluminum Plant and the chairman and an executive director of the board of Chinalco Research Institute of Science and Technology Co., Ltd.

Ge Xiaolei, aged 56, is currently the chief financial officer and the secretary to the Board (company secretary) of the Company. Mr. Ge graduated from Nanjing University majoring in economic management, and subsequently obtained a master's degree in business administration from the University of Texas in the United States. He is a senior economist. Mr. Ge has extensive experience in financial management and corporate management. He has successively served as the deputy head of the planning division and deputy head of the finance division of Zhongzhou Aluminum Plant, the deputy chief accountant and manager of the finance department of the Company's Zhongzhou Branch, the chief financial officer of Qinghai Yellow River Hydropower Renewable Aluminum Co., Ltd., the deputy general manager of Chinalco Finance Co., Ltd. and the director and general manager of Chinalco Finance Lease Co., Ltd., the general manager of Chinalco Finance Co., Ltd., a director of Chinalco Finance Lease Co., Ltd. and a director of Agricultural Bank Huili Fund Management Co., Ltd., the secretary of the party committee and chairman of Chinalco Capital Holdings Co., Ltd., the chairman of Chinalco Finance Co., Ltd. and a director of Agricultural Bank Huili Fund Management Co., Ltd.

B. Compensation

Executive Compensation

Executive directors are entitled to a director's fee, performance bonuses and welfare benefits provided under the relevant PRC laws and regulations. Non-executive directors are entitled only to a director's fees. In 2021, the aggregate amount of cash compensation paid by us to our directors, supervisors and other members of senior management for services performed in connection with their respective capacities above was approximately RMB3.8 million, RMB1.7 million and RMB1.9 million, respectively. Our executive directors and supervisors who are employees also receive compensation in forms including allowances, subsidies and medical care, maternity, unemployment, occupational injury and other benefits. None of the service contracts of our directors provide benefits to our directors upon their termination.

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Details of the emoluments paid to our directors and supervisors during the year ended December 31, 2021 are as follows:

Name of Directors and Supervisors	Fees	Salary	Bonus	Pension	Total
	RMB('000)	*RMB('000)*	*RMB('000)*	*RMB('000)*	*RMB('000)*
Directors					
Executive Directors					
Liu Jianping[(1)]	—	—	—	—	—
Zhu Runzhou	—	1,176	—	93	1,269
Ou Xiaowu[(2)]	—	973	—	93	1,066
Jiang Tao[(3)]	—	837	—	77	914
Non-Executive Directors					
Zhang Jilong[(4)]	—	—	—	—	—
Ao Hong[(5)]	—	—	—	—	—
Wang Jun[(6)]	—	—	—	—	—
Independent Non-Executive Directors					
Qiu Guanzhou[(7)]	98	—	—	—	98
Yu Jinsong[(7)]	98	—	—	—	98
Chan Yuen Sau Kelly[(7)]	98	—	—	—	98
Lie-A-Cheong Tai Chong, David[(8)]	95	—	—	—	95
Chen Lijie[(8)]	95	—	—	—	95
Hu Shihai[(8)]	95	—	—	—	95
Subtotal	**579**	**2,986**	**—**	**263**	**3,828**
Supervisors					
Ye Guohua	—	—	—	—	—
Lin Ni[(9)]	—	—	—	—	—
Shan Shulan	—	—	—	—	—
Guan Xiaoguang[(10)]	—	770	—	93	863
Yue Xuguang	—	770	—	93	863
Subtotal	—	**1,540**	**—**	**186**	**1,726**
Total	**579**	**4,526**	**—**	**449**	**5,554**

(1) On June 29, 2021, Mr. Liu Jianping was elected as executive director of the seventh session of the Board at the 2020 annual general meeting of the Company. On the same day, Mr. Liu Jianping was elected as the chairman of the seventh session of the Board. Mr. Liu Jianping received emoluments from Chinalco.
(2) On June 29, 2021, Mr. Ou Xiaowu was elected as executive director of the seventh session of the Board at the 2020 annual general meeting of the Company.
(3) On June 29, 2021, Mr. Jiang Tao was elected as executive director of the seventh session of the Board at the 2020 annual general meeting of the Company. On August 24, 2021, the appointment of Mr. Jiang Tao as the vice president of the Company was approved at the 22nd meeting of the seventh session of the Board.
(4) On June 29, 2021, Mr. Zhang Jilong was elected as non-executive director of the seventh session of the Board at the 2020 annual general meeting of the Company. Mr. Zhang Jilong received emoluments from Chinalco.
(5) On June 7, 2021, Mr. Ao Hong proposed to resign as a non-executive director of the Company and from all other positions in each of the special committees under the Board, with effect upon the election of a new non-executive director at the 2020 annual general meeting of the Company on June 29, 2021. Mr. Ao Hong received emoluments from Chinalco.
(6) Mr. Wang Jun submitted a voluntary waiver of director's remuneration to the Company, according to which Mr. Wang has voluntarily waived his remuneration for his service as a director of the Company since May 2020. Accordingly, Mr. Wang Jun did not receive remuneration from the Company in 2021.
(7) On June 29, 2021, Mr. Qiu Guanzhou, Mr. Yu Jinsong and Ms. Chan Yuen Sau Kelly were elected as independent non-executive directors of the seventh session of the Board at the 2020 annual general meeting of the Company.
(8) Ms. Chen Lijie, Mr. Hu Shihai and Mr. Lie-A-Cheong Tai Chong, David, reached the maximum term for consecutive appointment and no longer served as the independent nonexecutive directors and all other positions in each of the special committees under the Board upon election of new independent non-executive directors at the 2020 annual general meeting of the Company.
(9) On June 29, 2021, Ms. Lin Ni was elected as a shareholder representative supervisor of the Company at the 2020 annual general meeting of the Company.

(10) On March 18, 2022, Mr. Guan Xiaoguang resigned as a supervisor of the Company.
(11) On March 18, 2022, Ms. Xu Shuxiang was elected as an employee representative supervisor of the Company at the seventh session of the Supervisory Committee of the Company.
(12) The amounts of emoluments paid to directors and supervisors disclosed in this table include amounts paid for their services in all capacities to the Company and its subsidiaries.

Senior Management Incentive System

In order to better provide incentives for our senior management and improve our shareholders' value, we adopted a special compensation system for our senior management designed to align our senior management's financial interests with our operating performance. Under this system, the senior management's compensation consists of the following components:

- basic salaries;
- performance bonuses;
- welfare benefits; and
- incentive bonuses.

C. Board Practices

Board of Directors

All of our directors and supervisors serve a term of three years or until such later date as their successors are elected or appointed. Directors and supervisors may serve consecutive terms. Each of our directors and supervisors has entered into a service contract with us, none of which can be terminated by us within one year without payment of compensation (other than statutory compensation). There were no arrangements providing for benefits upon termination of directors, supervisors or other senior management personnel. Two of the supervisors are employee representatives appointed by our employees and the rest are appointed by the shareholders. The following table sets forth the number of years our current directors and supervisors have held their positions and the expiration of their current term:

Name	Held Position Since	Expiration of Term
Liu Jianping	June 29, 2021	June 30, 2022
Zhu Runzhou	December 11, 2018	June 30, 2022
Jiang Tao	June 29, 2021	June 30, 2022
Ou Xiaowu	June 29, 2021	June 30, 2022
Zhang Jilong	June 29, 2021	June 30, 2022
Wang Jun	June 27, 2013	June 30, 2022
Qiu Guanzhou	June 29, 2021	June 30, 2022
Yu Jinsong	June 29, 2021	June 30, 2022
Chan Yuen Sau Kelly	June 29, 2021	June 30, 2022
Ye Guohua	December 11, 2018	June 30, 2022
Lin Ni	December 21, 2021	June 30, 2022
Shan Shulan	February 20, 2019	June 30, 2022
Yue Xuguang	December 10, 2019	June 30, 2022
Xu Shuxiang	March 18, 2022	June 30, 2022

Audit Committee

As at the date of this annual report, our audit committee consists of three independent non-executive directors, namely, Mr. Qiu Guanzhou, Mr. Yu Jinsong and Ms. Chan Yuen Sau Kelly. Ms. Chan Yuen Sau Kelly is the chairman of the audit committee.

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The primary duties of our audit committee as set out in the committee charter include proposing to engage or replace the auditor, supervising our internal audit and its implementation, being responsible for the communication between the internal audit and external audit, auditing our financial information and its disclosure, reviewing the Company's financial control, internal control and risk management systems, studying on our other relevant professional matters, and putting forward suggestions for the decisions of the Board for reference.

Remuneration Committee

As at the date of this annual report, our remuneration committee consists of one non-executive director, namely Mr. Zhang Jilong, and two independent non-executive directors, namely Mr. Qiu Guanzhou and Mr. Yu Jinsong. Mr. Qiu Guanzhou is the chairman of the remuneration committee. The primary duties of our remuneration committee as set out in the committee charter include: preparing the remuneration management scheme and remuneration proposal for directors, employee-representative supervisors and senior management, and providing suggestions to the Board; preparing measures on performance evaluation of senior management, performance assessment procedures and relevant rewards and punishments, and providing suggestions to the Board; monitoring the implementation of the remuneration system of our Company; reviewing senior management's fulfilment of duties and conducting performance assessments; and other functions and authorities delegated by the Board. In 2021, the remuneration committee convened two meetings to consider and approve remuneration standards for 2021 for our directors, supervisors and other senior management members.

We follow our home country practice in relation to the composition of our remuneration committee in reliance on the exemption provided under NYSE Corporate Governance Rule 303A.00 available to foreign private issuers. Our home country practice does not require us to establish a remuneration committee which must be composed entirely of independent directors.

Nomination Committee

As at the date of this annual report, our nomination committee consists of two executive directors, namely Mr. Liu Jianping and Mr. Zhu Runzhou, and three independent non-executive directors, namely Mr. Qiu Guanzhou, Mr. Yu Jinsong and Ms. Chan Yuen Sau Kelly. Mr. Liu Jianping is the chairman of the nomination committee. The primary duties of our nomination committee as set out in the committee charter include: studying the selection standards and procedures for directors, senior management and members of special committees under the Board and providing suggestions to the Board; reviewing the qualification of candidates for directors, senior management and members of special committees under the Board and providing advice on inspection and appointment; assessing the independence of independent non-executive directors; and other functions and authorities delegated by the Board.

We follow our home country practice in relation to the composition of our nomination committee in reliance on the exemption provided under NYSE Corporate Governance Rule 303A.00 available to foreign private issuers. Our home country practice does not require us to establish a nomination committee which must be composed entirely of independent directors.

Development and Planning Committee

As at the date of this annual report, our development and planning committee consists of two executive directors, namely Mr. Liu Jianping and Mr. Zhu Runzhou, one non-executive director, namely Mr. Zhang Jilong, and two independent non-executive directors, namely Mr. Qiu Guanzhou and Mr. Yu Jinsong. Mr. Liu Jianping is the chairman of our development and planning committee. In accordance with the committee charter, the committee reviews and assesses our strategic plans for long-term development, fiscal budgeting, investment, business operations and investments returns.

Occupational Health and Safety and Environmental Committee

As at the date of this annual report, our occupational health and safety and environmental committee consists of three executive directors, namely Mr. Zhu Runzhou, Mr. Ou Xiaowu and Mr. Jiang Tao. Mr. Zhu Runzhou is the chairman of our occupational health and safety and environmental committee. This committee considers our annual planning on health, environmental protection and safety, supervises our implementation of the planning on health, environmental protection and safety initiatives, makes inquiries into serious incidents and inspects and supervises the handling of such incidents and makes recommendations to the Board on major decisions on health, environmental protection and safety.

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Supervisory Committee

As at the date of this annual report, our supervisory committee consists of five supervisors, namely Mr. Ye Guohua, Ms. Lin Ni and Ms. Shan Shulan as our shareholder representative supervisors and Mr. Yue Xuguang and Ms. Xu Shuxiang as our employee representative supervisors.

Mr. Ye Guohua is the chairman of our supervisory committee. The term of all members of the supervisory committee will expire upon the election of the eighth session of the supervisory committee at the general meeting and employees' representatives meeting of the Company by the end of June 2022. The primary duties of our supervisory committee include: inspecting implementation of resolutions of the general meetings; inspecting legal compliance of our operations; inspecting our financial activities; inspecting the utilization of proceeds raised by us; inspecting the acquisitions and disposals of our assets; inspecting our connected transactions; and reviewing self-assessment report on internal control.

D. Employees

As of December 31, 2019, 2020 and 2021, we had 65,507, 63,007 and 60,056 employees, respectively. The number of our employees decreased from 2020 to 2021, which was mainly due to retirement of employees and termination of employment contracts through negotiation. The table below sets forth the number of our employees by function and location as of the periods indicated:

	As of December 31,					
	2019		2020		2021	
Function		*(%)*		*(%)*		*(%)*
Alumina production	28,437	43.41	24,485	38.86	23,338	38.86
Primary aluminum production	22,189	33.87	22,612	35.89	21,553	35.89
Mining operation	3,996	6.10	4,721	7.49	4,500	7.49
Research and development	1,101	1.68	783	1.24	746	1.24
Sales and marketing	819	1.25	643	1.02	613	1.02
Energy	6,017	9.19	6,833	10.84	6,513	10.84
Management and others[(1)]	2,948	4.50	2,930	4.65	2,793	4.65
Total	**65,507**	**100.0**	**63,007**	**100.0**	**60,056**	**100.0**

(1) Excluding our management personnel for alumina production, and primary aluminum production.

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Location	Employees	% of Total
Shandong	5,276	8.79
Chalco Shandong	5,093	8.48
Shandong Huayu	183	0.30
Henan	9,459	15.75
Chalco Mining	5,061	8.43
Zhongzhou Aluminum	3,779	6.29
Zhengzhou Institute	619	1.03
Guizhou	6,227	10.36
Guizhou Huajin	2,560	4.26
Guizhou branch	2,055	3.42
Zunyi Aluminum	811	1.35
Guizhou Huaren	201	1.33
Guangxi	3,157	5.26
Guangxi branch	2,530	4.21
Guangxi Huasheng	627	1.04
Shanxi	10,828	18.02
Shanxi branch	1,912	3.18
Shanxi Huasheng	651	1.08
Shanxi New Material	5,773	9.61
Shanxi Zhongrun	887	1.48
Shanxi Huaxing	1,100	1.83
Xinghua Technology	505	0.84
Gansu	5,226	8.70
Lanzhou Aluminum	2,550	4.25
Gansu Hualu	965	1.61
Liancheng branch	1,711	2.85
Liaoning	1,203	2.00
Fushun Aluminum	1,203	2.00
Qinghai	2,842	4.73
Qinghai branch	2,842	4.73
Chongqing	37	0.06
Chongqing branch	37	0.06
Inner Mongolia	5,316	8.85
Baotou Aluminum	5,316	8.85
Ningxia	6,333	10.55
Ningxia Energy	6,333	10.55
Shanghai	304	0.51
Chalco Trading Group	304	0.51
Beijing	3,032	5.05
Chalco Materials	115	0.19
Chalco Energy	65	0.11
Chalco Logistics	2,852	4.75
Overseas	620	1.03
Chalco Guinea Company S.A.	620	1.03
Others	18	0.03
Chalco Hong Kong	18	0.03
Headquarters	178	0.30
Total	**60,056**	**100.00**

We have workers' unions at the plant level that protect employees' rights and welfare benefits, organize educational programs, encourage employee participation in management decisions and mediate disputes between individual employees and us. All employees are union members. We have not experienced any strikes or other labor disturbances that have interfered with our operations and we believe that we maintain good relationships with our employees.

The remuneration package of our employees includes salaries, bonuses, subsidies, allowances and medical care, housing subsidies, maternity, unemployment, occupational injury, retirement pension and other benefits.

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In accordance with applicable PRC regulations, we participate in pension contribution plans organized by provincial and municipal governments, under which each of our plants is required to contribute an amount equal to a specified percentage of its employees' salaries, bonuses and various allowances. As the relevant PRC authorities adjusted the social insurance rate, the amount of contribution as a percentage of the employees' salary has been adjusted to approximately 16% from approximately 20% since May 1, 2019. We have made all required pension contributions up to December 31, 2021. Retirees who retired prior to the date of the reorganization have their pensions paid out of the pension plans established by the PRC government. We provide to our employees various social welfare benefits through various institutions owned by Chinalco and its other affiliates or through third parties.

E. Share Ownership

As of the date of this annual report, other than as listed in the following table, none of our directors, supervisors or senior management own any interest in shares of our Company.

Name	Position	Share class	Number of shares	% of respective share class
Jiang Tao	Executive Director and Vice President	A Share	4,000*	<0.1%

* Directly held by Ms. Shi Biqiong, Mr. Jiang Tao's spouse.

On December 21, 2021, our Board reviewed and approved the relevant proposals on the Company's restricted share incentive scheme in 2021, and proposed to grant not more than 141 million restricted A shares to not more than 1,192 employees comprising directors, senior management, middle level management and core technical (business) backbones of the Company, including the grant of restricted A shares to connected persons under the Hong Kong Listing Rules. The aforesaid share incentive scheme is pending submission at the 2022 first extraordinary general meeting, 2022 first class meeting of A shareholders and 2022 first class meeting of H shareholders to be convened by the Company on April 26, 2022 for consideration and approval.

Item 7. Major Shareholders and Related Party Transactions

A. Major Shareholders

We are a joint stock limited company organized under the laws of the PRC. Our parent company, Chinalco, a state-owned enterprise, beneficially owns 32.16% of our outstanding ordinary Shares directly and indirectly through its controlled entities as of March 31, 2022. Chinalco holds a significant portion of our domestic shares in the form of state legal person shares, which do not have voting rights different from our other shares. Chinalco has substantial influence over our management, policies and corporate actions and can exercise all rights as our controlling shareholder subject to the relevant laws, rules and regulations. As of March 31, 2022, approximately 67.84% of our total outstanding ordinary Shares are held by public shareholders, of which 45.72% and 22.12% are owned by holders of A Shares and H Shares, respectively. The following table sets forth information regarding ownership of our issued and outstanding capital stock as of March 31, 2022. The table includes all persons who are known by us to own, either as beneficial owners or holders of record, 5% or more of any class of shares:

	March 31, 2022[2]		
Holders of A Shares and H Shares[1]	**Number of shares**	**% of respective share class**	**% of issued total share capital**
Chinalco[3]			
A Shares	5,295,895,019 (L) [4]	40.49 (L)	31.11 (L)
H Shares	178,590,000 (L)	4.53 (L)	1.05 (L)
UBS Group AG [5]			
H Shares	308,462,487 (L)	7.82 (L)	1.81 (L)
	194,359,064 (S) [6]	4.93 (S)	1.14 (S)
BlackRock, Inc.[8]			
H Shares			
	287,133,951 (L)	7.28 (L)	1.69 (L)
	8,040,000 (S)	0.20 (S)	0.05 (S)
Citigroup Inc. [9]			
H Shares	217,774,017 (L)	5.52 (L)	1.28 (L)
	4,880,973 (S)	0.12 (S)	0.03 (S)
	103,683,057 (P) [7]	2.62 (P)	0.06 (P)
Brown Brothers Harriman & Co.			
H Shares	198,003,860 (L)	5.02 (L)	1.16 (L)
	198,003,860 (P)	5.02 (P)	1.16 (P)

(1) Information disclosed hereby is based on the information available on the website of the Hong Kong Stock Exchange at www.hkexnews.hk.
(2) As at March 31, 2022, the total number of our A Shares was 13,078,706,983, the total number of our H Shares was 3,943,965,968, and the number of our total issued shares was 17,022,672,951 shares.
(3) Including 5,050,376,970 A Shares directly held by Chinalco, an aggregate interest of 245,518,049 A Shares directly held by various controlled subsidiaries of Chinalco, comprising 238,377,795 A Shares held by Baotou Aluminum (Group) Co., Ltd. and 7,140,254 A Shares held by Chalco Shanxi Aluminum Co., Ltd. and an interest of 178,590,000 H Shares directly held by Aluminum Corporation of China Overseas Holdings Limited, a subsidiary of Chinalco.
(4) The letter “L” denotes a long position.
(5) These interests were held directly by various corporations controlled by UBS Group AG. Among the aggregate interests in the long position in H shares, 227,419,502 H shares were held as derivatives. Among the aggregate interests in the short position in H shares, 132,126,723 H shares were held as derivatives.
(6) The letter “S” denotes a short position.
(7) The letter “P” denotes a lending pool.

(8) These interests were held directly by various corporations controlled by BlackRock, Inc. Among the aggregate interests in the long position in H shares, 22,000 H shares were held as derivatives. Among the aggregate interests in the short position in H shares, 7,962,000 H shares were held as derivatives.
(9) These interests were held directly by various corporations controlled by Citigroup Inc. Among the aggregate interests in the long position in H shares, 7,845,143 H shares were held as derivatives. Among the aggregate interests in the short position in H shares, 2,807,810 H shares were held as derivatives.

We are not aware of any arrangement that may on a subsequent date result in a change of control of Chalco. We have completed the Asset Restructuring through capital contributions by several investors to our subsidiaries and subsequent issuance of additional A Shares to these investors to purchase their entire stake in these subsidiaries. On February 25, 2019, we issued to the investors approximately 2.1 billion A Shares in aggregate, representing approximately 12.45% of the enlarged total issued share capital of the Company. See “Item 4. Information on the Company - A. History and Development of the Company - Subscription of Equity Interest of Certain Subsidiaries and Subsequent Issuance of Additional A Shares” for detailed information of the Asset Restructuring. For the period from June 25, 2018 to June 24, 2019, Chinalco increased its shareholding in the Company by 160,512,964 A shares and 115,276,000 H shares on a cumulative basis, representing approximately 0.94% and 0.68% of our total issued share capital as of June 24, 2019, respectively. See “Item 4. Information on the Company - A. History and Development of the Company - Controlling Shareholder’s Shareholding Increase in the Company” for detailed information of the shareholding increase. For the period from May 22, 2020 to May 29, 2020, Chinalco increased its shareholding in the Company by 16,314,000 H shares on a cumulative basis through its subsidiary, representing approximately 0.10% of our total issued share capital as of December 31, 2020.

As of March 31, 2022, there were 45 registered holders of ADRs evidencing 5,439,770 of our ADSs.

As an owner of at least 30% of our issued and outstanding shares, the parent company is deemed a controlling shareholder and therefore may not exercise its voting rights with respect to various matters related to our shares in a manner prejudicial to the interests of our other shareholders. See “Item 10. Additional Information - B. Memorandum and Articles of Association.” In accordance with our Articles of Association, each share of our capital stock has one vote and the shares of the same class have the same rights. Other than the foregoing restrictions, the voting rights of our major holders of domestic and H Shares are identical to those of any other holders of the same class of shares. Holders of domestic shares and H Shares are deemed to be shareholders of different classes for some matters, which may affect their respective interests. Other than the foregoing, holders of H Shares and domestic shares are entitled to the same voting rights.

B. Related Party Transactions

Connected Transactions under Hong Kong Listing Rules

Under the Listing Rules, transactions between connected persons and us, or connected transactions, generally must be reported to the Hong Kong Stock Exchange, announced to the public and/or approved by shareholders unless the foregoing requirements are waived by the Hong Kong Stock Exchange or exempted under the Listing Rules. Each year our independent non-executive directors must review our non-exempt continuing transactions and confirm that these transactions have been entered into:

(i) in the ordinary and usual course of our business;

(ii) with the terms of the transaction being fair and reasonable as far as our shareholders are concerned;

(iii) either on normal commercial terms or, if there are not sufficient comparable transactions to judge whether they are on normal commercial terms, on terms no less favorable to us than terms available to or from (as appropriate) independent third parties; and

(iv) in accordance with the relevant agreement governing them on terms that are fair and reasonable and in the interests of our shareholders as a whole.

Although the definition of connected transactions is not synonymous with the definition of related party transactions, the concepts are sufficiently similar that the description of our connected transactions would satisfy disclosure requirements under U.S. securities laws.

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The following table sets forth the details of our major connected transactions for the year ended December 31, 2021:

Agreement	Nature	Term/ Date of the Agreement	Transaction Amount in 2021 *(RMB in millions)*	Cap for 2021 *(RMB in millions)*
Continuing Connected Transactions				
Comprehensive Social and Logistics Services Agreement (Counterparty: Chinalco)	Chinalco provides us with a broad range of social and logistics services including education and schooling, public transportation and property management.	The original agreement was entered into on November 5, 2001, and expired on December 31, 2012. Pursuant to the supplementary agreement entered into in 2012, the term was renewed and expired on December 31, 2015. Pursuant to the supplementary agreement entered into in 2015, the term was renewed for three years from January 1, 2016 to December 31, 2018. Pursuant to the supplementary agreement entered into in 2018, the term was renewed for three years from January 1, 2019 to December 31, 2021. Pursuant to the supplementary agreement entered into in 2021, the term was renewed for three years from January 1, 2022 to December 31, 2024.	481	Annual cap: 500

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Agreement	Nature	Term/ Date of the Agreement	Transaction Amount in 2021 *(RMB in millions)*	Cap for 2021 *(RMB in millions)*
General Agreement on Mutual Provision of Production Supplies and Ancillary Services (Counterparty: Chinalco)	We purchase from Chinalco ancillary production supplies and services which include, among other things, various raw materials required in alumina and primary aluminum production, transportation and loading services and production supporting services.	The original agreement was entered into on November 5, 2001, and expired on December 31, 2012. Pursuant to the supplementary agreement entered into in 2012, the term was renewed and entered into on December 31, 2015. Pursuant to the supplementary agreement entered into in 2015, the term was renewed for three years from January 1, 2016 to December 31, 2018. Pursuant to the supplementary agreement entered into in 2018, the term was renewed for three years from January 1, 2019 to December 31, 2021. On June 3, 2019, we and Chinalco entered into a supplemental agreement to revise the scope of mutual supply of products and include the pricing principles and methods of payment for the additional products subject to mutual supply. Pursuant to the supplementary agreement entered into in 2021, the term was renewed for three years from January 1, 2022 to December 31, 2024.	6,578	Annual cap for expenditure transactions: 17,500
	We provide Chinalco with products including, among other things, aluminum and alumina products, supporting services and ancillary production services.		21,684	Annual cap for revenue transactions: 33,500

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Agreement	Nature	Term/ Date of the Agreement	Transaction Amount in 2021 *(RMB in millions)*	Cap for 2021 *(RMB in millions)*
Mineral Supply Agreement (Counterparty: Chinalco)	Chinalco provides us with bauxite and limestone from several mines that it operates. Chinalco must not provide bauxite and limestone to bauxite and limestone requirements.	The original agreement was entered into on November 5, 2001, and expired on December 31, 2012. Pursuant to the supplementary agreement entered into in 2012, the term was renewed and expired in December 31, 2015. Pursuant to the supplementary agreement entered into in 2015, the term was renewed for three years from January 1, 2016 to December 31, 2018. Pursuant to the supplementary agreement entered into in 2018, the term was renewed for three years from January 1, 2019 to December 31, 2021. Pursuant to the supplementary agreement entered into in 2021, the term was renewed for three years from January 1, 2022 to December 31, 2024.	87	Annual cap: 360

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Agreement	Nature	Term/ Date of the Agreement	Transaction Amount in 2021 *(RMB in millions)*	Cap for 2021 *(RMB in millions)*
Provision of Engineering, Construction and Supervisory Services Agreement (Counterparty: Chinalco)	Chinalco provides us with certain engineering, construction and supervisory services at the state guidance price and, where there is no state guidance price, at market price. Such services are mainly provided by subsidiaries of Chinalco including China Aluminum International Engineering Corporation Limited.	The original agreement was entered into on November 5, 2001, and expired on December 31, 2012. Pursuant to the supplementary agreement entered into in 2012, the term was renewed and expired on December 31, 2015. Pursuant to the supplementary agreement entered into in 2015, the term was renewed for three years from January 1, 2016 to December 31, 2018. Pursuant to the supplementary agreement entered into in 2018, the term was renewed for three years from January 1, 2019 to December 31, 2021. Pursuant to the supplementary agreement entered into in 2021, the term was renewed for three years from January 1, 2022 to December 31, 2024.	735	Annual cap: 8,300
Land Use Rights Leasing Agreement (Counterparty: Chinalco)	Chinalco leases 470 parcels of land covering an aggregate area of approximately 61.2 million square meters and spanning across eight provinces in the PRC to us.	The original agreement was entered on November 5, 2001, for a term of 50 years, expiring on June 30, 2051.	417	Annual cap: 500
Fixed Assets Lease Framework Agreement (Counterparty: Chinalco)	We have agreed with Chinalco to provide leases to each other regarding buildings, constructions, machinery, apparatus, transportation facilities as well as equipment, appliance or tools and other fixed assets owned by either party in relation to production and operation.	The original agreement was entered into on April 28, 2015 and expired on December 31, 2018. Pursuant to the supplementary agreement entered into in 2018, the term was renewed for three years from January 1, 2019 to December 31, 2021. Pursuant to the supplementary agreement entered into in 2021, the term was renewed for three years from January 1, 2022 to December 31, 2024.	66 34	Annual cap for expenditure transactions: 200 Annual cap for revenue transactions: 100

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Agreement	Nature	Term/ Date of the Agreement	Transaction Amount in 2021 *(RMB in millions)*	Cap for 2021 *(RMB in millions)*
Financial Services Agreement (Counterparty: Chinalco Finance)	Chinalco Finance has agreed with Chinalco to provide us with deposit services, credit services and miscellaneous financial services. We have the right to choose the financial institution for financial services and the financial institution for deposit services and loan services as well as the amounts of loans and deposits with reference to our own needs. Chinalco Finance undertakes that the terms for the provision of financial services to us at any time would be no less favorable than those of the same type of financial services provided by Chinalco Finance to Chinalco and other subsidiaries of Chinalco or those of the same type of financial services that may be provided to us by other financial institutions.	The original agreement expired on August 25, 2012, for a term of 1 year. Pursuant to the financial services agreement renewed on August 24, 2012, the term was extended and expired on August 25, 2015. Pursuant to the financial services agreement renewed on April 28, 2015, the term was renewed for a term of 3 years from August 26, 2015, and was amended and replaced as a whole by a new financial services agreement. A new financial services agreement was entered on October 26, 2017, for a term of 3 years, expired on October 25, 2020. Another new financial services agreement was entered into on August 27, 2020 for a term of 3 years from October 26, 2020.	7,823	Daily cap of deposit balance (including accrued interests): 12,000
			4,067	Daily cap of loan balance (including accrued interests): 15,000
			1	Other financial services (after October 26, 2020) (2): 40

Agreement	Nature	Term/ Date of the Agreement	Transaction Amount in 2021 *(RMB in millions)*	Cap for 2021 *(RMB in millions)*
Finance Lease Agreement (Counterparty: Chinalco Finance Lease Co., Ltd.)	Chinalco Finance Lease Co., Ltd. provides finance lease services to us.	The original finance lease framework agreement was entered into between the Company and Chinalco Lease on August 27, 2015, with a term from August 27, 2015, to December 31, 2016. A new finance lease framework agreement was entered into between the Company and Chinalco Lease on November 13, 2015, with a term of 3 years from January 1, 2016, to December 31, 2018. Pursuant to the supplementary agreement entered into in 2018, the term was renewed for three years from January 1, 2019 to December 31, 2021. Pursuant to the supplementary agreement entered into in 2021, the term was renewed for three years from January 1, 2022 to December 31, 2024.	251	10,000
Factoring Cooperation Agreement (Counterparty: Chinalco Commercial Factoring Co., Ltd.)	Chinalco Commercial Factoring Co., Ltd. provides factoring financing services to the Company.	The original agreement was entered into on September 27, 2017, and expired on December 31, 2018. Pursuant to the supplementary agreement entered into in 2018, the term was renewed for three years from January 1, 2019 to December 31, 2021. Pursuant to the supplementary agreement entered into in 2021, the term was renewed for three years from January 1, 2022 to December 31, 2024.	-	3,000

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Agreement	Nature	Term/ Date of the Agreement	Transaction Amount in 2021 (RMB in millions)	Cap for 2021 (RMB in millions)
Labor and Engineering Services Framework Agreement (Counterparty: Chalco Steering Intelligent Technology Co., Ltd.)	Chalco Steering Intelligent Technology Co., Ltd. provides us with engineering services and labor services which include, among other things, equipment repairs, intelligent industrial design and maintenance.	Pursuant to the original agreement entered into on September 17, 2018, the term is from January 1, 2018 to December 31, 2020, for a term of three years. Pursuant to the new labor and engineering services framework entered into on October 27, 2020, the term was renewed for one year from January 1, 2021 to December 31, 2021.	12	Annual cap: 100
One-Off Connected Transactions(1)				
Assets Transfer Agreements (Parties: Guangxi branch, Chalco Mining, Zunyi Aluminum and certain branches of China Rare Earth Holdings Limited)	Guangxi branch, Chalco Mining and Zunyi Aluminum entered into assets transfer agreements with the Guangxi Gallium branch, Henan Gallium branch and Zunyi Gallium branch of China Rare Earth Holdings Limited, respectively, pursuant to which Guangxi branch, Chalco Mining and Zunyi Aluminum agreed to acquire and the Guangxi Gallium branch, Henan Gallium branch and Zunyi Gallium branch of China Rare Earth Holdings Limited agreed to sell certain gallium assets.	August 24, 2021	395.6	N/A

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Agreement	Nature	Term/ Date of the Agreement	Transaction Amount in 2021 (RMB in millions)	Cap for 2021 (RMB in millions)
Establishment of Green Low-Carbon Fund (Parties: Chalco, ABC Capital Management Co., Ltd., China Aluminum Innovation and Development Equity Investment Fund Management (Beijing) Co., ABC Financial Assets Investment Co., Ltd., Chinalco, China Copper, Chinalco High-end Manufacturing Co., Ltd. and Chinalco Capital Holdings Co., Ltd.)	As considered and approved on December 21, 2021, the Company proposed to establish China Aluminum Suihe Nonferrous Metals Green Low-carbon Innovation and Development Fund (Beijing) Partnership (Limited Partnership (the "Fund", tentative name, subject to the business registration) with ABC Capital Management Co., Ltd., China Aluminum Innovation and Development Equity Investment Fund Management (Beijing) Co., Ltd., ABC Financial Assets Investment Co., Ltd., Chinalco, China Copper, Chinalco High-end Manufacturing Co., Ltd., and Chinalco Capital Holdings Co., Ltd.	As of December 31, 2021, the parties have not entered into any specific agreement on the establishment of the Fund.	N/A	N/A
Proposed Adoption of A Share Incentive Scheme and Grant of Restricted A Shares (Parties: Chalco and 32 connected participants under the incentive scheme)	As considered and approved on December 21, 2021 and the adjustment made on March 4, 2022, the Company proposed to adopt the Restricted A Share Incentive Scheme which shall not exceed 141,000,000 Shares. Specifically, a total of 6,506,700 restricted shares would be granted to 32 connected participants and at most 124,493,300 restricted shares would be granted to at most 1,160 participants other than the connected persons of the Company for the first time of grant.	N/A	The price of the restricted shares under the first grant shall be RMB3.08 per A share.	N/A

(1) See "Item 4. Information on the Company - A. History and Development of the Company - Subscription for A Shares of Yunnan Aluminum" for detailed information of other one-off connected transactions.

All transactions with related parties are conducted at prices and terms mutually agreed by the parties involved, which are determined as follows:

(a) Sales of materials and finished goods comprised sales of alumina, primary aluminum, copper and scrap materials. Transactions entered into are covered by general agreements on mutual provision of production supplies and ancillary services. The pricing policy is summarized below:

(1) The price prescribed by the PRC government ("State-prescribed price") is adopted;

(2) If there is no State-prescribed price, the price recommended in guidance issued by the PRC government ("State-guidance price") is adopted;

(3) If there is neither a State-prescribed price nor a State-guidance price, then the market price (being price charged to and from independent third parties) is adopted; and

(4) If none of the above is available, then the adoption of a contractual price (being reasonable costs incurred in providing the relevant services plus not more than 5% of such costs is adopted).

(b) Sales of utility, including electricity, gas, heat and water, are provided at State-prescribed prices.

(c) Engineering, project construction and supervisory services were provided for our construction projects. The State-guidance price or prevailing market price (including the tender price where by way of tender) is adopted for pricing purposes.

(d) The pricing policy for purchases of key and auxiliary materials (including bauxite, limestone, carbon, cement and coal) is the same as that set out in (i) above.

(e) Social services and logistics services provided by Chinalco cover public security, fire services, education and training, school and hospital services, cultural and physical education, newspaper and magazines, broadcasting and printing as well as property management, environmental and hygiene, greenery, nurseries and kindergartens, sanatoriums, canteens and offices, public transport and retirement management and other services. Provisions of these services are covered by the Comprehensive Social and Logistics Services Agreement. The pricing policy is the same as that set out in (a) above.

(f) Pursuant to the Land Use Rights Lease Agreements entered into between Chinalco and us, operating leases for industrial or commercial land are charged at the market rent rate. We also entered into a building rental agreement with Chinalco and pay rent based on the market rate for its lease of buildings owned by Chinalco.

(g) Other services are environmental protection operation services. The prevailing market price is adopted for pricing purposes.

(h) See Note 36(a) to our audited consolidated financial statements for more detailed information about our significant related party transactions.

During the years ended December 31, 2019, 2020 and 2021, our significant transactions with other state-owned enterprises (excluding Chinalco and its subsidiaries) constituted a relatively large portion of our sales of goods and purchases of raw materials, electricity, property, plant and equipment and services. In addition, substantially all restricted cash, time deposits, cash and cash equivalents and borrowings as of December 31, 2019, 2020 and 2021 and the relevant interest earned or paid during the year are transacted with banks and other financial institutions which are controlled by the PRC government and commercial banks.

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We provide the following additional information on significant related party transactions during the periods indicated based on Note 36 to our audited consolidated financial statements:

(a) Significant related party transactions

	For the year ended December 31		
	2019	2020	2021
		(RMB in thousands)	
Sales of goods and services rendered:			
Sales of materials and finished goods to:			
Chinalco and its subsidiaries	13,612,817	13,986,133	19,261,538
Associates of Chinalco	514,414	520,485	1,497,639
Joint ventures	5,676,548	6,694,824	9,071,474
Associates	3,812,565	9,232,432	672,403
Non-controlling shareholder of a subsidiary and its subsidiaries	—	42,298	—
	23,616,344	30,476,172	30,503,054
Provision of utility services to:			
Chinalco and its subsidiaries	687,290	1,104,542	910,655
Associates of Chinalco	4,062	3,268	14,380
Joint Ventures	263,436	470,984	250,525
Associates	35,650	18,568	375
	990,438	1,597,362	1,175,935
Rental revenue of land use rights and buildings from:			
Chinalco and its subsidiaries	52,571	39,284	34,221
Associates of Chinalco	65	237	237
Joint ventures	1,967	1,426	1,446
Associates	775	365	507
	55,378	41,312	36,411
Purchase of goods and services:			
Purchases of engineering, construction and supervisory services from:			
Chinalco and its subsidiaries	2,949,866	1,755,092	746,966
Associates of Chinalco	—	265	192
Joint ventures	69,332	—	251
Associates	218,616	12,233	12,413
	3,237,814	1,767,590	759,822
Purchases of primary and auxiliary materials, equipment and finished goods from:			
Chinalco and its subsidiaries	8,161,223	6,176,513	5,526,965
Associates of Chinalco	18	2,586	37,187
Joint ventures	2,647,234	5,501,158	8,141,929
Associates	1,893,449	10,576,907	7,407,805
Non-controlling shareholder of a subsidiary and its subsidiaries	—	30,101	—
	12,701,924	22,287,265	21,113,886
Provision of social services and logistics services by: Chinalco and its subsidiaries	309,180	475,532	480,828
Purchases of utility services from: Chinalco and its subsidiaries	763,812	644,638	731,222
Associates of Chinalco	100,835	85,469	98,966
Joint Ventures	280,523	443,290	820,031
Associates	8,326	—	—
	1,153,496	1,173,397	1,650,219
Provision of other services by: A joint venture	272,220	373,655	270,972
Rental expense of land use rights and buildings from: Chinalco and its subsidiaries	499,191	661,888	734,097
New right-of-use assets in current period:			
Additions			
Chinalco and its subsidiaries	1,950	22,936	83,249
Contract modification			
Chinalco and its subsidiaries	(91,351)	(43,395)	6,147,096
Other significant related party transactions:			
Borrowing from a subsidiary of Chinalco	3,890,000	1,925,000	3,370,000
Repayment of borrowings from subsidiaries of Chinalco	4,677,000	1,676,000	5,318,000
Interest expense on borrowings, discounted notes and factoring arrangement from subsidiaries of Chinalco	141,991	87,985	61,878
Investment in subsidiaries of Chinalco:			
Investment to Yunnan Aluminum	1,287,608	—	320,000
Investment to Yixin Aluminum	850,000	—	—
	2,137,608	—	320,000
Disposal of aluminum capacity quota to a subsidiary of Chinalco	800,000	—	—
Disposal of assets under a sale and leaseback contract to a subsidiary of Chinalco	500,000	—	—
Finance lease under a sale and leaseback contract to a subsidiary of Chinalco	558,924	—	—
Trade receivable factoring arrangement from a subsidiary of Chinalco	136,656	—	1,566,707
Interest income from cash and cash equivalents deposited	68,455	51,163	67,269
Discounted notes receivable to a subsidiary of Chinalco	679,517	36,750	128,000
Provision of financial guarantees to:			
Joint ventures	12,450	—	—

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(b) Balances with related parties

	December 31, 2020 (Restated)	December 31, 2021
Cash and cash equivalents deposited with		
A subsidiary of Chinalco	3,561,997	7,832,441
Trade and notes receivables		
Chinalco and its subsidiaries	762,489	1,476,833
Associates of Chinalco	44,958	45,180
Joint ventures	761,392	628,231
Associates	2,287	1
Non-controlling shareholder of a subsidiary and its subsidiaries	46,450	24,465
	1,617,576	2,174,710
Provision for impairment of receivables	(103,592)	(80,102)
	1,513,984	2,094,608
Other current assets		
Chinalco and its subsidiaries	818,318	325,247
Associates of Chinalco	21,753	21,820
Joint ventures	1,364,615	1,486,510
Associates	421,947	359,917
Non-controlling shareholder of a subsidiary and its subsidiaries	11,700	7,450
	2,638,333	2,200,944
Provision for impairment of other current assets	(496,703)	(1,310,379)
	2,141,630	890,565
Other non-current assets		
Associates	111,845	111,845
Interest-bearing loans and borrowings		
Subsidiaries of Chinalco (including lease liabilities)	8,887,422	13,028,565
Associates of Chinalco	—	2,245
	8,887,422	13,030,810
Trade and notes payables	437,732	301,386
Chinalco and its subsidiaries	561,508	229,994
Joint ventures	10,562	32,668
Associates	1,511	26,288
Associates of Chinalco	1,011,313	695,510
Other payables and accrued liabilities		
Chinalco and its subsidiaries	2,193,344	1,054,724
Associates of Chinalco	1,019	42,659
Associates	28,424	19,926
Joint ventures	3,940	49,618
	2,226,727	1,166,927
Contract liabilities	17,460	150,730
Chinalco and its subsidiaries	13,453	27,190
Associates of Chinalco	79	139
Associates	519	535
Joint ventures	656	—
Non-controlling shareholder of a subsidiary and its subsidiaries	32,167	178,594

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Guarantees

We did not provide any guarantees to our related parties to guarantee their loans during the period from January 1, 2021 to March 31, 2022. As of March 31, 2022, the outstanding balance of the loans we guaranteed was nil.

Our related parties also provided guarantees to us to guarantee our loans during the period from January 1, 2021 to March 31, 2022. The outstanding balance of the loans guaranteed by our related parties was RMB625 million as of March 31, 2022 and the largest amount outstanding of the loans guaranteed by our related parties during the period from January 1, 2021 to March 31, 2022 was RMB1,137.5 million. The interest rates on such loan range from 5.15% to 5.39% per annum.

Loans

We provided several entrusted loans to our related parties mainly for the purpose of supplementing working capital during the period from January 1, 2021 to March 31, 2022. The outstanding balance of such entrusted loans was mainly RMB629 million as of March 31, 2022 and the largest amount outstanding of the entrusted loans during the period from January 1, 2021 to March 31, 2022 was RMB675 million. The interest rates on such entrusted loans range from 4.3% to 10% per annum.

Our related party also provided several loans to us mainly for the purpose of supplementing working capital during the period from January 1, 2021 to March 31, 2022. The outstanding balance of such loans was RMB2.375 billion as of March 31, 2022 and the largest amount outstanding of the loans during the period from January 1, 2021 to March 31, 2022 was RMB2.38 billion. The interest rates on such loans range from 3.695% to 3.95% per annum.

C. Interests of Experts and Counsel

Not applicable.

Item 8. Financial Information

A. Consolidated Statements and Other Financial Information

We have appended our consolidated financial statements filed as part of this annual report on Form 20-F.

Legal Proceedings

We are not currently a party to any pending legal proceedings which are expected to have a significant effect on our financial position or results of operations, nor are we aware of any proceedings that are pending or threatened which may have a significant effect on our financial position or results of operations. We may from time to time become a party to various legal or administrative proceedings arising in the ordinary course of our business.

Dividend Policy

Under the Company Law of the PRC and our Articles of Association, all of our shareholders have equal rights to dividends and distributions. The holders of the H Shares share proportionately on a per share basis in all dividends and other distributions declared by our Board. Any final dividend for a fiscal year is subject to shareholders' approval. Cash dividends, if made, are declared in Renminbi with respect to H Shares on a per share basis and paid in HK dollars. The Bank of New York Mellon, as depositary, converts the HK dollar dividend payments and distributes them to holders of ADSs in U.S. dollars, less expenses of conversion.

We believe that our dividend policy strikes a balance between two important goals of providing our shareholders with a competitive return on investment and assuring sufficient reinvestment of profits to enable us to achieve our strategic objectives. The declaration of dividends is subject to the discretion of our Board, which takes into account the following factors:

- our financial results;
- capital requirements;
- contractual restrictions on the payment of dividends by us to our shareholders or by our subsidiaries to us;

- our shareholders' interests;
- the effect on our creditworthiness;
- general business conditions; and
- other factors our Board may deem relevant.

Under our current profit distribution policy as set forth in our Articles of Association, the basic principles of such policy include (i) giving adequate consideration to return to investors and making dividends to shareholders in an applicable percentage of the distributable profits, (ii) maintaining the continuity and stability of our dividend policy, while taking into consideration of our interests in the long term and the overall interests of all shareholders, as well as our sustainable development; and (iii) giving priority to dividends in cash.

More specifically, under such policy, we may make dividends in cash, in shares or in a combination of both cash and shares. Subject to conditions, we may make interim profit distributions. Save in exceptional circumstances, if our profit for the year and our cumulative undistributed profit are positive, we may make dividends in cash and (i) the profit to be distributed in cash per annum will not be less than 10% of the distributable profit realized for that year, or (ii) the total profit to be distributed in cash in the past three years will not be less than 30% of the average annual distributable profit realized in the past three years.

Pursuant to PRC laws and regulations, dividends may only be distributed after allowance has been made for: (1) recovery of losses, if any and (2) allocations to the statutory surplus reserve. The allocations to the statutory surplus reserve is 10% of our net profit determined in accordance with PRC Generally Accepted Accounting Principles, unless the accumulated statutory surplus reserve exceeds 50% of our registered share capital, in which case the surplus reserve is discretional.

See "Item 10. Additional Information - E. Taxation" for a discussion of the tax consequences of receipt of dividends.

B. Significant Changes

Except as disclosed elsewhere in this annual report, we have not experienced any significant changes since the date of our audited consolidated financial statements which is included in this annual report.

Item 9. The Offer and Listing

Our A Shares are traded under the stock code "601600" in the Shanghai Stock Exchange, as our principal host market, while our H Shares are traded under the stock code "02600" in the Hong Kong Stock Exchange as the principal market for our H Shares. The ADSs have been issued by The Bank of New York Mellon, acting as depositary bank, and are listed on the New York Stock Exchange under the symbol "ACH" with each ADS representing 25 H Shares.

Item 10. Additional Information

A. Share Capital

Not applicable.

B. Memorandum and Articles of Association

The following is a summary of certain provisions of our Articles of Association, as amended. Such summary does not purport to be complete. For further information, you and your advisors should refer to the text of our Articles of Association, as amended, and to the texts of applicable laws and regulations. A copy of our Articles of Association is filed as an exhibit to this annual report.

Our objects and purposes

Our Articles of Association as amended from time to time are filed with the Hong Kong Companies Registrar. Our business purpose and business scope can be found in Article 13 and Article 14, respectively, of our Articles of Association.

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Directors' power to vote on matters in which he or she has an interest

Under Article 174, a director shall not vote in any resolution of the board of directors for approving any contract, transaction or arrangement in which such director or any of his associates (as defined in the applicable rules governing the listing of securities amended from time to time) is materially interested, and shall not be counted into the quorum of the meeting either. Unless the interested director has disclosed his or her interest to the board of directors in accordance with Article 174 and the contract, transaction or arrangement has been approved by the board of directors at a meeting in which the interested director is not counted in the quorum and has refrained from voting, a contract, transaction or arrangement in which such director is materially interested is voidable at the instance of our Company except as against a bona fide party thereto acting without notice of the breach of duty by such director. According to Article 86(2), matters concerning the remuneration of directors shall be decided by the shareholders' general meeting.

Borrowing powers

Subject to compliance with applicable laws and regulations of the PRC, we have the power to raise and borrow money which power includes (without limitation) the issuance of debentures and the charging or mortgaging of part or whole of our business or properties and other rights permitted. The Articles of Association do not contain any specific provision in respect of the manner in which borrowing powers may be exercised by the directors nor do they contain any specific provision in respect of the manner in which such powers may be varied, other than (a) provisions which give the directors the power to formulate proposals for the issuance of debentures by us; (b) Article 87(2), which provides that the issuance of bonds must be approved by the shareholders in a general meeting by way of a special resolution; and (c) Article 112(4), which provides that the directors have the power to formulate our annual final financial budgets and final accounts.

Age limit for retirement

There is no provision pertaining to the retirement of directors pursuant to an age limit requirement in our Articles of Association.

Directors' qualifying shares

Under Article 107, the directors are not required to hold any qualifying shares.

Dividend rights

Article 55(1) provides that holders of our ordinary shares have the right to receive dividends and distribution of profits in other forms, in proportion to the number of shares held. Under Article 49, when we convene a shareholders' general meeting, distribute dividends, liquidate or perform other activities that require the verification of equity rights, the Board or the general meeting convener must specify a date as the record date. The shareholders registered in the shareholder register at closing on the record date are our shareholders entitled to appropriate rights and interests. Article 207 provides that under the premise of obeying the laws of the PRC, we have the right to forfeit the unclaimed dividends, subject to the expiry of the applicable relevant limitation period.

Voting rights

Article 55(2) provides that holders of our ordinary shares have the right to lawfully request, convene, chair, attend in person or appoint a proxy to attend and vote at shareholders' meetings in respect of the number of shares held. Each ordinary share is entitled to one vote on all matters submitted to a vote of our shareholders at all shareholders' meetings, except for (i) the cumulative voting system under Article 110; and (ii) meetings of a special class of shareholders where only holders of shares of the affected class are entitled to vote on the basis of one vote per share of the affected class, but Article 98 provides that interested shareholders shall not vote at class shareholders' meetings. Article 110 provides that in the case that our controlling shareholders' shareholding percentage is more than 30%, the cumulative voting system may be implemented for the election of directors and supervisors at a shareholders' general meeting.

A special resolution of the shareholders' general meeting will be required for important matters specified in Article 87, such as the increase or reduction of the registered capital and issuance of any class of shares, amendments to our Articles of Association, and our division, merger, dissolution and liquidation, and a special resolution must be adopted by shareholders in attendance (including proxies) at the meeting with supermajority votes as set forth in Article 80. For other matters to be approved in a shareholders' general meeting, an ordinary resolution as set forth in Article 80 will need to be adopted.

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Rights to share profits

Article 61(7) provides that a plan for profit distribution and a plan for making up for losses formulated by the Board in accordance with Article 112(6) must be approved by way of the shareholders' general meeting.

Rights to share surplus in the event of liquidation

Article 55(6) provides that the holders of ordinary shares have the right to participate in the distribution of our surplus assets in proportion to the number of shares held in the event of the termination or liquidation of us. Article 228 sets forth the order of priority of payments out of our properties in the event of liquidation.

Enforceability of Shareholders' Rights

Our Articles of Association provide that, with certain limited exceptions, where disputes and claims which concern our affairs and are based on rights or obligations provided for in our Articles of Association, the Company Law of the PRC or other relevant laws arise between holders of H Shares and us, holders of A Shares, or our director, supervisor, general manager or other senior management staff, such disputes and claims must be submitted to arbitration. Chapter 23 of our Articles of Association sets forth further details of the dispute resolution procedure.

Redemption provisions; sinking fund provisions and liability to further capital calls

Article 30 provides that we may repurchase issued shares in compliance with the requirements provided in relevant PRC laws and regulations, regulatory requirements or the Articles of Association and with the approvals from the relevant governing authorities of PRC under the following circumstances: (1) reduction of our registered capital; (2) merger with another company which owns our shares; (3) use of shares for our employee shareholding scheme or as equity incentive; (4) shareholders disagreeing with our general meeting's resolution on merger or division and requiring us to acquire the shares in their possession; (5) use of shares for conversion of corporate bonds convertible into our shares; (6) where it is necessary to safeguard our value and the rights and interests of our shareholders; and (7) other circumstances required by law and administrative regulations. Under Articles 32 and 33, share repurchases by agreements outside a stock exchange are generally subject to our shareholders' approval. Under Article 33, share repurchases under the circumstances described in items (1), (2) and (3) above shall be resolved at the shareholders' general meeting, while share repurchases under the circumstances described in item (5) and (6) above shall be subject to approval by more than two-thirds of directors present at the meeting of the Board.

No shares issued by us are redeemable, entitled to a sinking fund or subject to liability for further capital calls.

Actions necessary to change the rights of holders of our shares or holders of a class of shares

Under Article 87(5), revision of any rights of class shareholders, e.g., rights to dividends, share profits or surplus in the event of liquidation or voting rights, requires a special resolution of the shareholders' general meeting. A special resolution must be adopted by shareholders in attendance (including proxies) at the meeting with supermajority votes as set forth in Article 80.

The rights attached to any class of shares may be varied or abrogated only with the sanction of a special resolution passed at the shareholders' general meeting and by holders of shares of the affected class passed at a separate general meeting of the class convened in accordance with Articles 97 to 101, respectively. The circumstances which are deemed to be a variation or abrogation of the class rights, including alternation of the number of shares of the class, are set forth under Article 97. Except for the circumstances under Article 97(1), (9) and (10), shareholders of the affected class, whether or not otherwise having the right to vote at shareholders' general meetings, have the right to vote at class meetings but interested shareholders (which is defined under Article 98) are not entitled to vote at class meetings.

Resolutions of a class meeting shall be passed by the required percentage of shares (as specified under Article 99) with voting rights held by the class shareholders who, according to Article 98, are entitled to vote at that class meeting. Written notice must be given to all shareholders who are registered as holders of that class in the register of shareholders 45 days (inclusive of date of meeting) before the date of the class meeting. Such notice must contain the matters to be considered at such meeting, the date and the place of meeting. Those shareholders of the class who intend to attend shall send the written reply to us 20 days before the class meeting according to Article 100.

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The proceedings of class meetings shall be conducted as near as possible to those of shareholders' general meetings. The provisions in the Articles of Association relating to the proceedings of shareholders' general meetings shall apply to class meetings.

The special procedures for approval by a class of shareholders do not apply where we issue, upon approval by special resolution of shareholders in a general meeting, either separately or concurrently once every 12 months, domestic shares and H Shares not more than 20% of the outstanding shares of the respective class.

Provisions discriminating against any existing or prospective shareholder as a result of owning a substantial number of shares

Chinalco, as our controlling shareholder (which is defined under Article 59), shall not exercise its voting rights in a manner prejudicial to the interest of all or some part of the shareholders when making decisions:

- to relieve a director or supervisor of his duty to act honestly in our best interest;
- to approve the expropriation by a director or supervisor (for his own benefit or for the benefit of another) of our assets, in any manner, including but not limited to an opportunity beneficial to us; or
- to approve the expropriation by a director or supervisor (for his own benefit or for the benefit of another) the individual rights of other shareholders, including but not limited to rights to distributions and voting rights save and except for our restructuring, submitted for approval by the shareholders in a general meeting in accordance with the Articles of Association.

Conditions governing the manner in which annual general meetings and extraordinary general meetings of shareholders are convoked

Shareholders' general meetings can be held as annual general meetings or extraordinary general meetings. Annual general meetings are held once a year within six months after the end of the preceding fiscal year.

The Board is required to convene an extraordinary general meeting within two months of the occurrence of any of the following circumstances:

(1) the number of directors falls below the number required by the Company Law of the PRC or two-thirds of the number required by the Articles of Association;

(2) our unrecovered losses amount to one-third of the total amount of our paid-in-capital;

(3) upon the request of shareholder(s) holding 10% or more of our shares for more than ninety consecutive days (the number of shares held shall be the figures as of the date of the written request from the shareholder); and

(4) whenever the Board deems necessary or the supervisory committee proposes to convene the same.

We shall, within 45 days (inclusive of date of the meeting) before the date of the meeting, send written notices of the shareholders' general meeting and inform all registered shareholders of the matters to be considered at the meeting and the date and venue of the meeting. Those shareholders who intend to attend the meeting shall send the written reply to us 20 days before the meeting. The meeting may be held if the number of voting shares represented by the shareholders intending to attend the meeting meets the threshold prescribed under Article 66. Otherwise, we shall, within five days, inform the shareholders once again of the matters to be considered at, and the date and place of, the meeting in the form of a public announcement, after which we may hold the meeting. A meeting and the resolutions adopted thereat shall not be invalidated due to the accidental omission to give notice of the meeting to, or the non-receipt of notice of the meeting by, a person entitled to receive notice. Motions put forward at the general meeting shall be specific and shall relate to the matters to be considered at a shareholders' general meeting. Motions raised at a general meeting shall:

(1) be free of conflicts with the provision of laws, administrative regulations and Articles of Association, and fall within our business scope and the terms of the reference of the shareholders' general meeting;

(2) have definite topics to discuss and specific matters to resolve; and

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(3) be submitted in writing or served to the board of directors.

Limitations on the rights to own securities

Under Article 19, the shares issued to domestic investors and denominated in Renminbi are Domestic-Invested Shares whereas the shares issued to overseas investors and denominated in foreign currency are Foreign-Invested Shares.

Provisions having an effect of delaying, deferring or preventing a change in control

Under Article 116, decisions in respect of market development, merger and acquisition, and investment in a new field, where the consideration to be paid or the assets to be acquired exceed 10% of our total assets, the Board is required to engage relevant professional consultants to provide professional opinions, which shall serve as the key reference for the decision of the Board concerning such investment, merger or acquisition.

Under Article 87(3), division, merger, dissolution and liquidation of us and material acquisitions and disposals by us must be approved by a special resolution at a shareholders' general meeting.

There are no provisions under the Articles of Association pertaining to the ownership threshold above which shareholder ownership must be disclosed.

Conditions governing changes in registered capital

Under Article 112(7), any proposal for the increase or decrease of our registered capital must be formulated by the Board. Article 87(1) further provides that any increase or reduction in share capital requires adoption of a special resolution at a shareholders' general meeting. In addition, according to Article 97, alternation of the number of shares of a class or of a different class having voting rights, distribution rights or other privileges equal or superior to such class is regarded as alternation or abolishment of rights of such class, and must satisfy the requirements for shareholders' meetings of the affected class. See "—Actions necessary to change the rights of holders of our shares or holders of a class of shares."

Certain Differences Between PRC Company Law and Delaware Corporate Law

We are a PRC joint stock company, which is a corporate entity organized under the Company Law of the PRC. The PRC company law differs from laws applicable to United States corporations and their shareholders. A description of securities registered under Section 12 of the Exchange Act is filed as Exhibit 2.4 to this annual report on Form 20-F and includes a summary of certain significant differences between the provisions of the PRC company law applicable to us and the comparable provisions of the laws applicable to companies incorporated in the United States and their shareholders (for this purpose we refer to Delaware corporate law). Such summary does not purport to be complete and is subject to and qualified in its entirety by reference to our Articles of Association, as amended, and to the relevant laws and regulations.

C. Material Contracts

For the two years immediately preceding the date of this annual report, we have not entered into any additional material contracts other than in the ordinary course of business and other than those described in "Item 4. Information on the Company - A. History and Development of the Company" and "Item 7. Major Shareholders and Related Party Transactions - B. Related Party Transactions."

D. Exchange Controls

The existing PRC foreign exchange regulations have significantly reduced government foreign exchange controls for transactions under the current account, including trade and service-related foreign exchange transactions and payment of dividends. We may undertake current account foreign exchange transactions without prior approval from the SAFE by producing commercial documents evidencing such transactions, provided that they are processed through Chinese banks licensed to engage in foreign exchange transactions. The PRC government has stated publicly that it intends to make the Renminbi freely convertible in the future. However, we cannot predict whether the PRC government will continue its existing foreign exchange policy and when the PRC government will allow free conversion of Renminbi to foreign currency.

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Foreign exchange transactions under the capital account, including principal payments in respect of foreign currency-denominated obligations, continue to be subject to significant foreign exchange controls and require the approval of the SAFE. These limitations could affect our ability to obtain foreign exchange through debt or equity financing, or to obtain foreign exchange for capital expenditures.

Since 1994, the conversion of Renminbi into HK and U.S. dollars has been based on rates set by the PBOC, which are set daily based on the previous day's PRC interbank foreign exchange market rate and current exchange rates on the world financial markets. From 1994 to July 20, 2005, the official exchange rate for the conversion of Renminbi to U.S. dollars was generally stable. On July 21, 2005, the PRC government introduced a managed floating exchange rate system to allow the value of the Renminbi to fluctuate within a regulated band based on market supply and demand and by reference to a basket of currencies. Since then, the PRC government has made, and may in the future make, further adjustments to the exchange rate system. In April 2012, the PRC government took a milestone step in turning the Renminbi into a global currency by doubling the size of its trading band against the U.S. dollar, pushing through a crucial reform that further liberalizes its financial markets. The PBOC allows the Renminbi to rise or fall 1% from a mid-point every day, effective April 16, 2012, compared with its previous 0.5% limit. The PBOC further allows the Renminbi to rise or fall 2% from a mid-point every day, effective March 17, 2014. In August 2015, the PBOC announced that the daily central parity quotes the market-makers reported to the China Foreign Exchange Trade System operated by the PBOC before the market opens should be based on the closing rate of the inter-bank foreign exchange rate market on the previous day, supply and demand in the market, and price movement of major currencies, effective on August 11, 2015. Fluctuations in exchange rates may adversely affect the value, translated or converted into U.S. dollars or HK dollars, of our net assets, earnings and any declared dividends. We cannot give any assurance that any future movements in the exchange rate of the Renminbi against the U.S. dollar and other foreign currencies will not adversely affect our results of operations and financial condition.

E. Taxation

PRC Taxation

The following summary of the material PRC and United States federal income tax provisions relating to the ownership and disposition of H Shares or ADSs held by the investor as capital assets is based upon laws and relevant interpretations thereof in effect as of the date of this annual report, all of which are subject to change, and does not constitute legal or tax advice. This summary does not deal with all possible tax consequences relating to an investment in our ordinary shares, such as the tax consequences under state, local and other tax laws.

Dividends Paid to Individual Investors

Any shares registered in the name of our depositary bank will be deemed as being held by non-resident enterprise shareholders and the dividends attributable to the corresponding ADSs will be subject to the withholding of the PRC corporate income tax. We are therefore required to withhold 10% corporate income tax when we make dividend distributions to the investors of our ADSs. Investors of our ADSs will not be subject to further PRC individual income tax or PRC corporate income tax. The 10% dividend withholding tax rate is not subject to any reduction under the 1984 Agreement between the United States and the People's Republic of China for the Avoidance of Double Taxation, or the PRC Treaty.

Capital Gains

With respect to foreign enterprises which are established under the laws of non-PRC jurisdictions and have no establishment or residence in China or whose capital gains from China do not relate to their establishment or residence in China ("non-resident foreign enterprises"), according to the Enterprise Income Tax Law and its implementation rules, which became effective on January 1, 2008, capital gains realized by non-resident foreign enterprises are ordinarily subject to capital gains tax at the rate of 10%, unless exempted or reduced pursuant to an applicable double-taxation treaty or other exemptions. The capital gains realized by resident enterprises, including enterprises established under the laws of non-PRC jurisdictions but whose "de facto management body" is located in the PRC, upon the sales of overseas-listed shares are subject to the PRC enterprise income tax.

With respect to foreign individual investors, the Provisions for Implementation of Individual Income Tax Law of China, as amended, stipulated that individual income tax on gains realized on the sale of equity shares shall be regulated in separate rules to be drafted by the State Council of China. However, as of the date of this annual report, there are no such rules enacted by the State Council yet. On March 30, 1998, the MOF and the SAT jointly issued the "Circular of Taxation Regarding the Continued Exemption of Individual Income Taxes Levied on Income Obtained from the Transfer of Shares," which provided that income derived from the transfer of shares issued by listed companies shall not be taxed as income for the purposes of levying individual income taxes after July 1, 1997.

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For PRC mainland investors, on October 31, 2014, the SAT issued "Circular on Tax Policies Relating to the Pilot Program of Shanghai-Hong Kong Stock Connect," which provided that any capital gain from transferring stocks listed on the Hong Kong Stock Exchange by a PRC mainland investor would not be subject to tax during the period from November 17, 2014 to November 16, 2017. For mainland enterprises, such capital gains would be included in its income and subject to income tax. On November 1, 2017, the MOF, the SAT and the CSRC jointly issued "Circular on Extending Individual Income Tax Policies Relating to the Shanghai-Hong Kong Stock Connect," which provided that income generated from price differences through investment in stocks listed on the Hong Kong Stock Exchange by PRC mainland individual investors via the Shanghai-Hong Kong Stock Connect would be exempt from individual income tax from November 17, 2017 to December 4, 2019. On December 4, 2019, the MOF, the SAT and the CSRC jointly issued the "Circular on Extending Individual Income Tax Policies Relating to the Shanghai-Hong Kong Stock Connect, Shenzhen-Hong Kong Stock Connect and Mainland-Hong Kong Mutual Recognition of Funds," which further exempts the individual income tax on income generated from transfer through investment in stocks listed on the Hong Kong Stock Exchange by PRC mainland individual investors via the Shanghai-Hong Kong Stock Connect or Shenzhen-Hong Kong Stock Connect and investment in Mainland-Hong Kong mutually recognized Funds from December 5, 2019 to December 31, 2022.

Tax Treaties

China currently has such treaties with more than one hundred countries and regions, including the following countries:

- the United States;
- Australia;
- Canada;
- France;
- Germany;
- Japan;
- Malaysia;
- Singapore;
- the United Kingdom; and
- the Netherlands.

Under most treaties, the rate of withholding tax imposed by China's taxation authorities remains 10%. The double taxation treaty between China and the United States provides that 10% withholding tax rate will be applied to the gross amount of dividends repatriated to an eligible U.S. holder. Under the treaty, an eligible U.S. holder is a person who, by reason of domicile, residence, place of head office, place of incorporation or any other criterion of similar nature is subject to taxation in the United States, as applicable under the treaty's "treaty shopping provisions."

Additional China Tax Considerations

Pursuant to the prevailing stamp duty regulations, a stamp duty is not imposed by China on the transfer of shares, such as the H Shares or ADSs, of Chinese publicly traded companies that take place outside of China.

United States Federal Income Taxation

Each potential investor is strongly urged to consult its own tax advisor to determine the particular U.S. federal, state, local, treaty and foreign tax consequences of acquiring, owning or disposing of the H Shares or ADSs.

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The following summary describes the principal U.S. federal income tax consequences of purchasing, owning and disposing of the H Shares or ADSs. This summary only applies to U.S. holders, as defined below, who hold the H Shares or ADSs as capital assets within the meaning of Section 1221 of the Internal Revenue Code of 1986 as amended (the "Code"). This discussion does not address all of the tax consequences relating to the purchase, ownership and disposition of the H Shares or ADSs, and does not take into account U.S. holders that may be subject to special rules, including:

- financial institutions;
- insurance companies;
- tax-exempt organizations;
- real estate investment trusts, regulated investment companies, grantor trusts;
- persons that have a functional currency other than the U.S. dollar;
- persons that will own H Shares or ADSs through partnerships or other pass-through entities;
- persons that actually or constructively own 10% or more of the combined voting power of our voting stock or of the total value of our stock;
- dealers or traders in securities or currencies;
- certain former citizens or long-term residents of the United States;
- persons that will hold the H Shares or ADSs as a position in a "straddle" or as part of a "hedging" or "conversion" or other risk reduction transaction for U.S. federal income tax purposes;
- persons who receive the H Shares or ADSs as compensation for services;
- "dual resident" corporations;
- persons that generally mark their securities to market for U.S. federal income tax purposes;
- persons who are residents of the People's Republic of China or who are subject to Hong Kong profits tax; or
- persons who purchase or sell the H Shares or ADSs as part of a wash sale for U.S. federal tax purposes.

Moreover, this description does not address U.S. federal estate, gift or alternative minimum taxes, the U.S. federal unearned income Medicare contribution tax, or any foreign state or local tax consequences of the acquisition, ownership and disposition of the H Shares or ADSs. Each U.S. holder should consult its tax advisor with respect to the U.S. federal, state, local and foreign tax consequences of acquiring, owning and disposing of H Shares or ADSs.

This discussion is based on the Code, its legislative history, final, temporary and proposed U.S. Treasury regulations promulgated thereunder, published rulings and court decisions as in effect on the date hereof, as well as on the agreement between the United States and the People's Republic of China for the avoidance of double taxation (the "Treaty"), all of which are subject to change, or change in interpretation, possibly with retroactive effect. In addition, this discussion is based in part upon the assumption that each obligation in the deposit agreement and any related agreements will be performed according to its terms.

You are a "U.S. holder" if you are a beneficial owner of H Shares or ADSs and, for U.S. federal income tax purposes, are:

- an individual citizen or resident of the United States;
- a corporation created or organized under the laws of the United States or any political subdivision thereof;

- an estate the income of which is subject to U.S. federal income tax without regard to its source; or
- a trust: (i) subject to the primary supervision of a U.S. court and one or more U.S. persons (within the meaning of the Code) have the authority to control all substantial decisions of the trust; or (ii) that has validly elected to be treated as a U.S. person under applicable U.S. Treasury Regulations.

If a partnership (including any entity or arrangement treated as a partnership for U.S. federal tax purposes) holds H Shares or ADSs, the tax treatment of the partnership and a partner in such partnership will generally depend upon the status of the partner and the activities of the partnership. If an investor is a partner in a partnership that holds H Shares or ADSs, such investor should consult its tax advisor.

In general, if you hold ADSs evidencing H Shares, you will be treated as the owner of the H Shares represented by the ADSs. Exchanges of H Shares for ADSs, and ADSs for H Shares, generally will not be subject to United States federal income tax.

The tax treatment of your H Shares or ADSs will depend in part on whether or not we are classified as a passive foreign investment company, or PFIC, for United States federal income tax purposes. Except as discussed below under "—Passive Foreign Investment Company Rules," this discussion assumes that we are not classified as a PFIC for U.S. federal income tax purposes.

INVESTORS SHOULD CONSULT THEIR TAX ADVISORS AS TO THE PARTICULAR TAX CONSIDERATIONS APPLICABLE TO THEM RELATING TO THE PURCHASE, OWNERSHIP AND DISPOSITION OF THE H SHARES OR ADSs, INCLUDING THE APPLICABILITY OF U.S. FEDERAL, STATE AND LOCAL TAX LAWS OR NON-U.S. TAX LAWS, ANY CHANGES IN APPLICABLE TAX LAWS AND ANY PENDING OR PROPOSED LEGISLATION OR REGULATIONS.

Distributions on the H Shares or ADSs

The gross amount of any distribution (without reduction for any PRC tax withheld) we make on the H Shares or ADSs, other than certain pro-rata distributions of the H Shares, will be includible in income as dividend income when you, in the case of the H Shares, or the depositary, in the case of ADSs, receive the distribution, actually or constructively. Because we do not calculate earnings and profits in accordance with U.S. tax principles, all distributions by us to U.S. holders will generally be treated as dividends. Any dividend will not be eligible for the dividends-received deduction allowed to certain U.S. corporations in respect of dividends received from U.S. corporations.

If you are a noncorporate U.S. holder, dividends that constitute qualified dividend income will be taxable to you at the preferential rates applicable to long-term capital gains provided that you hold the H Shares or ADSs for more than 60 days during the 121-day period beginning 60 days before the ex-dividend date and meet other holding period requirements. Dividends that we pay with respect to the H Shares or ADSs will be qualified dividend income, provided that, in the year that you receive the dividend, we are eligible for the benefits of the Treaty. We believe that we are currently eligible for the benefits of the Treaty, and we therefore believe that dividends that we currently distribute on the H Shares or ADSs constitute qualified dividend income. However, there can be no assurance that we will be eligible for the benefits of the Treaty in future taxable years, and there can therefore be no assurance that dividends that we distribute on the H Shares or ADSs will continue to constitute qualified dividend income in such years.

Furthermore, even if we are not eligible for the benefits of the Treaty in a taxable year, dividends on the ADSs will nevertheless be treated as qualified dividend income if the ADSs are readily tradable on an established securities market in the United States. So long as our ADSs remain listed on the NYSE, we are therefore expect that dividends on the ADSs will be treated as qualified dividend income irrespective of whether we eligible for the benefits of the Treaty. However, if our ADSs were to be delisted from the NYSE (as discussed above in "Item 3. Key Information – D. Risk Factors – The audit reports included in this annual report are prepared by auditors who are not inspected fully by the Public Company Accounting Oversight Board and, as such, you are deprived of the benefits of such inspection. In addition, legislative and regulatory developments related to U.S.-listed China-based companies due to lack of PCAOB inspection and other developments may have a material adverse impact on our listing and trading in the United States and the trading prices of our ADSs."), our ADSs would no longer be readily tradable on an established securities market in the United States. If our ADSs were delisted from the NYSE, dividends paid with respect to ADSs will continue to be qualified dividend income so long as we continue to be eligible for the benefits of the Treaty (as discussed above).

The amount of the dividend distribution that you must include in your income as a U.S. holder will be the U.S. dollar value of the HK dollar payments made, determined at the spot HK dollar/U.S. dollar rate on the date the dividend is distributed, regardless of whether the payment is in fact converted into U.S. dollars. Generally, any gain or loss resulting from currency exchange fluctuations during the period from the date the dividend is distributed to the date you or the depositary convert the payment into U.S. dollars will be treated as ordinary income or loss and will not be eligible for the special tax rate applicable to qualified dividend income. Dividends paid by us generally will constitute income from sources outside the United States for U.S. foreign tax credit limitation purposes and will generally be categorized as "passive income" for U.S. foreign tax credit purposes. We may be required to withhold PRC income tax on dividends paid to U.S. holders on the H Shares or ADSs. Subject to various limitations, any PRC tax withheld from distributions in accordance with the Treaty will be deductible or creditable against your U.S. federal income tax liability.

You may not be able to claim a foreign tax credit (and instead may qualify to claim a deduction) for non-U.S. taxes imposed on dividends paid on the H Shares or ADSs if you (i) have held the H Shares or ADSs for less than a specified minimum period, or (ii) are obligated to make related payments with respect to positions in substantially similar or related property (for example, pursuant to a short sale). The rules relating to the U.S. foreign tax credit are complex and U.S. holders may be subject to various limitations on the amount of foreign tax credits that are available. In addition, in the case of a noncorporate U.S. holder, rules similar to the special rules that apply in determining the foreign tax credit limitation when the taxpayer has foreign source capital gains that are taxed in the U.S. at the lower capital gains rate apply in determining the noncorporate U.S. holder's foreign tax credit limitation arising from dividends that are taxed at the capital gains rate.

Sale, Exchange or Other Disposition

Upon a sale, exchange or other disposition of the H Shares, you will generally recognize capital gain or loss for U.S. federal income tax purposes in an amount equal to the difference between the U.S. dollar value of the amount realized and your tax basis, determined in U.S. dollars, in such H Shares. Generally, gain or loss recognized upon the sale or other disposition of H Shares or ADSs will be capital gain or loss, will be long-term capital gain or loss if the U.S. holder's holding period for such H Shares or ADSs exceeds one year, and will be income or loss from sources within the United States for foreign tax credit limitation purposes. Long-term capital gains of noncorporate U.S. holders are generally taxed at preferential rates. The deductibility of capital losses is subject to significant limitations.

With respect to the sale or exchange of H Shares, the amount realized upon a sale of H Shares generally will be the U.S. dollar value on the settlement date for the sale in the case of a cash basis U.S. holder (or an accrual basis U.S. Holder that so elects). If H Shares are traded on an "established securities market," a cash basis taxpayer or, if it so elects, an accrual basis taxpayer, will determine the U.S. dollar value of the amount realized by translating the amount received at the spot rate of exchange on the settlement date of the sale. A U.S. holder will have a tax basis in the foreign currency received equal to the U.S. dollar amount realized. Any currency exchange gain or loss realized on a subsequent conversion of the foreign currency into U.S. dollars for a different amount generally will be treated as ordinary income or loss from sources within the United States. However, if such foreign currency is converted into U.S. dollars on the date received by the U.S. holder, a cash basis or electing accrual basis U.S. holder should not recognize any gain or loss on such conversion.

Any gain or loss that you recognize upon a sale of the H Shares or ADSs will generally be U.S. source gain or loss for foreign tax credit limitation purposes. Under the Treaty, however, if any PRC tax were to be imposed on any gain from the disposition of H Shares or ADSs, the gain could be treated as PRC source income. In addition, under recently finalized Treasury regulations, you will generally be precluded from claiming a foreign tax credit in respect of any such taxes unless you are eligible for and elect to apply the benefits of the Treaty. U.S. holders are urged to consult their tax advisors regarding the tax consequences if a foreign tax is imposed on a disposition of H Shares or ADSs, including the availability of the foreign tax credit under their particular circumstances. Any Hong Kong stamp duty paid will not be a creditable tax for United States federal income tax purposes, although the proceeds that you are treated as receiving upon a sale of the H Shares will be reduced by the amount of the stamp duty.

Passive Foreign Investment Company Rules

A non-U.S. corporation is a PFIC for any taxable year in which, after applying relevant look-through rules with respect to the income and assets of subsidiaries:

- 75% or more of its gross income consists of passive income, such as dividends, interest, rents, royalties, and gains from the sale of assets that give rise to such income; or

- 50% or more of the average quarterly value of its gross assets consists of assets that produce, or are held for the production of, passive income.

Passive income generally includes dividends, interest, gains from the sale or exchange of investment property, rents and royalties, and certain other specified categories of income. However, passive income does not include certain rents and royalties derived from the active conduct of a trade or business. If the stock of a non-U.S. corporation is publicly traded for the taxable year, the asset test is applied using the fair market value of the assets for purposes of measuring such corporation's assets. If we own at least 25% (by value) of the stock of another corporation, we will be treated, for purposes of the PFIC tests, as owning our proportionate share of the other corporation's assets and receiving our proportionate share of the other corporation's income for purposes of the PFIC income and asset tests.

Based on the composition of our assets and income and the current expectations regarding the price of the H Shares and ADSs, we believe that we were not a PFIC for U.S. federal income tax purposes with respect to our 2021 taxable year and we do not intend or anticipate becoming a PFIC in the foreseeable future. However, the determination of PFIC status is a factual determination that must be made annually at the close of each taxable year and, therefore, there can be no certainty as to our status in this regard until the close of the current or any future taxable year. Changes in the nature of our income or assets or a decrease in the trading price of our shares may cause us to be considered a PFIC in the current or any subsequent year. If we were a PFIC in any year during a U.S. holder's holding period for the H Shares or ADSs, we would ordinarily continue to be treated as a PFIC for each subsequent year during which the U.S. holder owned the H Shares or ADSs.

If we were a PFIC in any taxable year that you held the H Shares or ADSs, you generally would be subject to special rules with respect to "excess distributions" made by us on the H Shares or ADSs and with respect to gain from your disposition of the H Shares or ADSs. An "excess distribution" generally is defined as the excess of the distributions you receive with respect to the H Shares or ADSs in any taxable year, other than the taxable year in which your holding period in the H Shares or ADSs begins, over 125% of the average annual distributions you have received from us during the shorter of the three preceding years, or your holding period for the H Shares or ADSs that preceded the taxable year in which you receive the distribution. Generally, you would be required to allocate any excess distribution or gain from the disposition of the H Shares or ADSs ratably over your holding period for the H Shares or ADSs. The portion of the excess distribution or gain allocated to a prior taxable year, other than a year prior to the first year in which we became a PFIC, would be taxed at the highest U.S. federal income tax rate in effect for such taxable year, and you would be subject to an interest charge on the resulting tax liability, determined as if the tax liability had been due with respect to such particular taxable years. The portion of the excess distribution or gain that is not allocated to prior taxable years, together with the portion allocated to the years prior to the first year in which we became a PFIC, would be included in your gross income for the taxable year of the excess distribution or disposition and taxed as ordinary income.

These adverse tax consequences may be mitigated if the U.S. holder is eligible to and does elect to annually mark-to-market the H Shares or ADSs. If a U.S. holder makes a mark-to-market election, such holder will generally include as ordinary income the excess, if any, of the fair market value of the H Shares or ADSs at the end of each taxable year over its adjusted basis, and will be permitted an ordinary loss in respect of the excess, if any, of the adjusted basis of the H Shares or ADSs over their fair market value at the end of the taxable year (but only to the extent of the net amount of income previously included in income as a result of the mark-to-market election). Any gain recognized on the sale or other disposition of the H Shares or ADSs will be treated as ordinary income and any loss would be an ordinary loss to the extent of the net amount of previously included income as a result of the market-to-market election and, thereafter, a capital loss. The mark-to-market election is available only for "marketable stock," which is stock that is traded in other than *de minimis* quantities on at least 15 days during each calendar quarter on a qualified exchange or other market, as defined in the applicable Treasury regulations. The H Shares or ADSs may qualify as "marketable stock" because the ADSs are listed on the New York Stock Exchange.

A U.S. holder's adjusted tax basis in the H Shares or ADSs will be increased by the amount of any income inclusion and decreased by the amount of any deductions under the mark-to-market rules. If a U.S. holder makes a mark-to-market election it will be effective for the taxable year for which the election is made and all subsequent taxable years unless the H Shares or ADSs are no longer regularly traded on a qualified exchange or the IRS consents to the revocation of the election. U.S. holders are urged to consult their tax advisors about the availability of the mark-to-market election, and whether making the election would be advisable in their particular circumstances. However, the stock of any of our subsidiaries that were PFICs would not be eligible for the mark-to-market election.

Alternatively, a timely election to treat us as a qualified electing fund could be made to avoid the foregoing rules with respect to excess distributions and dispositions. You should be aware, however, that if we become a PFIC, we do not intend to satisfy the recordkeeping requirements that would permit you to make a qualified electing fund election.

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In addition, notwithstanding any election you make with regard to the shares or ADSs, dividends that you receive from us will not constitute qualified dividend income to you if we are a PFIC (or are treated as a PFIC with respect to you) either in the taxable year of the distribution or the preceding taxable year. Dividends that you receive that do not constitute qualified dividend income are not eligible for taxation at the preferential rates applicable to qualified dividend income. Instead, you must include the gross amount of any such dividend paid by us in your gross income, and it will be subject to tax at rates applicable to ordinary income.

If we were regarded as a PFIC, a U.S. holder of H Shares or ADSs may be required to file an information return on IRS Form 8621.

U.S. holders should consult their tax advisors concerning the U.S. federal income tax consequences of holding the H Shares or ADSs if we were considered to be a PFIC.

Information with Respect to Foreign Financial Assets

Owners of “specified foreign financial assets” with an aggregate value in excess of $50,000 (and in some circumstances, a higher threshold) may be required to file an information report with respect to such assets with their tax returns. “Specified foreign financial assets” may include financial accounts maintained by foreign financial institutions, as well as the following, but only if they are held for investment and not held in accounts maintained by financial institutions: (i) stocks and securities issued by non-United States persons, (ii) financial instruments and contracts that have non-United States issuers or counterparties, and (iii) interests in foreign entities. Holders are urged to consult their tax advisors regarding the application of this reporting requirement to their ownership of the H Shares or ADSs.

Backup Withholding and Information Reporting

If you are a noncorporate U.S. holder, information reporting requirements, on IRS Form 1099, generally will apply to dividend payments or other taxable distributions made to you within the United States, and the payment of proceeds to you from the sale of the H Shares or ADSs effected at a United States office of a broker.

Additionally, backup withholding may apply to such payments if you fail to comply with applicable certification requirements or (in the case of dividend payments) are notified by the IRS that you have failed to report all interest and dividends required to be shown on your federal income tax returns.

Payment of the proceeds from the sale of the H Shares or ADSs effected at a foreign office of a broker generally will not be subject to information reporting or backup withholding. However, a sale effected at a foreign office of a broker could be subject to information reporting in the same manner as a sale within the United States (and in certain cases may be subject to backup withholding as well) if (i) the broker has certain connections to the United States, (ii) the proceeds or confirmation are sent to the United States or (iii) the sale has certain other specified connections with the United States.

You generally may obtain a refund of any amounts withheld under the backup withholding rules that exceed your income tax liability by filing a refund claim with the IRS.

Hong Kong Taxation

The following discussion summarizes the material Hong Kong tax provisions relating to the ownership of H Shares or ADSs held by you.

Dividends

Under current Hong Kong Inland Revenue Department practice, no Hong Kong tax is payable by the recipient in respect of dividends paid by us, either by withholding or otherwise, unless such dividends are attributable to a trade, profession or business carried on in Hong Kong.

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Taxation of Capital Gains

Hong Kong profits tax is currently charged at a flat rate of 16.5% for corporations and 15% for unincorporated businesses and individuals, except that the respective half-rates of 8.25% and 7.5% apply for the first HK$2 million of assessable profits for years of assessment beginning on or after April 1, 2018.

No Hong Kong tax is imposed on capital gains arising from the sale of property (such as H Shares) acquired and held as a capital investment. However, if a person carries on a business in Hong Kong that includes trading and dealing in securities, and derives trading gains from such activities or from other Hong Kong sources, Hong Kong profits tax will be payable. Gains from sales of H Shares effected on the Hong Kong Stock Exchange are considered to be from a Hong Kong source for this purpose. The source of gains from off-exchange transactions is less clear and, generally, will depend on whether the purchase and sale contracts were negotiated and, in substance, concluded in Hong Kong. In addition, exemption from profits tax is available for certain classes of taxpayers, notably privately offered onshore and offshore funds operating in Hong Kong, as well as non-Hong Kong residents who do not otherwise carry on business in Hong Kong, subject to compliance with various other requirements.

The Hong Kong tax position with respect to gains from the disposal of ADSs is similar. However, no Hong Kong tax will apply on trading gains arising from the sale of ADSs where the purchase and sale were effected on the NYSE.

Hong Kong Stamp Duty

Hong Kong stamp duty is payable by each seller and purchaser for every sold note and every bought note created for every sale and purchase of “Hong Kong stock” (which means stock the transfer of which is required to be registered in Hong Kong), including the H Shares. Stamp duty is currently charged at the total rate of 0.26% of the value of the H Shares transferred (the buyer and seller each paying half of such stamp duty). In addition, a fixed duty of HK$5 is currently payable on an instrument of transfer of H Shares. If one of the parties to a sale is a non-resident of Hong Kong and does not pay the required stamp duty, the unpaid stamp duty will be assessed on the instrument of transfer (if any), and the transferee will be liable for the full payment of such amount.

If the withdrawal of H Shares when ADSs are surrendered or the issuance of ADSs when H Shares are deposited results in a change of beneficial ownership in the H Shares under Hong Kong law, Hong Kong stamp duty at the rate described above for sale and purchase transactions will apply. The issuance of ADSs for deposited H Shares issued directly to the depositary or for the account of the depositary should not lead to a Hong Kong stamp duty liability. Holders of the ADSs are not liable for the Hong Kong stamp duty on transfers of ADSs outside of Hong Kong so long as the transfers do not result in a change of beneficial interest in the H Shares under Hong Kong law.

Estate Duty

The Revenue (Abolition of Estate Duty) Ordinance 2005 came into effect on February 11, 2006 in Hong Kong. No Hong Kong estate duty is payable and no estate duty clearance papers are needed for an application for a grant of representation in respect of holders of H Shares or ADSs whose death occurs on or after February 11, 2006.

F. Dividends and Paying Agents

Not applicable.

G. Statement by Experts

Not applicable.

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H. Documents on Display

We are subject to the periodic reporting and other informational requirements of the Exchange Act. Under the Exchange Act, we are required to file reports and other information with the SEC. Specifically, we are required to file an annual report under Form 20-F no later than four months after the close of each of our fiscal years, which is December 31, for fiscal years ended after December 15, 2011. Copies of reports and other information, when so filed, may be inspected without charge and may be obtained at prescribed rates at the SEC's public reference room located at 100 F Street, NE, Washington, D.C. 20549. The public may obtain information regarding the Washington, D.C. Public Reference Room by calling the SEC at 1-800-SEC-0330. The SEC also maintains a website at www.sec.gov that contains reports and other information regarding registrants that make electronic filings with the SEC using its EDGAR filing system. As a foreign private issuer, we are exempt from the rules under the Exchange Act prescribing the furnishing and content of quarterly reports and proxy statements, and officers, directors and principal shareholders of ours are exempt from the reporting and short-swing profit recovery provisions contained in Section 16 of the Exchange Act.

I. Subsidiary Information

Not applicable.

Item 11. Quantitative and Qualitative Disclosures about Market Risk

We are exposed to various types of market risks, including credit risk relating to financial assets and changes in foreign exchange rates, interest rates and the prices of alumina and primary aluminum, in the normal course of business.

We borrow short-term, medium-term and long-term funds, including variable rate debts, principally denominated in Renminbi. We hedge a limited amount of our sales through the trade of futures contracts on the SHFE and LME. Our hedging activities are subject to policies approved by our senior management. Substantially all of the financial instruments we hold are for purposes other than trading.

The following discussion, which contains "forward-looking statements" that involve risks and uncertainties, summarize our market-sensitive financial instruments. Such discussions address markets risk only and do not present other risks, which we face in the normal course of business.

Credit Risk

Credit risk arises from balances with banks and financial institutions, trade and notes receivables, other current and non-current receivables as well as credit exposures of customers, including outstanding receivables and committed transactions. We also provide financial guarantees to certain subsidiaries. The carrying amounts of these receivables and amounts of financial guarantees represent our maximum exposure to credit risk in relation to our financial assets and guarantees.

We maintain substantially all of our bank balances and cash and short-term investments in several major state-owned banks in the PRC. Our directors are of the opinion that these assets are not exposed to significant credit risk.

With regard to receivables, the marketing department assesses the credit quality of the customers and related parties, taking into account their financial positions, past experience and other factors. We perform periodic credit evaluations of our customers and believe that adequate provisions for impairment of receivables have been made in the financial statements. Management does not expect any further losses from non-performance by these counterparties.

For the year ended December 31, 2021, revenues of approximately RMB53,205 million are derived from entities directly or indirectly owned or controlled by the PRC government including Chinalco. There were no other individual customers from whom we have derived revenue of more than 10% of our revenue during the year ended December 31, 2019, 2020 and 2021. Thus, our directors are of the opinion that we were not exposed to any significant concentration of credit risk as of December 31, 2019, 2020 and 2021.

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Foreign Exchange Rate Risk

We conduct our business primarily in Renminbi, which is our functional and reporting currency. We convert a portion of our Renminbi revenues into other currencies to meet foreign currency obligations and to pay for imported equipment and materials.

Many foreign currency exchange transactions involving Renminbi, including foreign exchange transactions under our capital account, are subject to foreign exchange controls and require the approval of the SAFE. Actions taken by the PRC government could cause future exchange rates to vary significantly from current or historical exchange rates. On July 21, 2005, the PBOC announced a reform of its exchange rate system. Under the reform, the Renminbi is no longer effectively linked to the U.S. dollar but instead is allowed to fluctuate within a narrow and managed band against a basket of foreign currencies, according to market demand and supply conditions. In April 2012, the PRC government took a milestone step in turning the Renminbi into a global currency by doubling the size of its trading band against the U.S. dollar, pushing through a crucial reform that further liberalizes its financial markets. The PBOC allows the Renminbi to rise or fall 1% from a mid-point every day, effective on April 16, 2012, compared with its previous 0.5% limit. The PBOC allows the Renminbi to rise or fall 2% from a mid-point every day, effective on March 17, 2014, compared with its previous 1% limit. In August 2015, the PBOC announced that the daily central parity quotes the market-makers reported to the China Foreign Exchange Trade System operated by the PBOC before the market opens should be based on the closing rate of the inter-bank foreign exchange rate market on the previous day, supply and demand in the market, and price movement of major currencies, effective on August 11, 2015. Any appreciation of the Renminbi will increase the prices of our export sales denominated in foreign currencies and reduce the Renminbi equivalent value of our trade and notes receivable denominated in foreign currencies, which may adversely affect our financial condition and results of operations. Our financial condition and operating performance may also be affected by changes in the value of currencies other than Renminbi in which our earnings and obligations are denominated.

Our bank balances and cash on hand as of December 31, 2021 amounted to RMB19,178.0 million, including Renminbi balances and foreign currency deposits of U.S. dollar, HK dollar, Euro and others, which translated into RMB1,557.4 million, RMB7.3 million, RMB2.0 million and RMB6.2 million, respectively. Most of our sales are domestic and as such we have a limited amount of foreign currency denominated receivables and payables. As of December 31, 2021, we had foreign currency denominated loans with principal amount of RMB11 million in Japanese Yen and RMB1,333 million in U.S. dollars. In addition, as of December 31, 2021, our trade and notes receivables, other current assets and trade and notes payables denominated in U.S. dollars amounted to RMB512 million, RMB99 million and RMB241 million, respectively; our other payables and accrued liabilities denominated in U.S. dollars and HK dollars amounted to RMB1.24 million and RMB0.16 million, respectively.

As of December 31, 2021, if the Renminbi had strengthened/weakened by 5% against U.S. dollars with all other variables held constant, the total comprehensive income for the year would have been approximately RMB28 million higher/lower, mainly as a result of foreign exchange gains and losses arising from the translation of U.S.-dollar-denominated borrowings, other payables and medium-term notes. Profit was less sensitive to the fluctuation in the RMB/U.S. dollars exchange rates in 2021 than in 2020, mainly due to a decrease in the US$ denominated other payables and long-term and short-term borrowings.

As the assets and liabilities denominated in other foreign currencies other than U.S. dollars were relatively minimal to our total assets and liabilities, our directors are of the opinion that we were not exposed to significant foreign currency risk arising from other assets and liabilities denominated in currency other than the functional currency of the group entities as of December 31, 2020 and 2021.

Interest Rate Risk

As of December 31, 2021, as we had no significant interest-bearing assets except for bank deposits and entrusted loans, our income and operating cash flows are substantially independent of changes in market interest rates.

Most of the bank deposits are maintained in savings and time deposit accounts in the PRC. The interest rates are regulated by the PBOC and our Group treasury closely monitors the fluctuation on such rates periodically. The interest rates of entrusted loans are fixed. As the interest rates applied to the entrusted loans were fixed, our directors are of the opinion that we were not exposed to any significant interest rate risk for our financial assets held as of December 31, 2020 and 2021.

The interest rate risk for our financial liabilities primarily arises from interest-bearing loans. Loans borrowed at floating interest rates expose us to cash flow interest rate risk. We enter into debt obligations to support general corporate purposes including capital expenditures and working capital needs. Our Group treasury closely monitors market interest rates and maintains a balance between variable rate and fixed rate borrowings in order to reduce the exposures to the interest rate risk described above.

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As of December 31, 2021, if interest rates had been 100 basis points higher/lower for bank and other loans borrowed at floating interest rates with all other variables held constant, net profit for the year would have been RMB421 million lower/higher, respectively, mainly as a result of the higher/lower interest expense on floating rate borrowings.

Our interest rate risk for our financial liabilities also arises from medium-term notes and short-term bonds issued at fixed rates. As the fluctuation of comparable interest rates of corporate bonds with similar terms was relatively low, our directors are of the opinion that we are not exposed to any significant fair value interest rate risk for its fixed interest rate borrowings held as of December 31, 2020 and 2021.

Commodity Price Risk

We are exposed to fluctuations in the prices of alumina, primary aluminum and other products. We import a small portion of our alumina supply from suppliers outside China. Such purchases are made at market prices. In addition, all our sales of alumina, primary aluminum and other products are made at market prices. Therefore, fluctuations in the prices of alumina and primary aluminum have a significant effect on our operating performances.

We use mainly futures contracts and option contracts traded on the SHFE and the LME to hedge against fluctuations in primary aluminum prices. We use the futures contract for hedging other than speculation. As of December 31, 2021, the fair values of the outstanding futures and option contracts amounting to nil and RMB69 million were recognized in financial assets and financial liabilities at fair value through profit or loss, respectively.

As of December 31, 2020 and 2021, if the commodity futures prices had increased/decreased by 3% and all other variables held constant, the profit for the respective year would have changed by the amounts shown below:

	2020	2021
Primary aluminum	Decrease/increase RMB5 million	Decrease/increase RMB6 million

Liquidity risk

We monitor rolling forecasts of our liquidity requirements to ensure we have sufficient cash to meet operational needs while maintaining sufficient headroom on our undrawn committed borrowing facilities at all times so that we do not breach borrowing limits or covenants (where applicable) on any of our borrowing facilities. Such forecasts take into consideration our debt financing plans, covenant compliance, compliance with internal balance sheet ratio targets and, if applicable, external regulatory or legal requirements. Our management also monitors rolling forecasts of our liquidity reserve on the basis of expected cash flows.

As of December 31, 2021, we had total banking facilities of approximately RMB128,100 million, of which RMB36,056 million had been utilized, and unutilized banking facilities amounted to RMB92,044 million as of December 31, 2021, among which, banking facilities of approximately RMB25,530 million will remain unexpired over the 12 months from December 31, 2021. Our directors are confident that such banking facilities could be renewed upon their expiration based on our past experience with banks and our good credit standing. In addition, as of December 31, 2021, we had no credit facilities through our futures agent at LME. The futures agent has the right to adjust the related credit facilities.

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The following table sets forth the maturity profile of our financial liabilities as of December 31, 2021:

	Within 1 year(1)	1 to 2 years(1)	2 to 5 years(1)	Over 5 years(1)	Total(1)
			(RMB in millions)		
Lease liabilities, including current portion	1,590.2	1,473.7	4,347.7	15,394.4	22,806.0
Long-term bank and other loans, including current portion	5,859.1	11,837.7	9,771.4	14,657.0	42,125.2
Medium-term notes and bonds, including current portion	3,000.0	4,400.0	9,875.7	2,000.0	19,275.7
Short-term bonds	5,400.0	—	—	—	5,400.0
Short-term bank and other loans	9,219.3	—	—	—	9,219.3
Interest payables for loans and borrowings	2,620.9	2,147.8	3,941.5	1,680.4	10,390.6
Financial liabilities at fair value through profit or loss	68.9	—	—	—	68.9
Financial liabilities included in other payables and accrued liabilities, excluding accrued interest	6,497.8	—	—	—	6,497.8
Financial liabilities included in other non-current liabilities(2)	234.9	202.2	147.0	885.2	1,469.3
Trade and notes payables	15,505.4	—	—	—	15,505.4
Total	**49,996.5**	**20,061.4**	**28,083.3**	**34,617.0**	**132,758.2**

(1) The amounts disclosed are the contractual undiscounted cash flows.
(2) As of December 31, 2021, the carrying value of financial liabilities included in other non-current liabilities was RMB880.9 million.

Item 12. Description of Securities Other Than Equity Securities

A. Debt Securities

Not applicable.

B. Warrants and Rights

Not applicable.

C. Other Securities

Not applicable.

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D. American Depositary Shares

The following table summarizes the fees and charges that a holder of our ADSs may have to pay, directly or indirectly, in connection with the ownership of Chalco's ADSs.

Persons depositing or withdrawing shares must pay:	**For:**
$5.00 (or less) per 100 ADSs (or portion thereof)	• Issuance of ADSs, including issuances resulting from a distribution of shares or rights or other property
	• Cancellation of ADSs for the purpose of withdrawal, including if the deposit agreement terminates
$0.05 (or less) per ADS (or portion thereof)	• Any cash distribution to ADS holders
A fee equivalent to the fee that would be payable if securities distributed to ADS holders had been shares and the shares had been deposited for issuance of ADSs	• Distribution of securities distributed to holders of deposited securities (including rights) that are distributed by the depositary of ADS holders
$0.05 (or less) per ADS (or portion thereof) per calendar year	• Depositary services
As necessary	• Transfer and registration of shares on our share register to or from the name of the depositary or its agent when you deposit or withdraw shares
As necessary	• Cable (including SWIFT) and facsimile transmissions (when expressly provided in the deposit agreement)
	• Converting foreign currency to U.S. dollars
As necessary	• Taxes and other governmental charges that the depositary or the custodian have to pay on any ADS or share underlying an ADS, such as stock transfer taxes, stamp duty or withholding taxes
As necessary	• Any charges incurred by the depositary or its agents for servicing the deposited securities

The Bank of New York Mellon, as depositary, has agreed to reimburse certain expenses related to the administration and maintenance of our ADR program incurred by us in connection with the program. From January 1, 2021 to December 31, 2021, we received from the depositary reimbursements of US$26,129.31 for our continuing annual stock exchange listing fees and our expenses incurred in connection with investor relationship programs. The depositary has also agreed to waive certain standard out-of-pocket administrative, maintenance and shareholder services expenses related to our ADR program. From January 1, 2021 to December 31, 2021, the total amount of the fees that were waived was US$110,611.69.

PART II

Item 13. Defaults, Dividend Arrearages and Delinquencies

None.

Item 14. Material Modifications to the Rights of Security Holders and Use of Proceeds

None.

Item 15. Controls and Procedures

Our management, with the participation of our principal executive officer and principal financial officer, after evaluating the effectiveness of our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15(d)-15(e) of the Exchange Act) as of the end of the period covered by this annual report, have concluded that, as of such date, our disclosure controls and procedures were effective.

Management's Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting as defined in Rules 13a-15(f) and 15d- 15(f) under the Exchange Act. Our internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles.

Our internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of a company's assets, (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of consolidated financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures are being made only in accordance with authorizations of our management and directors, and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of our assets that could have a material effect on the consolidated financial statements. Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Under the supervision of and with the participation of the principal executive officer and principal financial officer, our management conducted an evaluation of the effectiveness of our internal control over financial reporting as of December 31, 2021, based on the framework in the Internal Control-Integrated Framework (2013 Framework) issued by the Committee of Sponsoring Organizations of the Treadway Commission in May 2013.

Based on our evaluation under the framework in Internal Control-Integrated Framework (2013 Framework) issued by the Committee of Sponsoring Organizations of the Treadway Commission, our management concluded that, as of December 31, 2021, our internal control over financial reporting was effective to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with the IFRS.

Attestation Report of the Registered Public Accounting Firm

The effectiveness of our internal controls over financial reporting as of December 31, 2021 has been audited by PricewaterhouseCoopers Zhong Tian LLP, an independent registered public accounting firm, as stated in their report which appears on page F-3 of this annual report on Form 20-F.

Changes in Internal Control over Financial Reporting

During 2021, there have been no changes in our internal control over financial reporting that occurred during the fiscal year covered by this annual report that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Item 16A. Audit Committee Financial Expert

Our audit committee members are three independent non-executive directors, namely, Mr. Qiu Guanzhou, Mr. Yu Jinsong and Ms. Chan Yuen Sau Kelly. Our Board has determined that Ms. Chan Yuen Sau Kelly, the chairman of the audit committee, qualifies as an "audit committee financial expert" as defined in Item 16A of Form 20-F and is the financial expert serving on our audit committee. See "Item 6. Directors, Senior Management and Employees."

Item 16B. Code of Ethics

We have adopted a code of ethics that applies to our chief executive officer, chief financial officer, other directors, independent non-executive directors, senior management and employees. We have posted our code of ethics on our website: http://www.chalco.com.cn/en/qywhen/gjglen/202012/P020201215377712432190.pdf. A hard copy of this code of ethics is available to investors free of charge upon written request to the address on the cover of this annual report on Form 20-F.

Item 16C. Principal Accountant Fees and Services

PricewaterhouseCoopers Zhong Tian LLP served as our independent auditor for the fiscal years ended December 31, 2020 and 2021. A description of the fees billed to us by our principal accountants for professional services in each of the last two fiscal years is set forth below:

	Year ended December 31	
	2020	2021
	(RMB in thousands)	
Audit fee(1)	18,170	18,170
Audit-related fee (2)	—	750
Tax fees(3)	700	120
Other fees	—	—

(1) "Audit fee" represents the fee obtained from audit work charged by PricewaterhouseCoopers and PricewaterhouseCoopers Zhong Tian LLP for the year ended December 31, 2020 and 2021.

(2) "Audit-related fees" represent fees charged by PricewaterhouseCoopers for assurance services for acquisition transactions and bond issuance for the year ended December 31, 2021.

(3) "Tax fees" represent the fees charged by PricewaterhouseCoopers Consultants (Shenzhen) Limited, Beijing Branch for providing consulting services for the year ended December 31, 2020 and 2021.

Our audit committee pre-approves all audit, audit-related services, tax services and other services performed by our principal accountants, including the services provided by PricewaterhouseCoopers Zhong Tian LLP for the years ended December 31, 2020 and 2021, respectively.

Item 16D. Exemptions from the Listing Standards for Audit Committees

Not applicable.

Item 16E. Purchase of Equity Securities by the Issuer and Affiliated Purchasers

We did not have an equity securities repurchase program and did not repurchase any of our equity securities during the year ended December 31, 2021.

Item 16F. Change in Registrant's Certifying Accountant

We changed our certifying accountant in 2020. Further disclosure is omitted in accordance with the Instruction 2 to Item 16F on Form 20-F. For details, please refer to Item 16F of our annual report on Form 20-F for the year ended December 31, 2020 filed with the SEC on April 22, 2021.

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Item 16G. Corporate Governance

The NYSE has imposed a series of corporate governance standards for companies listed on the NYSE in Section 303A of the NYSE Listed Company Manual. However, the NYSE provides that listed companies that are foreign private issuers, subject to certain limitations and conditions, are permitted to follow "home country" practice in lieu of the provisions of Section 303A of the NYSE Listed Company Manual. As a foreign private issuer listed on the NYSE, we are required to disclose a summary of the significant differences between our corporate governance practice and NYSE corporate governance rules that apply to U.S. domestic issuers.

	NYSE Listed Company Manual Requirements on Corporate Governance	Our Practice
Majority of independent directors	NYSE requires that the board of a listed company must comprise a majority of independent directors.	Under applicable PRC and Hong Kong laws and regulations, our Board is not required to be formed with a majority of independent directors. The Listing Rules require that every board of directors of a listed company must include at least three independent non-executive directors and at least one third of the board of directors of a listed company are independent non-executive directors. Our Board currently comprises three independent directors and six non-independent directors, which is in compliance with the requirements by the PRC securities regulatory authorities and of the Listing Rules.
Nominating/Corporate Governance Committee	NYSE requires U.S. domestic issuers to have only independent directors on their nominating/corporate governance committees.	The Listing Rules require that listed companies should establish a nomination committee which is chaired by the chairman of the board or an independent non-executive director and consists of a majority of independent non-executive directors. We have a nomination committee that is chaired by the chairman of our Board and consists of three independent directors and two non-independent directors, which is in compliance with the requirements of the Listing Rules.
Compensation Committee	NYSE requires U.S. domestic issuers to have a compensation committee composed entirely of independent directors.	The Listing Rules require that listed companies should establish a remuneration committee which is chaired by an independent non-executive director and consists of a majority of independent non-executive directors. We have a remuneration committee that is chaired by an independent director and consists of two independent directors and a non-independent director, which is in compliance with the requirements of the Listing Rules.

Item 16H. Mine Safety Disclosure

As of the date of this annual report, we do not own or operate any mine in the United States. For details of the mining safety control of our bauxite mines in China, see "Item 4. Information on the Company - B. Business Overview - Our Mines."

Item 16I. Disclosure Regarding Foreign Jurisdictions that Prevent Inspections

Not applicable to our annual report for the fiscal year ended December 31, 2021.

PART III

Item 17. Financial Statements

We have elected to provide the financial statements and related information specified in Item 18 in lieu of Item 17.

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Item 18. Financial Statements

The audited Consolidated Financial Statements as required under Item 18 are attached hereto starting on page F-1 of this Form 20-F.

Item 19. Exhibits

Exhibit Number	Description
1.1	English translation of the Amended Articles of Association of Aluminum Corporation of China Limited (incorporated by reference to Exhibit 1.1 of our annual report on Form 20-F (file No. 001-15264) filed with the Securities and Exchange Commission on April 22, 2020)
2.1	Registrant's Specimen American Depositary Receipt (incorporated by reference to Exhibit 2.1 of our annual report on Form 20-F/A (file No. 001-15264) filed with the Securities and Exchange Commission on October 9, 2012)
2.2	Registrant's Specimen Certificate for H Shares (incorporated by reference to Exhibit 2.2 of our annual report on Form 20-F/A (file No.001-15264) filed with the Securities and Exchange Commission on October 9, 2012)
2.3	Deposit Agreement among the Registrant, The Bank of New York, as depositary, and Owners and Beneficial Owners of the American Depositary Receipts (incorporated by reference to Exhibit 2.3 of our annual report on Form 20-F/A (file No. 001-15264) filed with the Securities and Exchange Commission on October 9, 2012)
2.4	Description of securities registered under Section 12 of the Securities Exchange Act of 1934, as amended (incorporated by reference to Exhibit 2.4 of our annual report on Form 20-F (file No. 001-15264) filed with the Securities and Exchange Commission on April 22, 2020)
4.1	English translation of Form of Employment Contract (incorporated by reference to Exhibit 4.1 of our annual report on Form 20-F/A (file No. 001-15264) filed with the Securities and Exchange Commission on October 9, 2012)
8.1*	List of Subsidiaries of Aluminum Corporation of China Limited as of December 31, 2021
12.1*	Certification by the Chief Executive Officer pursuant to Section 302 of the Sarbanes-Oxley Act of 2002
12.2*	Certification by the Chief Financial Officer pursuant to Section 302 of the Sarbanes-Oxley Act of 2002
13.1*	Certification by the Chief Executive Officer pursuant to Section 906 of the Sarbanes-Oxley Act of 2002
13.2*	Certification by the Chief Financial Officer pursuant to Section 906 of the Sarbanes-Oxley Act of 2002
96.1*	Technical Report Summary
101.INS*	Inline XBRL Instance Document—this instance document does not appear in the Interactive Data File because its XBRL tags embedded within the Inline XBRL document
101.SCH*	Inline XBRL Taxonomy Extension Schema Document
101.CAL*	Inline XBRL Taxonomy Extension Calculation Linkbase Document
101.DEF*	Inline XBRL Taxonomy Extension Definition Linkbase Document
101.LAB*	Inline XBRL Taxonomy Extension Label Linkbase Document
101.PRE*	Inline XBRL Taxonomy Extension Presentation Linkbase Document
104*	Cover Page Interactive Data File (embedded within the Inline XBRL document)

* Filed with this annual report on Form 20-F

SIGNATURES

The registrant hereby certifies that it meets all of the requirements for filing on Form 20-F and that it has duly caused and authorized the undersigned to sign this annual report on its behalf.

ALUMINUM CORPORATION OF CHINA LIMITED
By: /s/ Zhu Runzhou
Name: Zhu Runzhou
Title: Executive Director and President
Date: April 22, 2022

ALUMINUM CORPORATION OF CHINA LIMITED AND ITS SUBSIDIARIES

Consolidated Financial Statements

For the Years Ended December 31, 2019, 2020 and 2021

Together with Reports of Independent Public Accounting Firm

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INDEX TO THE CONSOLIDATED FINANCIAL STATEMENTS

ALUMINUM CORPORATION OF CHINA LIMITED

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Shareholders of Aluminum Corporation of China Limited

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated statements of financial position of Aluminum Corporation of China Limited and its subsidiaries (the "Company") as of December 31, 2021 and 2020, and the related consolidated statements of profit or loss and other comprehensive income, changes in equity and cash flows for the years then ended, including the related notes (collectively referred to as the "consolidated financial statements"). We also have audited the Company's internal control over financial reporting as of December 31, 2021, based on criteria established in Internal Control - Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2021 and 2020, and the results of its operations and its cash flows for the years then ended in conformity with International Financial Reporting Standards as issued by the International Accounting Standards Board. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2021, based on criteria established in Internal Control - Integrated Framework (2013) issued by the COSO.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control over Financial Reporting appearing under Item 15. Our responsibility is to express opinions on the Company's consolidated financial statements and on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

The critical audit matters communicated below are matters arising from the current period audit of the consolidated financial statements that were communicated or required to be communicated to the audit committee and that (i) relate to accounts or disclosures that are material to the consolidated financial statements and (ii) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matters below, providing separate opinions on the critical audit matters or on the accounts or disclosures to which they relate.

Impairment assessment of property, plant and equipment

As described in Note 3(a), and Note 7 to the consolidated financial statements, the Group's net carrying value of property, plant and equipment ("PP&E) was RMB 93,427 million as of December 31, 2021. Management assesses related assets for potential impairment whenever there are indications that the carrying value of an asset or a group of assets may not be recoverable. As of December 31, 2021, management performed impairment assessment on PP&E with impairment indications at the level of cash generating unit ("CGU") to which the PP&E was allocated using discounted cash flow model. The discounted cash flows model applied for the impairment assessment involved significant assumptions including product prices and discount rate. Based on the impairment test, RMB 2,328 million of impairment losses were recognized by management for PP&E for the year ended December 31, 2021.

The principal considerations for our determination that performing procedures relating to the impairment assessment of PP&E is a critical audit matter are there were significant judgements made by management in determining their respective recoverable amounts using discounted cash flows model. This in turn led to a high degree of auditor judgment, subjectivity and audit effort in evaluating management's significant assumptions including product prices and discount rate. In addition, the audit effort involved the use of professionals with specialized skill and knowledge.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included evaluating and testing the effectiveness of controls relating to management's impairment assessment of PP&E, including controls over the development of model and significant assumptions used in the impairment assessment. These procedures also included, among others, (i) testing management's process for determining the recoverable amount of PP&E with impairment indications; (ii) evaluating the appropriateness of the management's model used to determine the recoverable amount; (iii) evaluating the reasonableness of significant assumption of the product prices by comparing the management forecast prices against historical prices and present market prices, taking into account the published forecast prices; (iv) testing the completeness, accuracy and relevancy of the underlying data used and the mathematical accuracy of the calculations in the model. Professionals with specialized skill and knowledge were used to assist in the evaluation of the appropriateness of the model and the reasonableness of certain significant assumptions, including the discount rate.

Impairment assessment of goodwill

As described in Note 3(b) and Note 6 to the consolidated financial statements, the Group's carrying value of goodwill was RMB 3,510 million as of December 31, 2021. Management performed impairment assessment of goodwill on an annual basis. When performing the impairment assessment, the recoverable amount of the CGU to which the goodwill was allocated was estimated by management using discounted cash flows model, and compared with the carrying value of the CGU to determine if goodwill was impaired. The discounted cash flows model used for the impairment assessment involved significant assumptions including product prices, long-term growth rate and discount rate. No impairment losses were recognized by management for goodwill for the year ended December 31, 2021.

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The principal considerations for our determination that performing procedures relating to the impairment assessment of goodwill is a critical audit matter are there were significant judgements made by management in determining their respective recoverable amounts using discounted cash flows model. This in turn led to a high degree of auditor judgment, subjectivity and audit effort in evaluating management's significant assumptions including product prices, long-term growth rate and discount rate. In addition, the audit effort involved the use of professionals with specialized skill and knowledge.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included evaluating and testing the effectiveness of controls relating to management's impairment assessment of goodwill, including controls over the development of model and significant assumptions used in the impairment assessment. These procedures also included, among others, (i) testing management's process for determining recoverable amount of goodwill; (ii) evaluating the appropriateness of management's model used to determine recoverable amount; (iii) evaluating the reasonableness of significant assumption of the product prices used by management by comparing the management forecast price against historical prices and present market prices, taking into account the published forecast prices; and (iv) testing the completeness, accuracy and relevancy of the underlying data used and the mathematical accuracy of the calculations in the model. Professionals with specialized skill and knowledge were used to assist in the evaluation of the appropriateness of the model and the reasonableness of certain significant assumptions, including the long-term growth rate and discount rate.

/s/ PricewaterhouseCoopers Zhong Tian LLP
Shanghai, the People's Republic of China
April 22, 2022

We have served as the Company's auditor since 2020.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Shareholders and the Board of Directors of Aluminum Corporation of China Limited

Opinion on the Financial Statements

We have audited the accompanying consolidated statements of profit or loss and other comprehensive income, changes in equity and cash flows of Aluminum Corporation of China Limited (the "Group") for the year ended December 31, 2019 and the related notes (collectively referred to as the "consolidated financial statements"). In our opinion, the consolidated financial statements present fairly, in all material respects, the results of its operations and its cash flows for the year ended December 31, 2019, in conformity with International Financial Reporting Standards as issued by the International Accounting Standards Board.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) ("PCAOB"), the Group's internal control over financial reporting as of December 31, 2019, based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) and our report dated April 22, 2020 expressed an unqualified opinion thereon.

Basis for Opinion

These financial statements are the responsibility of the Group's management. Our responsibility is to express an opinion on the Group's financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Group in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audit included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audit also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audit provide a reasonable basis for our opinion.

/s/ Ernst & Young Hua Ming LLP

We served as the Group's auditor from 2012 to 2019.

Beijing, the People's Republic of China

April 22, 2020 except for the effects of business combinations under common control incurred in 2020 and 2021 as discussed in Note 39 and changes in accounting policies as discussed in Note 2.1.6, as to which the date is April 22, 2022

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ALUMINUM CORPORATION OF CHINA LIMITED
CONSOLIDATED STATEMENT OF FINANCIAL POSITION

As of December 31, 2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

		December 31, 2020	December 31, 2021	
	Notes	(Restated) RMB'000	RMB'000	USD'000
ASSETS				
Non-current assets				
Intangible assets	6	13,448,304	12,986,876	2,037,924
Property, plant and equipment	7	100,712,423	93,427,029	14,660,740
Investment properties	8	1,601,876	1,814,589	284,749
Right-of-use assets	20 (a)	14,287,838	18,346,136	2,878,909
Investments in joint ventures	9 (a)	3,374,553	3,350,959	525,839
Investments in associates	9 (b)	9,173,410	9,636,634	1,512,198
Other financial assets measured at fair value	10	1,526,703	239,538	37,589
Deferred tax assets	11	1,481,235	1,386,147	217,517
Other non-current assets	12	3,165,920	2,474,946	388,373
Total non-current assets		148,772,262	143,662,854	22,543,838
Current assets				
Inventories	13	19,861,776	18,677,875	2,930,966
Trade and notes receivables	14	9,313,647	6,904,850	1,083,522
Other current assets	15	6,348,401	3,953,326	620,363
Other financial assets measured at fair value	37.2	17,311	—	—
Restricted cash	16	1,056,037	1,324,748	207,882
Cash and cash equivalents (excluding bank overdrafts)	16	9,671,477	17,853,244	2,801,564
Total current assets		46,268,649	48,714,043	7,644,297
Total assets		195,040,911	192,376,897	30,188,135

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ALUMINUM CORPORATION OF CHINA LIMITED
CONSOLIDATED STATEMENT OF FINANCIAL POSITION (CONTINUED)

As of December 31, 2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

	Notes	December 31, 2020 (Restated) RMB'000	December 31, 2021 RMB'000	December 31, 2021 USD'000
EQUITY AND LIABILITIES				
EQUITY				
Equity attributable to owners of the Company				
Share capital	17	17,022,673	17,022,673	2,671,229
Other equity instruments	41	4,486,429	2,498,429	392,058
Other reserves	18	34,915,968	30,919,358	4,851,922
Retained earnings/(Accumulated losses)		(1,975,753)	6,824,227	1,070,870
		54,449,317	57,264,687	8,986,079
Non-controlling interests	38	16,855,847	15,518,810	2,435,240
Total equity		71,305,164	72,783,497	11,421,319
LIABILITIES				
Non-current liabilities				
Interest-bearing loans and borrowings	19	57,518,097	64,095,849	10,058,037
Other non-current liabilities	21	2,147,558	1,938,240	304,152
Deferred tax liabilities	11	1,437,087	1,378,519	216,320
Total non-current liabilities		61,102,742	67,412,608	10,578,509
Current liabilities				
Trade and notes payables	23	15,444,354	15,505,443	2,433,142
Other payables and accrued liabilities	22	10,755,679	9,353,693	1,467,802
Contract liabilities	5	1,399,340	2,177,072	341,630
Financial liabilities at fair value through profit or loss	37.2	26,684	68,871	10,807
Income tax payable		299,665	569,591	89,381
Interest-bearing loans and borrowings	19	34,707,283	24,506,122	3,845,545
Total current liabilities		62,633,005	52,180,792	8,188,307
Total liabilities		123,735,747	119,593,400	18,766,816
Total equity and liabilities		195,040,911	192,376,897	30,188,135
Net current liabilities		(16,364,356)	(3,466,749)	(544,010)
Total assets less current liabilities		132,407,906	140,196,105	21,999,828

The accompanying notes on pages F-14 to F-123 are an integral part of these consolidated financial statements.

The financial statements on pages F-7 to F-123 were approved by the Board of Directors on April 22, 2022 and were signed on its behalf.

Liu Jianping Director	Ge Xiaolei Chief Financial Officer

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ALUMINUM CORPORATION OF CHINA LIMITED
CONSOLIDATED STATEMENT OF PROFIT OR LOSS AND OTHER COMPREHENSIVE INCOME

For the years ended December 31, 2019, 2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

		2019 (Restated)	2020 (Restated)	2021	
	Note	**RMB'000**	**RMB'000**	**RMB'000**	**USD'000**
Revenue	5	190,215,398	185,990,577	269,748,232	42,329,384
Cost of sales	25	(179,283,995)	(173,674,234)	(243,269,910)	(38,174,357)
Gross profit		10,931,403	12,316,343	26,478,322	4,155,027
Selling and distribution expenses	25	(447,368)	(315,653)	(314,926)	(49,419)
General and administrative expenses	25	(3,972,056)	(4,157,694)	(5,204,208)	(816,654)
Research and development expenses	25	(940,828)	(1,434,056)	(2,362,204)	(370,681)
Impairment losses on property, plant and equipment		(259,354)	(416,842)	(2,328,131)	(365,335)
Net impairment losses on financial assets	26	(171,016)	(979,161)	(1,384,888)	(217,319)
Other income	27	84,611	139,551	148,399	23,287
Other gains/(losses) - net	28	981,677	903,871	(1,623,503)	(254,763)
Operating profit		6,207,069	6,056,359	13,408,861	2,104,143
Finance income	29	261,194	227,201	275,996	43,310
Finance costs	29	(4,921,541)	(4,420,528)	(3,942,761)	(618,705)
Finance costs, net		(4,660,347)	(4,193,327)	(3,666,765)	(575,395)
Share of net profits of investments accounted for using the equity method					
Joint ventures	9 (a)	270,115	180,502	164,100	25,751
Associates	9 (b)	48,767	145,737	272,584	42,774
		318,882	326,239	436,684	68,525
Profit before income tax		1,865,604	2,189,271	10,178,780	1,597,273
Income tax expense	32	(631,512)	(590,023)	(2,389,761)	(375,006)
Profit for the year		1,234,092	1,599,248	7,789,019	1,222,267
Profit attributable to:					
Owners of the Company		595,643	764,306	5,079,562	797,094
Non-controlling interests		638,449	834,942	2,709,457	425,173
		1,234,092	1,599,248	7,789,019	1,222,267
Basic and diluted earnings per share for profit attributable to owners of the Company (expressed in RMB per share)	33	0.022	0.030	0.286	0.045
Profit for the year		1,234,092	1,599,248	7,789,019	1,222,267
Other comprehensive income					
Items that will be reclassified to profit or loss					
Exchange differences on translation of foreign operations		(32,323)	163,008	255,230	40,051
Items that will not be reclassified to profit or loss					
Changes in fair value of financial assets measured at fair value through other comprehensive income		57,815	(43,920)	(52,207)	(8,192)
Income tax effect		(14,642)	3,066	11,117	1,744
Share of other comprehensive income of associates and joint ventures accounted for using the equity method		—	(2,522)	8,879	1,394
Other comprehensive income for the year, net of tax		10,850	119,632	223,019	34,997
Total comprehensive income for the year		1,244,942	1,718,880	8,012,038	1,257,264
Total comprehensive income for the year attributable to:					
Owners of the company		606,243	885,421	5,303,141	832,179
Non-controlling interests		638,699	833,459	2,708,897	425,085
		1,244,942	1,718,880	8,012,038	1,257,264

The accompanying notes on pages F-14 to F-123 are an integral part of these consolidated financial statements.

The financial statements on pages F-7 to F-123 were approved by the Board of Directors on April 22, 2022 and were signed on its behalf.

ALUMINUM CORPORATION OF CHINA LIMITED
CONSOLIDATED STATEMENT OF CHANGES IN EQUITY

As of December 31, 2019, 2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

	Attributable to owners of the Company											
		Capital reserves										
	Share capital (Note 17)	Share premium	Other reserves	Statutory surplus reserve	Special reserve	Fair value reserve	Other equity instruments	Foreign currency translation reserve	Retained earnings/ (Accumulated losses)	Total	Non-controlling interests	Total equity
As of December 31, 2020	17,022,673	27,003,477	1,161,392	5,867,557	179,255	7,618	4,486,429	345,205	(1,741,596)	54,332,010	16,839,706	71,171,716
Adjustment due to business combinations under common control (Note 39)	—	350,291	—	—	1,173	—	—	—	(234,157)	117,307	16,141	133,448
As of January 1, 2021 (Restated)	17,022,673	27,353,768	1,161,392	5,867,557	180,428	7,618	4,486,429	345,205	(1,975,753)	54,449,317	16,855,847	71,305,164
Profit for the year	—	—	—	—	—	—	—	—	5,079,562	5,079,562	2,709,457	7,789,019
Other comprehensive income for the year												
Changes in fair value of equity investments at fair value through other comprehensive income, net of tax	—	—	—	—	—	(41,090)	—	—	—	(41,090)	—	(41,090)
Exchange differences on translation of foreign operations	—	—	—	—	—	—	—	255,790	—	255,790	(560)	255,230
Share of other comprehensive income of associates and joint ventures accounted for using the equity method	—	—	—	—	—	8,879	—	—	—	8,879	—	8,879
Total comprehensive income for the year	—	—	—	—	—	(32,211)	—	255,790	5,079,562	5,303,141	2,708,897	8,012,038
Business combination under common control (Note 39)	—	(395,624)	—	—	—	—	—	—	—	(395,624)	—	(395,624)
Disposal of subsidiaries	—	—	—	—	—	—	—	—	—	—	(3,886)	(3,886)
Dividends distribution by subsidiaries to non-controlling shareholders	—	—	—	—	—	—	—	—	—	—	(540,418)	(540,418)
Capital reduction from non-controlling shareholders	—	—	9,798	—	—	—	—	—	—	9,798	(15,087)	(5,289)
Appropriation to surplus reserves	—	—	—	254,642	—	—	—	—	(254,642)	—	—	—
Distribution of other equity instruments	—	—	—	—	—	—	—	—	(209,500)	(209,500)	(140,127)	(349,627)
Offset of statutory surplus reserves against accumulated losses (Note 18)	—	—	—	(4,229,913)	—	—	—	—	4,229,913	—	—	—
Disposal of other equity instrument investments	—	—	—	—	—	45,353	—	—	(45,353)	—	—	—
Other appropriations	—	—	—	—	92,003	—	—	—	—	92,003	39,834	131,837
Share of reserves of joint ventures and associates	—	—	—	—	15,552	—	—	—	—	15,552	—	15,552
Repayment of senior perpetual securities	—	—	(12,000)	—	—	—	(1,988,000)	—	—	(2,000,000)	(3,386,250)	(5,386,250)
As of December 31, 2021	17,022,673	26,958,144	1,159,190	1,892,286	287,983	20,760	2,498,429	600,995	6,824,227	57,264,687	15,518,810	72,783,497

ALUMINUM CORPORATION OF CHINA LIMITED
CONSOLIDATED STATEMENT OF CHANGES IN EQUITY (CONTINUED)

As of December 31, 2019, 2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

	Attributable to owners of the Company											
		Capital reserve										
	Share capital (Note 17)	Share premium	Other capital reserves	Statutory surplus reserve	Special reserve	Fair value reserve	Other equity instruments	Foreign currency translation reserve	Accumulated losses	Total	Non-controlling interests	Total equity
As of December 31, 2019	17,022,673	27,022,102	1,108,544	5,867,557	139,891	49,511	5,487,104	182,197	(2,207,600)	54,671,979	16,085,487	70,757,466
Adjustment due to business combinations under common control (Note 39)	—	341,724	—	—	—	—	—	—	(257,459)	84,265	11,124	95,389
As of January 1, 2020 (Restated)	17,022,673	27,363,826	1,108,544	5,867,557	139,891	49,511	5,487,104	182,197	(2,465,059)	54,756,244	16,096,611	70,852,855
Profit for the year	—	—	—	—	—	—	—	—	764,306	764,306	834,942	1,599,248
Other comprehensive income for the year												
Changes in fair value of equity investments at fair value through other comprehensive income, net of tax	—	—	—	—	—	(39,371)	—	—	—	(39,371)	(1,483)	(40,854)
Exchange differences on translation of foreign operations	—	—	—	—	—	—	—	163,008	—	163,008	—	163,008
Share of other comprehensive income of associates and joint ventures accounted for using the equity method	—	—	—	—	—	(2,522)	—	—	—	(2,522)	—	(2,522)
Total comprehensive income for the year	—	—	—	—	—	(41,893)	—	163,008	764,306	885,421	833,459	1,718,880
Business combinations under common control (Note 39)	—	(13,329)	—	—	—	—	—	—	—	(13,329)	23,996	10,667
Capital injection from non-controlling shareholders	—	3,271	—	—	—	—	—	—	—	3,271	426,751	430,022
Disposal of subsidiaries	—	—	3,616	—	—	—	—	—	—	3,616	—	3,616
Issuance of senior perpetual securities	—	—	—	—	—	—	1,000,000	—	—	1,000,000	—	1,000,000
Release of deferred government subsidies	—	—	49,290	—	—	—	—	—	—	49,290	—	49,290
Other appropriations	—	—	—	—	33,432	—	—	—	—	33,432	(19,741)	13,691
Share of reserves of joint ventures and associates	—	—	(58)	—	7,105	—	—	—	—	7,047	—	7,047
Distribution of other equity instruments	—	—	—	—	—	—	—	—	(275,000)	(275,000)	(146,416)	(421,416)
Underwriting fees of other equity instruments	—	—	—	—	—	—	(675)	—	—	(675)	—	(675)
Dividends distribution of subsidiaries to non- controlling shareholders	—	—	—	—	—	—	—	—	—	—	(358,813)	(358,813)
Repayment of senior perpetual securities	—	—	—	—	—	—	(2,000,000)	—	—	(2,000,000)	—	(2,000,000)
As of December 31, 2020 (Restated)	17,022,673	27,353,768	1,161,392	5,867,557	180,428	7,618	4,486,429	345,205	(1,975,753)	54,449,317	16,855,847	71,305,164

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ALUMINUM CORPORATION OF CHINA LIMITED
CONSOLIDATED STATEMENT OF CHANGES IN EQUITY (CONTINUED)

As of December 31, 2019, 2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

	Attributable to owners of the Company											
		Capital reserve										
	Share capital (Note 17)	Share premium	Other capital reserves	Statutory surplus reserve	Special reserve	Fair value reserve	Other equity instruments	Foreign currency translation reserve	Accumulated losses	Total	Non-controlling interests	Total equity
As of January 1, 2019	14,903,798	18,457,678	11,690,292	5,867,557	145,938	6,588	3,988,000	214,520	(2,848,821)	52,425,550	15,273,971	67,699,521
Profit for the year	—	—	—	—	—	—	—	—	595,643	595,643	638,449	1,234,092
Other comprehensive income for the year												
Changes in fair value of equity investments at fair value through other comprehensive income, net of tax	—	—	—	—	—	42,923	—	—	—	42,923	250	43,173
Exchange differences on translation of foreign operations	—	—	—	—	—	—	—	(32,323)	—	(32,323)	—	(32,323)
Total comprehensive income for the year	—	—	—	—	—	42,923	—	(32,323)	595,643	606,243	638,699	1,244,942
Business combinations under common control	—	341,487	—	—	—	—	—	—	—	341,487	10,158	351,645
Capital injection from non-controlling shareholders	—	—	4,144	—	—	—	—	—	—	4,144	706,970	711,114
Acquisition of non-controlling interests	—	—	149,322	—	—	—	—	—	—	149,322	(149,322)	—
Disposal of subsidiaries	—	—	—	—	(1,666)	—	—	—	119	(1,547)	(26,234)	(27,781)
Issuance of senior perpetual securities	—	—	—	—	—	—	1,499,104	—	—	1,499,104	—	1,499,104
Issuance of share capital	2,118,875	8,564,661	(10,735,214)	—	—	—	—	—	—	(51,678)	—	(51,678)
Other appropriations	—	—	—	—	(5,317)	—	—	—	—	(5,317)	(17,768)	(23,085)
Share of reserves of joint ventures and associates	—	—	—	—	936	—	—	—	—	936	—	936
Dividends distribution of subsidiaries to non-controlling shareholders	—	—	—	—	—	—	—	—	—	—	(199,215)	(199,215)
Distribution of other equity instruments	—	—	—	—	—	—	—	—	(212,000)	(212,000)	(140,648)	(352,648)
As of December 31, 2019 (Restated)	17,022,673	27,363,826	1,108,544	5,867,557	139,891	49,511	5,487,104	182,197	(2,465,059)	54,756,244	16,096,611	70,852,855

The accompanying notes on pages F-14 to F-123 are an integral part of these consolidated financial statements.
The financial statements on pages F-7 to F-123 were approved by the Board of Directors on April 22, 2022 and were signed on its behalf.

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ALUMINUM CORPORATION OF CHINA LIMITED
CONSOLIDATED STATEMENT OF CASH FLOWS

For the years ended December 31, 2019, 2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

		For the year ended December 31			
		2019	2020	2021	
	Notes	(Restated) RMB'000	(Restated) RMB'000	RMB'000	USD'000
Net cash flows from operating activities	35	12,505,876	14,907,468	28,230,385	4,429,963
Investing activities					
Purchases of property, plant and equipment		(9,050,859)	(5,038,896)	(2,039,354)	(320,019)
Purchase of other financial assets measured at fair value		(3,500,700)	(7,020,000)	(11,900,000)	(1,867,370)
Purchases of investment properties		(44,063)	—	—	—
Purchases of intangible assets		—	—	(93,654)	(14,696)
Purchases of land use rights		—	—	(2,544)	(399)
Proceeds from disposal of property, plant and equipment		1,132,847	1,534,275	1,011,232	158,684
Proceeds from disposal of a joint venture and an associate		367,867	—	50,984	8,001
Proceeds from disposal of subsidiaries, net of cash		23,797	42,910	20,950	3,288
Proceeds from disposal of other financial assets measured at fair value		2,155	11,207,783	12,850,400	2,016,508
Proceeds from disposal of intangible assets		5,764	277,715	9,548	1,498
Proceeds from disposal of right-of-use assets		—	15,117	21,421	3,361
Investments in joint ventures		(50,000)	(4,333)	—	—
Investments in associates		(2,653,244)	(7,473)	(341,000)	(53,510)
Dividend received from other financial assets measured at fair value		97,775	82,794	10,912	1,712
Dividends received from associates and joint ventures		236,708	323,109	606,236	95,132
Change in deposit of futures contracts		(67,253)	(56,156)	(628,661)	(98,651)
Assets-related government grants received		103,373	47,558	75,971	11,922
Investment income/(loss) from other financial assets measured at fair value		—	524,727	(447,137)	(70,166)
Repayment of entrusted loans		—	—	50,395	7,908
Proceeds from acquisition of subsidiaries, net of cash		—	3,690	—	—
Net cash flows (used in)/ generated from investing activities		(13,395,833)	1,932,820	(744,301)	(116,797)
Financing activities					
Repayments of short-term bonds and mid-term notes		(22,400,000)	(30,638,813)	(21,537,420)	(3,379,691)
Repayments of short-term and long-term bank borrowings and other loans		(66,105,388)	(43,111,460)	(40,560,042)	(6,364,756)
Repayments of gold leasing arrangements		(1,607,905)	(6,921,860)	—	—
Cash consideration paid for business combination under common control		(237)	—	(395,624)	(62,081)
Proceeds from gold leasing arrangements		6,921,860	—	—	—
Proceeds from issuance of short-term bonds and medium-term notes		37,974,402	25,900,000	24,845,054	3,898,731
Drawdown of short-term and long-term bank borrowings and other loans		40,669,197	46,021,404	29,542,456	4,635,856
Senior perpetual securities' distribution paid		(352,648)	(421,416)	(349,627)	(54,864)
Capital injection from non-controlling shareholders		711,114	197,276	—	—
Share issue cost		(51,678)	—	—	—
Principal portion of lease payments		(3,032,106)	(1,748,202)	(639,675)	(100,379)
Dividends paid by subsidiaries to non-controlling shareholders		(222,930)	(356,340)	(460,744)	(72,301)
Interest paid		(4,467,803)	(3,664,725)	(3,505,649)	(550,113)
Repayments of senior perpetual securities		—	(2,000,000)	(5,386,250)	(845,220)
Instalment payment of bonds issuance expenses		(9,913)	(29,285)	(30,752)	(4,826)
Proceeds from issuance of perpetual securities		1,500,000	1,000,000	—	—
Net cash flows used in financing activities		(10,474,035)	(15,773,421)	(18,478,273)	(2,899,644)
Net increase/(decrease) in cash and cash equivalents		(11,363,992)	1,066,867	9,007,811	1,413,522
Cash and cash equivalents at beginning of year		19,135,843	7,793,056	8,771,522	1,376,443
Effect of foreign exchange rate changes, net		21,205	(88,401)	73,911	11,599
Cash and cash equivalents as of December 31	16	7,793,056	8,771,522	17,853,244	2,801,564

The accompanying notes on pages F-14 to F-123 are an integral part of these consolidated financial statements.

The financial statements on pages F-7 to F-123 were approved by the Board of Directors on April 22, 2022 and were signed on its behalf.

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ALUMINUM CORPORATION OF CHINA LIMITED
NOTES TO THE FINANCIAL STATEMENTS

For the years ended December 31, 2019 ,2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

1 GENERAL INFORMATION

Aluminum Corporation of China Limited (the “Company”) (中國鋁業股份有限公司) and its subsidiaries (together the “Group”) are principally engaged in exploration and mining of bauxite resources; production, sales, related technical development and technical services of alumina, primary aluminum, aluminum alloy and carbon; power generation business; exploration, mining and operation of coal resources; trading and logistics.

The Company is a joint stock company which was established on September 10, 2001 and is domiciled in the People’s Republic of China (the “PRC”) with limited liability. The address of its registered office is No. 62 North Xizhimen Street, Haidian District, Beijing, the PRC.

The Company’s shares have been listed on the Main Board of the Hong Kong Stock Exchange and the New York Stock Exchange since 2001. The Company also listed its A shares on the Shanghai Stock Exchange in 2007.

In the opinion of the directors, the immediate and ultimate parent company of the Company is Aluminum Corporation of China (“Chinalco”) (中國鋁業集團有限公司), a company incorporated and domiciled in the PRC and wholly owned by the State-owned Assets Supervision and Administration Commission of the State Council.

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ALUMINUM CORPORATION OF CHINA LIMITED
NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

For the years ended December 31, 2019 ,2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

1 GENERAL INFORMATION (CONTINUED)

Information about subsidiaries

Particulars of the Company's principal subsidiaries are as follows:

Name	Place of registration and business	Registered capital	Principal activities	Percentage of equity attributable to the Company	
				Direct	Indirect
Shanxi Huaxing Aluminum Co. Ltd. ("Shanxi Huaxing") (山西華興鋁業有限公司)	PRC/Mainland China	1,850,000	Manufacture and distribution of alumina	60.00 %	40.00 %
Baotou Aluminum Co., Ltd. ("Baotou Aluminum") (包頭鋁業有限公司)	PRC/Mainland China	2,245,510	Manufacture and distribution of primary aluminum, aluminum alloy and related fabricated products and carbon products	100.00 %	—
China Aluminum International Trading Co., Ltd. ("Chalco Trading") (中鋁國際貿易有限公司)	PRC/Mainland China	1,731,111	Import and export activities	100.00 %	—
Chalco Shanxi New Material Co., Ltd. ("Shanxi New Material") (中鋁山西新材料有限公司)	PRC/Mainland China	4,279,601	Manufacture and distribution of alumina, primary aluminum and anode carbon products and electricity generation and supply	85.98 %	—
China Aluminum International Trading Group Co., Ltd. ("Trading Group") (中鋁國際貿易集團有限公司)	PRC/Mainland China	1,030,000	Import and export activities	100.00 %	—
Zunyi Aluminum Co., Ltd. (遵義鋁業股份有限公司)	PRC/Mainland China	3,204,900	Manufacture and distribution of primary aluminum and alumina	67.45 %	—
Chalco Hong Kong Ltd. ("Chalco Hong Kong") (中國鋁業香港有限公司)	Hong Kong	HKD849,940 in thousand	Overseas investments and alumina import and export activities, and mining and distribution of bauxite.	100.00 %	—
Chalco Mining Co., Ltd. ("Chalco Mining") (中鋁礦業有限公司)	PRC/Mainland China	4,028,859	Manufacture, acquisition and distribution of bauxite mines, limestone ore and alumina	100.00 %	—
Chalco Energy Co., Ltd. (中鋁能源有限公司)	PRC/Mainland China	1,384,398	Thermoelectric supply and investment management	100.00 %	—
China Aluminum Ningxia Energy Group Co., Ltd. ("Ningxia Energy") (中鋁寧夏能源集團)	PRC/Mainland China	5,025,800	Thermal power, wind power and solar power generation, coal mining, and power-related equipment manufacturing	70.82 %	—
Guizhou Huajin Aluminum Co., Ltd. ("Guizhou Huajin") (貴州華錦鋁業有限公司)	PRC/Mainland China	1,000,000	Manufacture and distribution of alumina	60.00 %	—

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ALUMINUM CORPORATION OF CHINA LIMITED
NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

For the years ended December 31, 2019 ,2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

Name	Place of registration and business	Registered capital	Principal activities	Percentage of equity attributable to the Company	
				Direct	Indirect
Chalco Zhengzhou Research Institute of Non-ferrous Metal Co., Ltd. (中國鋁業鄭州有色金屬研究院有限公司)	PRC/Mainland China	214,858	Research and development services	100.00 %	—
Chalco Shandong Co., Ltd. ("Chalco Shandong“) (中鋁山東有限公司)	PRC/Mainland China	4,052,847	Manufacture and distribution of alumina	100.00 %	—
Chalco Zhongzhou Aluminum Co., Ltd. ("Zhongzhou Aluminum“) (中鋁中州鋁業有限公司)	PRC/Mainland China	5,071,235	Manufacture and distribution of alumina	100.00 %	—
China Aluminum Logistics Group Corporation Co., Ltd. (中鋁物流集團有限公司)	PRC/Mainland China	964,291	Logistics and transportation	100.00 %	—
Chinalco Shanxi Jiaokou Xinghua Technology Ltd. (“Xinghua Technology“) (中鋁集團山西交口興華科技股份有限公司)	PRC/Mainland China	588,182	Manufacture and distribution of primary aluminum	33.00 %	33.00 %
Chinalco Shanghai Company Limited (“Chinalco Shanghai“) (中鋁(上海)有限公司)	PRC/Mainland China	968,300	Trading and engineering project management and leasing	100.00 %	—
Shanxi China Huarun Co., Ltd. (“Shanxi Huarun”) (山西中鋁華潤有限公司)	PRC/Mainland China	1,641,750	Manufacture and distribution of primary aluminum	40.00 %	—
Guizhou Huaren New Material Co., Ltd. (“Guizhou Huaren”) (貴州華仁新材料有限公司)	PRC/Mainland China	1,200,000	Manufacture and distribution of primary aluminum	40.00 %	—
Chinalco Materials Co., Ltd. (中鋁物資有限公司)	PRC/Mainland China	1,000,000	Import and export activities and trading	100.00 %	—

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

This note provides a list of the significant accounting policies adopted in the preparation of these consolidated financial statements. These policies have been consistently applied to all the years presented, unless otherwise stated. The financial statements are for the Group consisting of the Company and its subsidiaries.

2.1 **Basis of preparation**

2.1.1 Compliance with IFRS

The consolidated financial statements of the Company have been prepared in accordance with International Financial Reporting Standards ("IFRS") as issued by the International Accounting Standards Board ("IASB").

The preparation of the financial statements in conformity with IFRS requires the use of certain critical accounting estimates. It also requires management to exercise its judgement in the process of applying the Group's accounting policies. The areas involving a higher degree of judgement or complexity, or areas where assumptions and estimates are significant to the consolidated financial statements are disclosed in Note 3.

2.1.2 Going Concern

As of December 31, 2021, the Group's current liabilities exceeded its current assets by approximately RMB3,467 million (December 31, 2020 (restated): RMB16,364 million). The directors of the Company have considered the Group's available sources of funds as follows:

- The Group's expected net cash inflows from operating activities in 2022;
- Unutilized banking facilities of approximately RMB92,044 million as of December 31, 2021, of which amounts totaling RMB25,530 million will remain unexpired over 12 months from December 31, 2021. The directors of the Company are confident that these banking facilities could be renewed upon expiration based on the Group's past experience and good credit standing;
- Other available sources of financing from banks and other financial institutions given the Group's credit history.

The directors of the Company believe that the Group has adequate resources to continue operations for the foreseeable future of not less than 12 months from December 31, 2021. The directors of the Company therefore are of the opinion that it is appropriate to adopt the going concern basis in preparing the consolidated financial statements.

2.1.3 Historical cost convention

The financial statements have been prepared on a historical cost basis except for certain financial assets and financial liabilities measured at fair value.

2.1.4 New and amended standards adopted by the Group

New standards and amendments that are effective for the first time for periods commencing on or after January 1, 2021 did not have any material impact on the amounts recognized in prior periods and are not expected to significantly affect the current or future periods.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.1 Basis of preparation (Continued)

2.1.5 New standards and interpretations not yet adopted

Certain new accounting standards and interpretations have been published that are not mandatorily effective for December 31, 2021 reporting period and have not been early adopted by the Group. These standards are not expected to have a material impact on the entity in the current or future reporting periods and on foreseeable future transactions.

2.1.6 Changes in accounting policies

(i) Presentation of transportation and logistic costs

The Group previously presented the transportation and logistic costs incurred to fulfill the sales contracts in "selling and distribution expenses" in the consolidated statement of profit or loss. In 2021, due to the mandatory change in the presentation of such transportation and logistic costs in the consolidated statement of profit or loss of the Group under Accounting Standard for Business Enterprise issued by the Ministry of Finance of China ("CAS"), i.e., change from "selling and distribution expenses" to "cost of sales", the Group made the same change in presentation in the consolidated statement of profit or loss under IFRS. Accordingly, the comparative consolidated statement of profit or loss for the year ended December 31, 2019 and 2020 were restated with the amount of RMB1,229 million and RMB1,141 million reclassified from selling and distribution expenses to cost of sales, respectively. This change in accounting policy did not have any impact on the opening balance sheet of the Group for the years ended December 31, 2020 and 2021.

(ii) Accounting for the investments in associates and joint ventures in the separate financial statements

In the prior years, the Company accounted for the investments in associates and joint ventures at cost. In 2021, to make the carrying amounts of these investments better reflect their status and values, and to reduce the difference between the financial statements of the Company under IFRS and CAS, the Company changed the accounting for the investment in associates and joint ventures in the separate financial statements from cost method to equity method. This change in accounting treatment has been accounted for retrospectively and comparative information has been restated.

2.2 Principles of consolidation and equity accounting

2.2.1 Subsidiaries

Subsidiaries are all entities (including structured entities) over which the Group has control. The Group controls an entity where the Group is exposed to, or has rights to, variable returns from its involvement with the entity and affect those returns through its power to direct the activities of the entity. Subsidiaries are fully consolidated from the date on which control is transferred to the Group. They are deconsolidated from the date that control ceases.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.2 Principles of consolidation and equity accounting (Continued)

2.2.1 Subsidiaries (Continued)

The acquisition method of accounting is used to account for business combinations by the Group (Note 2.3).

Inter-company transactions, balances and unrealized gains on transactions between group companies are eliminated. Unrealized losses are also eliminated unless the transaction provides evidence of an impairment of the transferred asset. Accounting policies of subsidiaries have been changed where necessary to ensure consistency with the policies adopted by the Group.

Non-controlling interests in the results and equity of subsidiaries are shown separately in the consolidated statement of profit or loss and other comprehensive income, statement of changes in equity and balance sheet respectively.

2.2.2 Associates

Associates are all entities over which the Group has significant influence but not control or joint control. This is generally the case where the Group holds between 20% and 50% of the voting rights. Investments in associates are accounted for using the equity method of accounting (Note 2.2.4), after initially being recognized at cost.

2.2.3 Joint arrangements

Under IFRS 11 ‘Joint Arrangements’, investments in joint arrangements are classified as either joint operations or joint ventures. The classification depends on the contractual rights and obligations of each investor, rather than the legal structure of the joint arrangement. The Group only has joint ventures.

Joint ventures

Interests in joint ventures are accounted for using the equity method (Note 2.2.4), after initially being recognized at cost in the consolidated statement of financial position.

2.2.4 Equity method

Under the equity method of accounting, the investments are initially recognized at cost and adjusted thereafter to recognize the Group’s share of the post-acquisition profits or losses of the investee in profit or loss, and the Group’s share of movements in other comprehensive income of the investee in other comprehensive income. Dividends received or receivable from associates and joint ventures are recognized as a reduction in the carrying amount of the investment.

Where the Group’s share of losses in an equity-accounted investment equals or exceeds its interest in the entity, including any other unsecured long-term receivables, the Group does not recognize further losses, unless it has incurred obligations or made payments on behalf of the other entity.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.2 Principles of consolidation and equity accounting (Continued)

2.2.4 Equity method (Continued)

Unrealized gains on transactions between the Group and its associates and joint ventures are eliminated to the extent of the Group's interest in these entities. Unrealized losses are also eliminated unless the transaction provides evidence of an impairment of the asset transferred. Accounting policies of equity-accounted investees have been changed where necessary to ensure consistency with the policies adopted by the Group.

The carrying amount of equity-accounted investments is tested for impairment in accordance with the policy described in Note 2.11.

2.2.5 Changes in ownership interests

The Group treats transactions with non-controlling interests that do not result in a loss of control as transactions with equity owners of the Group. A change in ownership interest results in an adjustment between the carrying amounts of the controlling and non-controlling interests to reflect their relative interests in the subsidiary. Any difference between the amount of the adjustment to non-controlling interests and any consideration paid or received is recognized in a separate reserve within equity attributable to owners of the Company.

When the Group ceases to consolidate or equity account for an investment because of a loss of control, joint control or significant influence, any retained interest in the entity is remeasured to its fair value with the change in carrying amount recognized in profit or loss. This fair value becomes the initial carrying amount for the purposes of subsequently accounting for the retained interest as an associate, joint venture or financial asset. In addition, any amounts previously recognized in other comprehensive income in respect of that entity are accounted for as if the Group had directly disposed of the related assets or liabilities. This may mean that amounts previously recognized in other comprehensive income are reclassified to profit or loss or transferred to another category of equity as specified/ permitted by applicable IFRSs.

If the ownership interest in a joint venture or an associate is reduced but joint control or significant influence is retained, only a proportionate share of the amounts previously recognized in other comprehensive income are reclassified to profit or loss where appropriate.

2.3 Business combination

(a) Merger accounting for business combinations under common control

The consolidated financial statements incorporate the financial statements of the combining entities or businesses in business combination under common control as if they had been combined from the date when the combining entities or businesses first came under the control of the ultimate holding company.

The net assets of the combining entities or businesses are consolidated using the carrying amount from the ultimate holding company's perspective. No amount is recognized for goodwill or excess of the Group's interest in the book value of the net assets over cost at the time of the common control combination, to the extent of the continuation of the ultimate holding company's interest.

2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.3 Business combination (Continued)

(a) Merger accounting for business combinations under common control (Continued)

The consolidated statement of comprehensive income includes the results of each of the combining entities or businesses from the earliest date presented or since the date when the combining entities or businesses first came under common control, where this is a shorter period, regardless of the date of the common control combination.

The comparative financial data have been restated to reflect the business combinations under common control occurred during this year (Note 39).

Transaction costs, including professional fees, registration fees, costs of furnishing information to shareholders, costs or losses incurred in combining operations of the previously separate businesses and other costs incurred in relation to the common control combination that is to be accounted for by using the merger accounting method are recognized as expenses in the period in which they are incurred.

(b) Acquisition method of accounting for other business combinations and goodwill

The acquisition method of accounting is used to account for the acquisition of subsidiaries by the Group, other than common control combinations. The consideration transferred is measured at the acquisition date fair value which is the sum of acquisition date fair value of assets transferred by the Group, liabilities assumed by the Group to the former owner of the acquiree and the equity interests issued by the Group in exchange for control of the acquiree. The consideration transferred included the fair value of any assets and liabilities resulting from a contingent consideration arrangement. Acquisition-related costs are expensed as incurred. Identifiable assets acquired and liabilities and contingent liabilities assumed in a business combination are measured initially at fair value at the acquisition date. All other components of non-controlling interests are measured at fair value. For each business combination, the Group elects whether to measure the non-controlling interests in the acquiree that are present ownership interests and entitle their holders to a proportional share of net assets in the event of liquidation at fair value or at the proportional share of the acquiree’s identifiable net assets.

When the Group acquires a business, it assesses the financial assets and liabilities assumed for appropriate classification and designation in accordance with the contractual terms, economic circumstances and pertinent conditions as of the acquisition date. This includes the separation of embedded derivatives in host contracts of the acquiree.

If the business combination is achieved in stages, the previously held equity interest is remeasured at its acquisition date fair value and any resulting gain or loss is recognized in profit or loss.

Goodwill is initially measured at cost, being the excess of the aggregate of the consideration transferred, the amount recognized for non-controlling interests and any fair value of the Group’s previously held equity interests in the acquiree over the identifiable net assets acquired and liabilities assumed. If the sum of this consideration and other items is lower than the fair value of the net assets acquired, the difference is, after reassessment, recognized in profit or loss as a gain on bargain purchase.

2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.3 Business combination (Continued)

(b) Acquisition method of accounting for other business combinations and goodwill (Continued)

After initial recognition, goodwill is measured at cost less any accumulated impairment losses. Goodwill is tested for impairment at least annually or more frequently if events or changes in circumstances indicate that the carrying value may be impaired. The Group performs its annual impairment test of goodwill as of December 31,. For the purpose of impairment testing, goodwill acquired in a business combination is, from the acquisition date, allocated to each of the Group's cash-generating units, or groups of cash-generating units, that are expected to benefit from the synergies of the combination, irrespective of whether other assets or liabilities of the Group are assigned to those units or groups of units.

Impairment is determined by assessing the recoverable amount of the cash-generating unit (group of cash- generating units) to which the goodwill relates. Where the recoverable amount of the cash-generating unit (group of cash-generating units) is less than the carrying amount, an impairment loss is recognized. An impairment loss recognized for goodwill is not reversed in a subsequent period.

Where goodwill has been allocated to a cash-generating unit (or group of cash-generating units) and part of the operation within that unit is disposed of, the goodwill associated with the operation disposed of is included in the carrying amount of the operation when determining the gain or loss on the disposal. Goodwill disposed of in these circumstances is measured based on the relative value of the operation disposed of and the portion of the cash-generating unit retained.

2.4 Separate financial statements

Investments in subsidiaries are accounted for at cost less impairment. Cost includes direct attributable costs of investment. The results of subsidiaries are accounted for by the Company on the basis of dividend received and receivable.

Impairment testing of the investments in subsidiaries is required upon receiving a dividend from these investments if the dividend exceeds the total comprehensive income of the subsidiary in the period the dividend is declared or if the carrying amount of the investment in the separate financial statements exceeds the carrying amount in the consolidated financial statements of the investee's net assets including goodwill.

2.5 Segment reporting

Operating segments are reported in a manner consistent with the internal reporting provided to the chief operating decision maker. The chief operating decision-makers, who are responsible for allocating resources and assessing the performance of the operating segments, have been identified as the executive presidents committee of the Company that make strategic decisions.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.6 Foreign currency translation

(a) Functional and presentation currency

Items included in the financial statements of each of the Group's entities are measured using the currency of the primary economic environment in which the entity operates ('the functional currency'). The consolidated financial statements are presented in RMB, which is the Company's functional and presentation currency.

(b) Transactions and balances

Foreign currency transactions are translated into the functional currency using the exchange rates at the dates of the transactions. Foreign exchange gains and losses resulting from the settlement of such transactions and from the translation of monetary assets and liabilities denominated in foreign currencies at year end exchange rates are generally recognized in profit or loss.

Non-monetary items that are measured at fair value in a foreign currency are translated using the exchange rates at the date when the fair value was determined. Translation differences on assets and liabilities carried at fair value are reported as part of the fair value gain or loss. For example, translation differences on non-monetary assets and liabilities such as equities held at fair value through profit or loss are recognized in profit or loss as part of the fair value gain or loss and translation differences on non-monetary assets such as equities classified as fair value through other comprehensive income are recognized in other comprehensive income.

(c) Group companies

The results and financial positions of all the group entities (none of which has the currency of a hyper-inflationary economy) that have a functional currency different from the presentation currency are translated into the presentation currency as follows:

(i) assets and liabilities in each statement of financial position presented are translated at the closing rates at the end of the reporting period;

(ii) income and expenses in each statement of profit and loss and other comprehensive income are translated at average exchange rates (unless this average is not a reasonable approximation of the cumulative effect of the rates prevailing on the transaction dates, in which case income and expenses are translated at the rates at the dates of the transactions); and

(iii) all resulting exchange differences are recognized in other comprehensive income.

Goodwill and fair value adjustments arising on the acquisition of a foreign operation are treated as assets and liabilities of the foreign operation and translated at the closing rate.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.6 Foreign currency translation (Continued)

(d) Disposal of foreign operation and partial disposal

On the disposal of a foreign operation (that is, a disposal of the group's entire interest in a foreign operation, or a disposal involving loss of control over a subsidiary that includes a foreign operation, a disposal involving loss of joint control over a joint venture that includes a foreign operation, or a disposal involving loss of significant influence over an associate that includes a foreign operation), all of the currency translation differences accumulated in equity in respect of that operation attributable to the owners of the company are reclassified to profit or loss.

2.7 Property, plant and equipment

Property, plant and equipment, other than construction in progress, are stated at cost less accumulated depreciation and any impairment losses. When an item of property, plant and equipment is classified as held for sale or when it is part of a disposal group classified as held for sale, it is not depreciated and is accounted for in accordance with IFRS 5. Construction in progress represents buildings under construction, which is stated at cost less any impairment losses, and is not depreciated. The cost of an item of property, plant and equipment comprises its purchase price and any directly attributable costs of bringing the asset to its working condition and location for its intended use.

Subsequent costs are included in the asset's carrying amount or recognized as a separate asset, as appropriate, only when it is probable that future economic benefits associated with the item will flow to the group and the cost of the item can be measured reliably. The carrying amount of any component accounted for as a separate asset is derecognized when replaced. All other repairs and maintenance are charged to profit or loss during the reporting period in which they are incurred.

Depreciation is calculated using the straight-line method to allocate their cost or revalued amounts, net of their residual values, over their estimated useful lives as follows:

Buildings and infrastructure	8 – 45 years
Machinery	3 – 30 years
Transportation facilities	6 – 10 years
Office and other equipment	3 – 10 years

Residual values, useful lives and the depreciation method are reviewed, and adjusted if appropriate, at least at each financial year end.

Construction in progress ("CIP") represents buildings under construction, which is stated at cost less any impairment losses, and is not depreciated. Cost comprises the direct costs of construction and capitalized borrowing costs on related borrowed funds during the period of construction. CIP is reclassified to the appropriate categories of property, plant and equipment when completed and ready for use.

An asset's carrying amount is written down immediately to its recoverable amount if the asset's carrying amount is greater than its estimated recoverable amount (Note 2.11).

Gains and losses on disposals are determined by comparing proceeds with carrying amount. These are included in profit or loss.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.8 Investment properties

Investment properties are interests in land use rights and buildings (including the leasehold property held as a right-of-use asset which would otherwise meet the definition of an investment property) held to earn rental income and/or for capital appreciation, rather than for use in the production or supply of goods or services or for administrative purposes; or for sale in the ordinary course of business. Such properties are measured initially at cost, including transaction costs. After initial recognition, the Group uses the cost methods to measure all of its investment properties.

Depreciation is calculated using the straight-line method to allocate their cost or revalued amounts, net of their residual values, over their estimated useful lives as follows:

Buildings	25 – 50 years
Land use rights	40 – 70 years

The carrying amounts of investment properties measured using the cost method are reviewed for impairment when events or changes in circumstances indicate that the carrying amounts may not be recoverable.

Any gains or losses on the retirement or disposal of an investment property are recognized in profit or loss in the year of the retirement or disposal.

2.9 Intangible assets

(a) Goodwill

Goodwill is measured as described in Note 2.3. Goodwill on acquisitions of subsidiaries is included in intangible assets. Goodwill is not amortized but it is tested for impairment annually, or more frequently if events or changes in circumstances indicate that it might be impaired, and is carried at cost less accumulated impairment losses. Gains and losses on the disposal of an entity include the carrying amount of goodwill relating to the entity sold.

Goodwill is allocated to cash-generating units for the purpose of impairment testing. The allocation is made to those cash-generating units or groups of cash-generating units that are expected to benefit from the business combination in which the goodwill arose. The units or groups of units are identified at the lowest level at which goodwill is monitored for internal management purposes, being the operating segments (Note 5).

2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.9 Intangible assets (Continued)

(b) Mining rights and mineral exploration rights

The Group's mineral exploration rights and mining rights relate to coal, bauxite and other mines.

(i) Recognition

Except for mineral exploration rights and mining rights acquired in a business combination, mineral exploration rights and mining rights are initially recorded at cost which includes the acquisition consideration, qualifying exploration and other direct costs. The mineral exploration rights are stated at cost less any impairment, and the mining rights are stated at cost less any amortization and impairment.

(ii) Reclassification

Mineral exploration rights are converted to mining rights when obtain mining rights certification, or technical feasibility and commercial viability of extracting a mineral resource are demonstrable, and are subject to amortization when commercial production has commenced.

The Group assesses the stage of each mine under construction to determine when a mine moves into the production stage. The criteria used to assess the start date are determined based on the unique nature of each mine construction project. The Group considers various relevant criteria, such as completion of a reasonable period of testing of the mine and equipment, ability to produce in saleable form (within specifications) and ability to sustain ongoing production to assess when a mine is substantially complete and ready for its intended use.

(iii) Amortization

Mining rights other than coal mining rights are amortized on a straight-line basis over a shorter period of the mining right valid period and expected mining life. Estimated mineable periods of the majority of the mining rights range from 3 to 30 years.

Coal mining rights are amortized on a unit-of-production basis over the economically recoverable reserves evaluated based on the reserves estimated in accordance with the standards of the mine concerned.

(iv) Impairment

An impairment review is performed when there are indicators that the carrying amount of the mineral exploration rights and mining rights may exceed their recoverable amounts. To the extent that this occurs, the excess is fully provided as an impairment loss.

(c) Computer software

Acquired computer software licences are capitalized on the basis of the costs incurred to acquire and bring to use specific software. These costs are amortized over their estimated useful lives, which do not exceed 10 years. Costs associated with maintaining computer software programmes are recognized as an expense as incurred.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.9 Intangible assets (Continued)

(d) Aluminum production quota

Historically the Group acquired aluminum production quotas from third parties as the license for certain newly developed aluminum production lines. Currently such aluminum production quotas have no definite legal or regulatory terms, and their residual values at the end of the lives of the production lines to which they are currently attached are very uncertain. Aluminum production quota are initially recorded at cost and subsequently states at cost less any amortization and impairment. Amortization is provided on a straight-line basis over expected useful life of related aluminum production lines.

2.10 Research and development costs

Research and development expenditures are classified as research expenditures and development expenditures according to the nature of the expenditures and whether there is significant uncertainty of development activities transforming to assets.

Research expenditures are recognized in profit or loss for the current period. Development expenditures are recognized as assets when all of the following criteria are met:

(i) it is technically feasible to complete the asset so that it will be available for use or sale;

(ii) management intends to complete the asset and intends and has the ability to use or sell it;

(iii) it can be demonstrated that the asset will generate probable future economic benefits;

(iv) there are adequate technical, financial and other resources to complete the development of the asset and management has the ability to use or sell the asset; and

(v) the expenditure attributable to the asset during its development phase can be reliably measured.

Development expenditures that do not meet the criteria above are recorded in profit or loss for the current period as incurred. Development expenditures that have been recorded in profit or loss in previous periods will be not recognized as assets in subsequent periods. The Group has not had any development expenditure capitalized.

2.11 Impairment of non-financial assets

Goodwill and intangible assets that have an indefinite useful life are not subject to amortization and are tested annually for impairment, or more frequently if events or changes in circumstances indicate that they might be impaired. Other assets are tested for impairment whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. An impairment loss is recognized for the amount by which the asset's carrying amount exceeds its recoverable amount. The recoverable amount is the higher of an asset's fair value less costs of disposal and value in use. For the purposes of assessing impairment, assets are grouped at the lowest levels for which there are separately identifiable cash inflows which are largely independent of the cash inflows from other assets or groups of assets (cash-generating units). Non-financial assets other than goodwill that suffered an impairment are reviewed for possible reversal of the impairment at the end of each reporting period.

2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.12 Non-current assets (or disposal groups) held for sale

Non-current assets (or disposal groups) are classified as held for sale if their carrying amount will be recovered principally through a sale transaction rather than through continuing use and a sale is considered highly probable. They are measured at the lower of their carrying amount and fair value less costs to sell, except for assets such as deferred tax assets, assets arising from employee benefits, financial assets and investment property that are carried at fair value and contractual rights under insurance contracts, which are specifically exempt from this requirement.

An impairment loss is recognized for any initial or subsequent write-down of the asset (or disposal group) to fair value less costs to sell. A gain is recognized for any subsequent increases in fair value less costs to sell of an asset (or disposal group), but not in excess of any cumulative impairment loss previously recognized. A gain or loss not previously recognized by the date of the sale of the non-current asset (or disposal group) is recognized at the date of derecognition.

Non-current assets (including those that are part of a disposal group) are not depreciated or amortized while they are classified as held for sale. Interest and other expenses attributable to the liabilities of a disposal group classified as held for sale continue to be recognized.

Non-current assets classified as held for sale and the assets of a disposal group classified as held for sale are presented separately from the other assets in the balance sheet. The liabilities of a disposal group classified as held for sale are presented separately from other liabilities in the balance sheet.

2.13 Investments and other financial assets

(a) Classification

The Group classifies its financial assets in the following measurement categories:

- those to be measured subsequently at fair value (either through OCI or through profit or loss), and
- those to be measured at amortized cost.

The classification depends on the entity’s business model for managing the financial assets and the contractual terms of the cash flows.

Except for trade receivables that do not contain a significant financing component or for which the Group has applied the practical expedient of not adjusting the effect of a significant financing component, the Group initially measures a financial asset at its fair value, plus in the case of a financial asset not at fair value through profit or loss, transaction costs. Trade receivables and notes receivable that do not contain a significant financing component or for which the Group has applied the practical expedient are measured at the transaction price determined under IFRS 15 in accordance with the policies set out for “Revenue recognition” below.

For a financial asset to be classified and measured at amortized cost or fair value through other comprehensive income, it needs to give rise to cash flows that are solely payments of principal and interest (“SPPI”) on the principal amount outstanding. Financial assets with cash flows that are not SPPI are classified and measured at fair value through profit or loss, irrespective of the business model.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.13 Investments and other financial assets (Continued)

(a) Classification (Continued)

The Group's business model for managing financial assets refers to how it manages its financial assets to generate cash flows. The business model determines whether cash flows will result from collecting contractual cash flows, selling the financial assets, or both. Financial assets classified and measured at amortized cost are held within a business model with the objective to hold financial assets to collect contractual cash flows, while financial assets classified and measured at fair value through other comprehensive income are held within a business model with the objective of both holding to collect contractual cash flows and selling. Financial assets which are not held within the aforementioned business models are classified and measured at fair value through profit or loss.

All regular way purchases and sales of financial assets are recognized on the trade date, that is, the date that the Group commits to purchase or sell the asset. Regular way purchases or sales are purchases or sales of financial assets that require delivery of assets within the period generally established by regulation or convention in the market place.

(b) Subsequent measurement

The subsequent measurement of financial assets depends on their classification as follows:

(i) Financial assets at amortized cost (debt instruments)

Financial assets at amortized cost are subsequently measured using the effective interest method and are subject to impairment. Gains and losses are recognized in profit or loss when the asset is derecognized, modified or impaired.

(ii) Financial assets at fair value through other comprehensive income (debt instruments)

For debt investments at fair value through other comprehensive income, interest income, foreign exchange revaluation and impairment losses or reversals are recognized in profit or loss and computed in the same manner as for financial assets measured at amortized cost. The remaining fair value changes are recognized in other comprehensive income. Upon derecognition, the cumulative fair value change recognized in other comprehensive income is recycled to profit or loss.

(iii) Financial assets designated at fair value through other comprehensive income (equity investments)

Upon initial recognition, the Group can elect to classify irrevocably its equity investments as equity investments designated at fair value through other comprehensive income when they meet the definition of equity under IAS 32 Financial Instruments: Presentation and are not held for trading. The classification is determined on an instrument-by-instrument basis.

Gains and losses on these financial assets are never recycled to profit or loss. Dividends are recognized as other income in profit or loss when the right of payment has been established, it is probable that the economic benefits associated with the dividend will flow to the Group and the amount of the dividend can be measured reliably, except when the Group benefits from such proceeds as a recovery of part of the cost of the financial asset, in which case, such gains are recorded in other comprehensive income. Equity investments designated at fair value through other comprehensive income are not subject to impairment assessment.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.13 Investments and other financial assets (Continued)

(b) Subsequent measurement (Continued)

(iv) Financial assets at fair value through profit or loss

Financial assets at fair value through profit or loss are carried in the statement of financial position at fair value with net changes in fair value recognized in profit or loss.

This category includes derivative instruments, wealth management products and equity investments which the Group had not irrevocably elected to classify at fair value through other comprehensive income. Dividends on equity investments classified as financial assets at fair value through profit or loss are also recognized as other gains in profit or loss when the right of payment has been established, it is probable that the economic benefits associated with the dividend will flow to the Group and the amount of the dividend can be measured reliably.

A derivative embedded in a hybrid contract, with a financial liability or non-financial host, is separated from the host and accounted for as a separate derivative if the economic characteristics and risks are not closely related to the host; a separate instrument with the same terms as the embedded derivative would meet the definition of a derivative; and the hybrid contract is not measured at fair value through profit or loss. Embedded derivatives are measured at fair value with changes in fair value recognized in profit or loss. Reassessment only occurs if there is either a change in the terms of the contract that significantly modifies the cash flows that would otherwise be required or a reclassification of a financial asset out of the fair value through profit or loss category.

A derivative embedded within a hybrid contract containing a financial asset host is not accounted for separately. The financial asset host together with the embedded derivative is required to be classified in its entirety as a financial asset at fair value through profit or loss.

A financial asset (or, where applicable, a part of a financial asset or part of a group of similar financial assets) is primarily derecognized (i.e., removed from the Group's consolidated statement of financial position) when:

- the rights to receive cash flows from the asset have expired; or
- the Group has transferred its rights to receive cash flows from the asset or has assumed an obligation to pay the received cash flows in full without material delay to a third party under a "pass-through" arrangement; and either (a) the Group has transferred substantially all the risks and rewards of the asset, or (b) the Group has neither transferred nor retained substantially all the risks and rewards of the asset, but has transferred control of the asset.

When the Group has transferred its rights to receive cash flows from an asset or has entered a pass-through arrangement, it evaluates if, and to what extent, it has retained the risk and rewards of ownership of the asset. When it has neither transferred nor retained substantially all the risks and rewards of the asset nor transferred control of the asset, the Group continues to recognize the transferred asset to the extent of the Group's continuing involvement. In that case, the Group also recognizes an associated liability. The transferred asset and the associated liability are measured on a basis that reflects the rights and obligations that the Group has retained.

Continuing involvement that takes the form of a guarantee over the transferred asset is measured at the lower of the original carrying amount of the asset and the maximum amount of consideration that the Group could be required to repay.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.13 Investments and other financial assets (Continued)

(c) Impairment of financial assets

The Group recognizes an allowance for expected credit losses ("ECLs") for all debt instruments not held at fair value through profit or loss. ECLs are based on the difference between the contractual cash flows due in accordance with the contract and all the cash flows that the Group expects to receive, discounted at an approximation of the original effective interest rate.The impact of COVID-19 on GDP and other key indicators have been considered when determining the severity and likelihood of downside economic scenarios that are used to estimate ECL under IFRS 9 in 2021.

General approach

ECLs are recognized in three stages. For credit exposures for which there has not been a significant increase in credit risk since initial recognition, ECLs are provided for credit losses that result from default events that are possible within the next 12 months (a 12-month ECL). For those credit exposures for which there has been a significant increase in credit risk since initial recognition, a loss allowance is required for credit losses expected over the remaining life of the exposure, irrespective of the timing of the default (a lifetime ECL). For those have objective evidence of impairment at the reporting date, lifetime ECL are recognized and interest revenue is calculated on the net carrying amount.

At each reporting date, the Group assesses whether the credit risk on a financial instrument has increased significantly since initial recognition. When making the assessment, the Group compares the risk of a default occurring on the financial instrument as of the reporting date with the risk of a default occurring on the financial instrument as of the date of initial recognition and considers reasonable and supportable information that is available without undue cost or effort, including historical and forward-looking information.

The Group considers a financial asset to be in default when internal or external information indicates that the Group is unlikely to receive the outstanding contractual amounts in full before taking into account any credit enhancements held by the Group. A financial asset is written off when there is no reasonable expectation of recovering the contractual cash flows.

Debt investments at fair value through other comprehensive income and financial assets at amortized cost are subject to impairment under the general approach and they are classified within the following stages for measurement of ECLs except for trade receivables and contract assets which apply the simplified approach as detailed below.

Stage 1 - Financial instruments for which credit risk has not increased significantly since initial recognition and for which the loss allowance is measured at an amount equal to 12-month ECLs

Stage 2 - Financial instruments for which credit risk has increased significantly since initial recognition but that are not credit-impaired financial assets and for which the loss allowance is measured at an amount equal to lifetime ECLs

Stage 3 - Financial assets that are credit-impaired at the reporting date (but that are not purchased or originated credit-impaired) and for which the loss allowance is measured at an amount equal to lifetime ECLs

2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.13 Investments and other financial assets (Continued)

(c) Impairment of financial assets (Continued)

Simplified approach

For trade receivables, notes receivable and contract assets that do not contain a significant financing component or when the Group applies the practical expedient of not adjusting the effect of a significant financing component, the Group applies the simplified approach in calculating ECLs. Under the simplified approach, the Group does not track changes in credit risk, but instead recognizes a loss allowance based on lifetime ECLs at each reporting date. The Group has established a provision matrix that is based on its historical credit loss experience, adjusted for forward-looking factors specific to the debtors and the economic environment.

For trade receivables, notes receivable and contract assets that contain a significant financial component and lease receivables, the Group chooses as its accounting policy to adopt the simplified approach in calculating ECLs with policies as described above.

2.14 Financial liabilities

(a) Initial recognition and measurement

Financial liabilities are classified, at initial recognition, as financial liabilities at fair value through profit or loss, loans and borrowings, payables, or as derivatives designated as hedging instruments in an effective hedge, as appropriate.

All financial liabilities are recognized initially at fair value and, in the case of loans and borrowings and payables, net of directly attributable transaction costs.

The Group’s financial liabilities include trade and other payables, derivative financial instruments and interest-bearing bank and other borrowings.

(b) Subsequent measurement

The subsequent measurement of financial liabilities depends on their classification as follows:

(i) Financial liabilities at fair value through profit or loss

Financial liabilities at fair value through profit or loss include financial liabilities held for trading and financial liabilities designated upon initial recognition as of fair value through profit or loss.

Financial liabilities are classified as held for trading if they are incurred for the purpose of repurchasing in the near term. This category also includes derivative financial instruments entered by the Group that are not designated as hedging instruments in hedge relationships as defined by IFRS 9. Separated embedded derivatives are also classified as held for trading unless they are designated as effective hedging instruments. Gains or losses on liabilities held for trading are recognized in profit or loss. The net fair value gain or loss recognized in profit or loss does not include any interest charged on these financial liabilities.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.14 Financial liabilities (Continued)

(b) Subsequent measurement (Continued)

(ii) Financial liabilities at amortized cost (loans and borrowings)

After initial recognition, interest-bearing loans and borrowings are subsequently measured at amortized cost, using the effective interest rate method unless the effect of discounting would be immaterial, in which case they are stated at cost. Gains and losses are recognized in profit or loss when the liabilities are derecognized as well as through the effective interest rate amortization process.

Amortized cost is calculated by taking into account any discount or premium on acquisition and fees or costs that are an integral part of the effective interest rate. The effective interest rate amortization is included in finance costs in profit or loss.

(iii) Financial liabilities at amortized cost (trade and other payables)

These amounts represent liabilities for goods and services provided to the Group prior to the end of financial year which are unpaid. The amounts are unsecured and are usually paid within 30 days of recognition. Trade and other payables are presented as current liabilities unless payment is not due within 12 months after the reporting period. They are subsequently measured at amortized cost using the effective interest method.

(iv) Financial guarantee contracts

Financial guarantee contracts issued by the Group are those contracts that require a payment to be made to reimburse the holder for a loss it incurs because the specified debtor fails to make a payment when due in accordance with the terms of a debt instrument. A financial guarantee contract is recognized initially as a liability at its fair value, adjusted for transaction costs that are directly attributable to the issuance of the guarantee. Subsequent to initial recognition, the Group measures the financial guarantee contracts at the higher of: (i) the ECL allowance determined in accordance with the policy as set out in "Impairment of financial assets"; and (ii) the amount initially recognized less, when appropriate, the cumulative amount of income recognized.

(c) Derecognition of financial liabilities

A financial liability is derecognized when the obligation under the liability is discharged or cancelled or expires. When an existing financial liability is replaced by another from the same lender on substantially different terms, or the terms of an existing liability are substantially modified, such an exchange or modification is treated as a derecognition of the original liability and a recognition of a new liability, and the difference between the respective carrying amounts is recognized in profit or loss.

2.15 Offsetting financial instruments

Financial assets and liabilities are offset and the net amount is reported in the balance sheet where the Group currently has a legally enforceable right to offset the recognized amounts, and there is an intention to settle on a net basis or realize the asset and settle the liability simultaneously.

2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.16 Derivatives

Derivatives are initially recognized at fair value on the date a derivative contract is entered into and are subsequently remeasured to their fair value at the end of each reporting period. The accounting for subsequent changes in fair value depends on whether the derivative is designated as a hedging instrument. The Group's derivative instruments do not qualify for hedge accounting. Changes in the fair value of any derivative instrument that does not qualify for hedge accounting are recognized immediately in profit or loss and are included in other gains/(losses).

2.17 Inventories

Raw materials and stores, work in progress and finished goods are stated at the lower of cost and net realizable value. Cost comprises direct materials, direct labour and an appropriate proportion of variable and fixed overhead expenditure, the latter being allocated on the basis of normal operating capacity. Costs are assigned to individual items of inventory on the basis of weighted average costs. Costs of purchased inventory are determined after deducting rebates and discounts. Net realizable value is the estimated selling price in the ordinary course of business less the estimated costs of completion and the estimated costs necessary to make the sale.

2.18 Cash and cash equivalents

For the purpose of presentation in the statement of cash flows, cash and cash equivalents includes cash on hand and demand deposits, and short term highly liquid investments that are readily convertible into known amounts of cash, are subject to an insignificant risk of changes in value, and have a short maturity of generally within three months when acquired, and bank overdrafts. Bank overdrafts are shown within borrowings in current liabilities in the balance sheet.

2.19 Borrowing costs

General and specific borrowing costs that are directly attributable to the acquisition, construction or production of a qualifying asset are capitalized during the period of time that is required to complete and prepare the asset for its intended use or sale. Qualifying assets are assets that necessarily take a substantial period of time to get ready for their intended use or sale.

Investment income earned on the temporary investment of specific borrowings pending their expenditure on qualifying assets is deducted from the borrowing costs eligible for capitalization.

Other borrowing costs are expensed in the period in which they are incurred.

2.20 Current and deferred income tax

The income tax expense or credit for the period is the tax payable on the current period's taxable income based on the applicable income tax rate for each jurisdiction adjusted by changes in deferred tax assets and liabilities attributable to temporary differences and to unused tax losses.

2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.20 Current and deferred income tax (Continued)

Current income tax

The current income tax charge is calculated on the basis of the tax laws enacted or substantively enacted at the end of the reporting period in the countries where the Company and its subsidiaries and associates operate and generate taxable income. Management periodically evaluates positions taken in tax returns with respect to situations in which applicable tax regulation is subject to interpretation and considers whether it is probable that a taxation authority will accept an uncertain tax treatment. The Group measures its tax balances either based on the most likely amount or the expected value, depending on which method provides a better prediction of the resolution of the uncertainty.

Deferred income tax

Deferred income tax is provided in full, using the liability method, on temporary differences arising between the tax bases of assets and liabilities and their carrying amounts in the consolidated financial statements. However, deferred tax liabilities are not recognized if they arise from the initial recognition of goodwill. Deferred income tax is also not accounted for if it arises from initial recognition of an asset or liability in a transaction other than a business combination that at the time of the transaction affects neither accounting nor taxable profit or loss. Deferred income tax is determined using tax rates (and laws) that have been enacted or substantively enacted by the end of the reporting period and are expected to apply when the related deferred income tax asset is realized or the deferred income tax liability is settled.

Deferred tax assets are recognized only if it is probable that future taxable amounts will be available to utilize those temporary differences and losses.

Deferred tax liabilities and assets are not recognized for temporary differences between the carrying amount and tax bases of investments in foreign operations where the Company is able to control the timing of the reversal of the temporary differences and it is probable that the differences will not reverse in the foreseeable future.

Deferred tax assets and liabilities are offset where there is a legally enforceable right to offset current tax assets and liabilities and where the deferred tax balances relate to the same taxation authority. Current tax assets and tax liabilities are offset where the entity has a legally enforceable right to offset and intends either to settle on a net basis, or to realize the asset and settle the liability simultaneously.

Current and deferred tax is recognized in profit or loss, except to the extent that it relates to items recognized in other comprehensive income or directly in equity. In this case, the tax is also recognized in other comprehensive income or directly in equity, respectively.

2.21 Employee benefits

Employee benefits mainly include salaries, bonuses, allowances and subsidies, pension insurance, social insurance and housing funds, labor union fees, employees’ education fees and other expenses related to the employees for their services. The Group recognizes employee benefits as liabilities during the accounting period when employees rendered the services and allocates the related cost of assets and expenses based on different beneficiaries.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.21 Employee benefits (Continued)

(a) Bonus plans

The expected cost of bonus plans is recognized as a liability when the Group has a present legal or constructive obligation as a result of services rendered by employees and a reliable estimate of the obligation can be made.

(b) Retirement benefit obligations

The Group primarily pays contributions on a monthly basis to participate in a pension plan organised by the relevant municipal and provincial governments in the PRC. The municipal and provincial governments undertake to assume the retirement benefit obligations of all existing and future retired employees payable under these plans. The Group has no legal or constructive obligations for further contributions if the fund does not hold sufficient assets to pay all employees the benefit relating to their current and past services.

(c) In addition, the Company and its eligible subsidiaries have established an enterprise annuity plan in accordance with national policies and relevant requirements under the Company's system. Fees required for the enterprise annuity plan shall be jointly paid by the enterprise and its employees. Employees may elect to join or not to join the enterprise annuity plan on voluntary basis.

As of December 31, 2021, the Group had no forfeited contributions available to offset contributions payable in future years. For the year ended December 31, 2021, the Group did not have any defined benefit plan.

(d) Other social insurance and housing funds

The Group provides other social insurance and housing funds to the qualified employees in the PRC based on certain percentages of their salaries. These percentages are not to exceed the upper limits of the percentages prescribed by the Ministry of Human Resources and Social Security of the PRC. These benefits are paid to social security organizations and the amounts are expensed as incurred. The Group has no legal or constructive obligations for further contributions if the fund does not hold sufficient assets to pay all employees the benefit relating to their current and past services.

(e) Termination benefit obligations

Termination benefit obligations are payable when employment is terminated by the Group before the normal retirement date, or whenever an employee accepts voluntary redundancy in exchange for these benefits. The Group recognizes termination benefit obligations when it is demonstrably committed to either: terminating the employment of current employees according to a detailed formal plan without possibility of withdrawal; or providing termination benefits as a result of an offer made to encourage voluntary redundancy. The specific terms vary among the terminated employees depending on various factors including position, length of service and district of the employees concerned. Benefits falling due for more than 12 months after the end of the reporting period are discounted to their present values.

2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.22 Provisions

Provisions for legal claims, asset retirement obligations are recognized when the Group has a present legal or constructive obligation as a result of past events, it is probable that an outflow of resources will be required to settle the obligation and the amount can be reliably estimated. Provisions are not recognized for future operating losses.

Where there are a number of similar obligations, the likelihood that an outflow will be required in settlement is determined by considering the class of obligations as a whole. A provision is recognized even if the likelihood of an outflow with respect to any one item included in the same class of obligations may be small.

Provisions are measured at the present value of management's best estimate of the expenditure required to settle the present obligation at the end of the reporting period. The discount rate used to determine the present value is a pre-tax rate that reflects current market assessments of the time value of money and the risks specific to the liability. The increase in the provision due to the passage of time is recognized as interest expense.

2.23 Revenue recognition

Revenue from contracts with customers

Revenue from contracts with customers is recognized when control of goods or services is transferred to the customers at an amount that reflects the consideration to which the Group expects to be entitled in exchange for those goods or services.

When the consideration in a contract includes a variable amount, the amount of consideration is estimated to which the Group will be entitled in exchange for transferring the goods or services to the customer. The variable consideration is estimated at contract inception and constrained until it is highly probable that a significant revenue reversal in the amount of cumulative revenue recognized will not occur when the associated uncertainty with the variable consideration is subsequently resolved.

When the contract contains a financing component which provides the customer with a significant benefit of financing the transfer of goods or services to the customer for more than one year, revenue is measured at the present value of the amount receivable, discounted using the discount rate that would be reflected in a separate financing transaction between the Group and the customer at contract inception. When the contract contains a financing component which provides the Group a significant financial benefit for more than one year, revenue recognized under the contract includes the interest expense accreted on the contract liability under the effective interest method. For a contract where the period between the payment by the customer and the transfer of the promised goods or services is one year or less, the transaction price is not adjusted for the effects of a significant financing component, using the practical expedient in IFRS 15.

(a) Sale of industrial products

Revenue from the sale of industrial products (including sales of scrap and other materials) is recognized at the point in time when control of the asset is transferred to the customer, generally on delivery of the industrial products. Revenue from electricity is recognized upon transmission of electricity based on the confirmation from the power grid.

(b) Rendering of services

The Group provides transportation service and the revenue from services is recognized over time, using an input method to measure progress towards complete satisfaction of the service, because the customer simultaneously receives and consumes the benefits provided by the Group.

2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.24 Earnings per share

(a) Basic earnings per share

Basic earnings per share is calculated by dividing:

- the profit attributable to owners of the Company, excluding any costs of servicing equity other than ordinary shares;
- by the weighted average number of ordinary shares outstanding during the financial year, adjusted for bonus elements in ordinary shares issued during the year and excluding treasury shares.

(b) Diluted earnings per share

Diluted earnings per share adjusts the figures used in the determination of basic earnings per share to take into account:

- the after-income tax effect of interest and other financing costs associated with dilutive potential ordinary shares, and
- the weighted average number of additional ordinary shares that would have been outstanding assuming the conversion of all dilutive potential ordinary shares.

2.25 Dividend income

Dividend income is recognized when the shareholders' right to receive payment has been established, it is probable that the economic benefits associated with the dividend will flow to the Group and the amount of the dividend can be measured reliably.

2.26 Leases

Leases are recognized as a right-of-use asset and a corresponding liability at the date which the leased asset is available for use by the Group.

Contracts may contain both lease and non-lease components. The Group allocates the consideration in the contract to the lease and non-lease components based on their relative stand-alone prices. However, for leases of real estate for which the Group is a lessee, it has elected not to separate lease and non-lease components and instead accounts for these as a single lease component.

Lease terms are negotiated on an individual basis and contain a wide range of different terms and conditions. The lease agreements do not impose any covenants other than the security interests in the leased assets that are held by the lessor. Leased assets may not be used as security for borrowing purposes.

Assets and liabilities arising from a lease are initially measured on a present value basis. Lease liabilities include the net present value of the following lease payments:

- fixed payments (including in-substance fixed payments), less any lease incentives receivable;

2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.26 Leases (Continued)

- variable lease payment that are based on an index or a rate, initially measured using the index or rate as of the commencement date;
- amounts expected to be payable by the Group under residual value guarantees;
- the exercise price of a purchase option if the Group is reasonably certain to exercise that option, and
- payments of penalties for terminating the lease, if the lease term reflects the Group exercising that option.

Lease payments to be made under reasonably certain extension options are also included in the measurement of the liability.

The lease payments are discounted using the interest rate implicit in the lease. If that rate cannot be readily determined, which is generally the case for leases in the Group, the lessee's incremental borrowing rate is used, being the rate that the individual lessee would have to pay to borrow the funds necessary to obtain an asset of similar value to the right-of-use asset in a similar economic environment with similar terms, security and conditions.

To determine the incremental borrowing rate, the Group:

- where possible, uses recent third-party financing received by the individual lessee as a starting point, adjusted to reflect changes in financing conditions since third party financing was received;
- uses a build-up approach that starts with a risk-free interest rate adjusted for credit risk for leases held by the Group, which does not have recent third-party financing, and,
- makes adjustments specific to the lease, eg term, country, currency and security.

If a readily observable amortizing loan rate is available to the individual lessee (through recent financing or market data) which has a similar payment profile to the lease, then the Group entities use that rate as a starting point to determine the incremental borrowing rate.

The Group is exposed to potential future increases in variable lease payments based on an index or rate, which are not included in the lease liability until they take effect. When adjustments to lease payments based on an index or rate take effect, the lease liability is reassessed and adjusted against the right-of-use asset.

Lease payments are allocated between principal and finance cost. The finance cost is charged to profit or loss over the lease period so as to produce a constant periodic rate of interest on the remaining balance of the liability for each period.

Right-of-use assets are measured at cost comprising the following:

- the amount of the initial measurement of lease liability;
- any lease payments made at or before the commencement date less any lease incentives received;
- any initial direct costs, and

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.26 Leases (Continued)

- restoration costs.

Right-of-use assets are generally depreciated over the shorter of the asset's useful life and the lease term on a straight-line basis as follows:

Buildings	2 – 20 years
Machinery	2 – 10 years
Land use rights	10 – 50 years

If the Group is reasonably certain to exercise a purchase option, the right-of-use asset is depreciated over the underlying asset's useful life. While the Group revalues its land and buildings that are presented within property, plant and equipment, it has chosen not to do so for the right-of-use buildings held by the Group.

Payments associated with short-term leases of equipment and vehicles and all leases of low-value assets are recognized on a straight-line basis as an expense in profit or loss. The Group applies the short-term lease recognition exemption to its short-term leases of machinery and equipment (that is those leases that have a lease term of 12 months or less from the commencement date and do not contain a purchase option). It also applies the recognition exemption for leases of low-value assets to leases of office equipment that are considered to be of low value (i.e. below RMB30,000).

Rental income

Rental income is recognized on a time proportion basis over the lease terms. Variable lease payments that do not depend on an index or a rate are recognized as income in the accounting period in which they are incurred.

2.27 Dividend distribution

Provision is made for the amount of any dividend declared, being appropriately authorized and no longer at the discretion of the entity, on or before the end of the reporting period but not distributed at the end of the reporting period.

2.28 Government grants

Government grants are recognized at their fair value where there is reasonable assurance that the grant will be received and all attaching conditions will be complied with. When the grant relates to an expense item, it is recognized as income on a systematic basis over the periods that the costs, which it is intended to compensate, are expensed.

Asset-related government grants are recognized when the government document designates that the government grants are used for constructing or forming long-term assets. If the government document is inexplicit, the Group should make a judgement based on the basic conditions to obtain the government grants, and recognize them as asset-related government grants if the conditions are to construct or to form long-term assets. Otherwise, the government grants should be income-related.

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2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

2.28 Government grants (Continued)

For asset-related government grants that is related to long lived assets that already exist at the time of recognizing the government grant, the grant is deducted in calculating the carrying amount of the asset. The grant is recognized in profit or loss over the life of a depreciable asset as a reduced depreciation expense. If the asset is not yet purchased or constructed at the time of recognizing the government grant, the grant is recognized as deferred income and will be deducted from the cost of the asset once the asset is recognized.

Income-related government grants that are specific to compensate expenses or costs that have already incurred, they are directly recognized in profit or loss for the current period as deduction of the related expenses or costs. If the income-related government grants are specific to compensate future expenses or costs of the Group, they are recognized as deferred income and will be released to profit or loss when the related expenses or costs are incurred.

2.29 Interest income

Interest income from financial assets at FVPL is included in the net fair value gains/(losses) on these assets. Interest income on financial assets at amortized cost and financial assets at FVOCI calculated using the effective interest method is recognized in profit or loss as part of other income. Interest income is presented as finance income where it is earned from financial assets that are held for cash management purposes. Any other interest income is included in other income.

Interest income is calculated by applying the effective interest rate to the gross carrying amount of a financial asset except for financial assets that subsequently become credit-impaired. For credit-impaired financial assets the effective interest rate is applied to the net carrying amount of the financial asset (after deduction of the loss allowance).

3 SIGNIFICANT ACCOUNTING JUDGEMENTS AND ESTIMATES

The preparation of the Group’s consolidated financial statements requires management to make judgements, estimates and assumptions that affect the reported amounts of revenues, expenses, assets and liabilities, and the accompanying disclosures, and the disclosure of contingent liabilities. Uncertainty about these judgements, assumptions and estimates could result in outcomes that require a material adjustment to the carrying amounts of assets or liabilities affected in future periods.

Judgements

In the process of applying the Group’s accounting policies and preparing the Group’s consolidated financial statements, management has made the following judgements, apart from those involving estimates, which have a significant effect on the amounts recognized in the consolidated financial statements.

(a) Significant influence over an entity in which the Group holds less than 20% of voting rights

As of December 31, 2021, the Group owned a 6.68% equity interest in China Copper Mineral Resources Co.,Ltd. (“Chalco Resources”) (中銅礦產資源有限公司). The Group considers that it has significant influence over Chalco Resources even though it owns less than 20% of the voting rights, on the grounds that the Group can appoint one out of the five directors of the Board of Directors of Chalco Resources, thus have the right to participate in decision making of Chalco Resources.

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3 SIGNIFICANT ACCOUNTING JUDGEMENTS AND ESTIMATES (CONTINUED)

Judgements (Continued)

(a) Significant influence over an entity in which the Group holds less than 20% of voting rights (Continued)

As of December 31, 2021, the Group owned a 16% equity interest in Baise New Aluminum Power Co., Ltd. ("New Aluminum Power") (百色新鋁電力有限公司). The Group considers that the Group has significant influence over New Aluminum Power even though it owns less than 20% of the voting rights, on the grounds that the Group can appoint one out of the nine directors of the Board of Directors of New Aluminum Power, thus have the right to participate in decision making of New Aluminum Power.

As of December 31, 2021, the Group owned 14.71% of the voting right of Chinalco Capital Holdings Co., Ltd. ("Chinalco Capital") (中鋁資本控股有限公司). The Group considers that the Group has significant influence over Chinalco Capital even though it owns less than 20% of the voting rights, on the grounds that the Group can appoint one out of the three directors of the Board of Directors of Chinalco Capital, thus have the right to participate in decision making of Chinalco Capital.

As of December 31, 2021, the Group owned a 14.29% equity interest in Inner Mongolia Geliugou Co., Ltd. ("Inner Mongolia Geliugou") (內蒙古圪柳溝能源有限公司). The Group considers that it has significant influence over Inner Mongolia Geliugou even though it owns less than 20% of the voting rights, on the grounds that the Group can appoint one out of the seven directors of the Board of Directors of Inner Mongolia Geliugou, thus have the right to participate in decision making of Inner Mongolia Geliugou.

As of December 31, 2021, the Group owned 10.10% equity interest in Yunnan Aluminum Co., Ltd. ("Yunnan Aluminum") (雲南鋁業股份有限公司). The Group considers that it has significant influence over Yunnan Aluminum even though it owns less than 20% of the voting rights, on the grounds that the Group is the second largest shareholders of Yunnan Aluminum and assigned one out of the eleven directors of the Board of Directors of Yunnan Aluminum, thus have the right to participate in decision making of Yunnan Aluminum.

As of December 31, 2021, the Group owned a 19.49% equity interest in Chalco Innovation Development Investment Co., Ltd. ("Chalco Innovation") (中鋁創新開發投資有限公司). The Group considers that it has significant influence over Chalco Innovation even though it owns less than 20% of the voting rights, on the grounds that the Group can appoint one out of the seven directors of the Board of Directors of Chalco Innovation, thus have the right to participate in decision making of Chalco Innovation.

(b) Consolidation of entities in which the Group holds less than a majority of voting rights

As of December 31, 2021, the Group owned a 40.23% equity interest in Ningxia Yinxing Energy Co., Ltd. ("Yinxing Energy") (寧夏銀星能源股份有限公司). Since the remaining 59.77% of the equity shares in Yinxing Energy are held by a large number of individual shareholders, in opinion of the directors of the Company, the Group has control over Yinxing Energy, and Yinxing Energy continues to be included in the consolidation scope.

3 SIGNIFICANT ACCOUNTING JUDGEMENTS AND ESTIMATES (CONTINUED)

Judgements (Continued)

(b) Consolidation of entities in which the Group holds less than a majority of voting rights (Continued)

As of December 31, 2021, the Company owned a 40% equity interest in Guizhou Huaren New Materials Co., Ltd. (“Guizhou Huaren”)(貴州華仁新材料有限公司). In accordance with the acting-in-concert agreement signed between the Company and Qingzhen Industry Investment Co., Ltd. (“Qingzhen Industry”)(清鎮市工業投資有限公司) and Guizhou Chengqian Enterprise (Group) Co., Ltd. (“Guizhou Chengqian”) (貴州成黔企業(集團)有限公司). Qingzhen Industry and Guizhou Chengqian would exercise the shareholders’ and board of directors’ votes in concert with the Group's voting decisions. Therefore, the directors of the Company believe that the Company has control over Guizhou Huaren and consolidated Guizhou Huaren’s financial statements from the date the Group obtained control.

As of December 31, 2021, the Company owned 40% of the shares of Shanxi China Aluminum China Resources Co., Ltd. (“Shanxi Zhongrun”)(山西中鋁華潤有限公司). In accordance with the acting-in-concert agreement signed between the Company and China Resources Coal Industry Group Co., Ltd. (“China Resources Coal Industry”), China Resources Coal Industry would exercise the shareholders’ and Board of Directors’ votes in concert with the Group. Therefore, the directors of the Company believe that the Company has control over Shanxi Zhongrun and consolidated Shanxi Zhongrun’s financial statements from the date the Group obtained control.

Estimates and assumptions

The key assumptions concerning the future and other key sources of estimation uncertainty at the reporting date, that have a significant risk of causing a material adjustment to the carrying amounts of assets and liabilities within the next financial year, are described below. The Group’s assumptions and estimates are based on parameters available when the consolidated financial statements were prepared. Existing circumstances and assumptions about future developments, however, may change due to market changes or circumstances arising beyond the control of the Group. Such changes are reflected in the assumptions when they occur.

(a) Impairment assessment of property, plant and equipment

As of December 31, 2021, the Group’s net carrying amount of property, plant and equipment (“PP&E”) was RMB93,427 million. Management assesses related assets for potential impairment whenever there are indications that the carrying value of an asset or a group of assets may not be recoverable. As of December 31, 2021, management performed impairment assessment on property, plant and equipment (“PP&E”) with impairment indications at the level of cash generating unit (“CGU”) to which the PP&E was allocated using discounted cash flow model. The discounted cash flows model used for the impairment assessment of PP&E involved significant assumptions including product prices and the discount rate. Based on the impairment test, RMB2,328 million of impairment was recognized by management for PP&E for the year ended December 31, 2021.

3 SIGNIFICANT ACCOUNTING JUDGEMENTS AND ESTIMATES (CONTINUED)

Estimates and assumptions (Continued)

(b) Impairment assessment of goodwill

As of December 31, 2021, the Group's carrying value of goodwill was RMB3,510 million. Management performed impairment assessment of goodwill on an annual basis. When performing the impairment assessment, the recoverable amount of the CGU to which the goodwill was allocated was estimated by management using discounted cash flow model, and compared with the carrying amount of the CGU to determine if goodwill was impaired. The discounted cash flow models used for the impairment assessment of goodwill involved significant assumptions including product prices, the long-term growth rate and the discount rate. Based on the impairment test, no impairment provision is required for goodwill for the year ended December 31, 2021.

(c) Property, plant and equipment and intangible assets (excluding goodwill) – estimated useful lives and residual values

The Group's management determines the estimated useful lives and residual values (if applicable) and consequently the related depreciation/amortization charges for its property, plant and equipment and intangible assets (excluding goodwill). These estimates are based on the historical experience of the actual useful lives of property, plant and equipment of similar nature and functions, or based on the useful life of intangible assets. Management will increase the depreciation/amortization charge where useful lives are less than previously estimated, and it will write off or write down technically obsolete or non-strategic assets that have been abandoned or sold.

Actual economic lives may differ from estimated useful lives and actual residual values may differ from estimated residual values. Periodic review could result in change in depreciable lives and residual values and therefore change in depreciation/amortization expense in future periods.

(d) Coal reserve estimates and units-of-production amortization for coal mining rights

External qualified valuation professionals evaluate "economically recoverable reserves" based on the reserves estimated by external qualified exploration engineers in accordance with the PRC standards. The estimates of coal reserves are inherently imprecise and represent only the approximate amounts of the coal reserves because of the subjective judgements involved in developing such information. Economically recoverable reserve estimates are evaluated on a regular basis and have taken into account recent production and technical information about each mine.

(e) Estimated net realizable value of inventories

In accordance with the Group's accounting policy, the Group's management estimated net realizable value of inventories based on specific facts and circumstances. For different types of inventories, it requires the estimation on selling prices, costs of conversion, selling expenses and the related tax expense to calculate the net realizable amount of inventories. For inventories held for executed sales contracts, management estimates the net realizable amount based on the contracted price. For raw materials and work-in-progress, management has established a model in estimating the net realizable amount at which the inventories can be realized in the normal course of business after considering the Group's manufacturing cycles, production capacity and forecasts, estimated future conversion costs and selling prices. Management also takes into account the price or cost fluctuations and other related matters occurring after the end of the reporting period which reflect conditions that existed at the end of the reporting period.

It is reasonably possible that if there is a significant change in circumstances including the Group's business and the external environment, outcomes within the next financial year would be significantly affected.

3 SIGNIFICANT ACCOUNTING JUDGEMENTS AND ESTIMATES (CONTINUED)

Estimates and assumptions (Continued)

(f) Investments in joint ventures and associates – recoverable amount

In accordance with the Group's accounting policy, each investment in a joint venture and an associate is evaluated in every reporting period to determine whether there are any indicators of impairment. If any such indicators exists, an estimate of the recoverable amount is performed and an impairment loss is recognized to the extent that the carrying amount exceeds the recoverable amount. The recoverable amount of the investment in a joint venture and an associate is measured at the higher of fair value less costs of disposal and value in use.

A fair value measurement of a non-financial asset takes into account a market participant's ability to generate economic benefits by using the asset in its highest and best use or by selling it to another market participant that would use the asset in its highest and best use.

Value in use is also generally determined as the present value of the estimated future cash flows of those expected to arise from the continued use of the asset in its present form and its eventual disposal. Present values are determined using a risk-adjusted pre-tax discount rate appropriate to the risks inherent in the asset. Future cash flow estimates are based on expected production and sales volumes, commodity prices (considering current and historical prices, price trends and related factors) and operating costs. This policy requires management to make these estimates and assumptions which are subject to risk and uncertainty; hence there is a possibility that changes in circumstances will alter these projections, which may impact on the recoverable amounts of the investments. In such circumstances, some or all of the carrying value of the investments may be impaired and the impairment would be charged against profit or loss.

(g) Determination of the lease term

The Group leased certain land use rights from Chinalco for operation use. Pursuant to the framework lease contract entered into between the Company and Chinalco in 2001, the lease term is 50 years from July 1, 2001 with a termination option entitled to the Company. Under this framework contract, the related branches and subsidiaries of the Group signed lease agreements annually respectively with subsidiaries of Chinalco which owns the related land use right, with the extension option entitled to the leasees.

The lease term is determined based on the Group's assessment if the related termination option or extension option would be reasonably exercised taking into account the use of the land and operating status. The Group will reassess the lease term if any significant events or changes in circumstances that may have impact on the exercise of such options and are under the control of the Group occurred.

(h) Income tax

The Group estimates its income tax provision and deferred taxation in accordance with the prevailing tax rules and regulations, taking into account any special approvals obtained from the relevant tax authorities and any preferential tax treatment to which it is entitled in each location or jurisdiction in which the Group operates. There are many transactions and calculations for which the ultimate tax determination is uncertain during the ordinary course of business. The Group recognizes liabilities for anticipated tax audit issues based on estimates of whether additional taxes will be due. Where the final tax outcome of these matters is different from the amounts that were initially recorded, the differences will impact on the income tax and deferred tax provisions in the period in which the determination is made.

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3 SIGNIFICANT ACCOUNTING JUDGEMENTS AND ESTIMATES (CONTINUED)

Estimates and assumptions (Continued)

(h) Income tax (Continued)

Deferred tax assets are recognized for unused tax losses and deductible temporary differences, such as the provision for impairment of receivables, inventories and property, plant and equipment and accruals of expenses not yet deductible for tax purposes, to the extent that it is probable that taxable profits will be available against which the losses deductible temporary difference can be utilized.

An entity shall recognize a deferred tax liability for all taxable temporary differences associated with investments in subsidiaries, associates, and joint ventures, except to the extent that both of the following conditions are satisfied:

- the parent, investor or joint venture is able to control the timing of the reversal of the temporary difference; and
- it is probable that the temporary difference will not reverse in the foreseeable future.

In the event that future tax rules and regulations or related circumstances change, adjustments to current and deferred taxation may be necessary which would impact on the Group's results or financial position.

(i) Impairment of receivables

The loss allowances for receivables are based on assumptions about risk of default and expected loss rates to determine the expected loss. The Group uses judgement in making these assumptions and selecting the inputs to the impairment calculation, based on the Group's history, existing market conditions as well as forward looking estimates at the end of each reporting period.

The Group takes into account different macroeconomic scenarios in considering forward looking information. The Group regularly monitors and reviews the key macroeconomic assumptions and parameters related to the calculation of expected credit losses, including the risk of economic downturn, external market environment, technological environment, changes in customer conditions, GDP and consumer price index, etc. During the year ended December 31, 2021, the Group has taken into account the uncertainties arising from the COVID-19 outbreak and updated the relevant assumptions and parameters accordingly. The key macroeconomic parameters are listed below:

		Scenarios		
As of December 31, 2021	Year	Basic	Negative	Positive
Growth Rate of GDP	2022	5.30 %	5.04 %	5.57 %
	2023 and subsequent years	5.00 %	4.75 %	5.25 %
Growth Rate of CPI	2022	2.20 %	2.09 %	2.31 %
	2023 and subsequent years	1.60 %	1.52 %	1.68 %

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3 SIGNIFICANT ACCOUNTING JUDGEMENTS AND ESTIMATES (CONTINUED)

Estimates and assumptions (Continued)

(i) Impairment of receivables (Continued)

		Scenarios		
As of December 31, 2020	Year	Basic	Negative	Positive
Growth Rate of GDP	2021	8.83 %	8.39 %	9.27 %
	2022 and subsequent years	5.30 %	5.04 %	5.57 %
Growth Rate of CPI	2021	1.33 %	1.26 %	1.40 %
	2022 and subsequent years	2.40 %	2.28 %	2.52 %

4 SIGNIFICANT CHANGES IN THE CURRENT REPORTING PERIOD

The significant increase of revenue and net profit for 2021 is mainly due to the rise in market price of aluminum.

5 REVENUE AND SEGMENT INFORMATION

(a) Revenue

Revenue recognized during the year is as follows:

	For the years ended December 31		
	2019 (Restated)	2020 (Restated)	2021
Revenue from contracts with customers (net of value-added tax)			
Sale of goods	188,752,179	184,073,342	268,034,695
Transportation services	1,145,304	1,587,246	1,414,732
	189,897,483	185,660,588	269,449,427
Revenue from other sources			
Rental income	317,915	329,989	298,805
	190,215,398	185,990,577	269,748,232

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For the years ended December 31, 2019 ,2020 and 2021
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5 REVENUE AND SEGMENT INFORMATION (Continued)

(a) Revenue (Continued)

(i) Disaggregated revenue information

	For the year ended December 31, 2021						
	Alumina segment	Primary Aluminum segment	Energy Segment	Trading	Corporate and other operating segments	Inter-segment elimination	Total
Type of goods or services							
Sales of goods	56,315,755	72,586,897	7,915,219	214,724,462	483,349	(83,990,987)	268,034,695
Transportation services	—	—	—	5,652,938	—	(4,238,206)	1,414,732
Total	56,315,755	72,586,897	7,915,219	220,377,400	483,349	(88,229,193)	269,449,427
Geographical markets							
Mainland China	56,315,755	72,586,897	7,915,219	207,570,682	483,349	(88,229,193)	256,642,709
Outside of Mainland China	—	—	—	12,806,718	—	—	12,806,718
Total	56,315,755	72,586,897	7,915,219	220,377,400	483,349	(88,229,193)	269,449,427
Timing of revenue recognition							
Goods transferred at a point in time	56,315,755	72,586,897	7,915,219	214,724,462	483,349	(83,990,987)	268,034,695
Services transferred over time	—	—	—	5,652,938	—	(4,238,206)	1,414,732
Total	56,315,755	72,586,897	7,915,219	220,377,400	483,349	(88,229,193)	269,449,427

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ALUMINUM CORPORATION OF CHINA LIMITED
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5 REVENUE AND SEGMENT INFORMATION (CONTINUED)

(a) Revenue (Continued)

(i) Disaggregated revenue information (Continued)

	For the year ended December 31, 2020 (Restated)						
	Alumina segment	Primary Aluminum segment	Energy Segment	Trading	Corporate and other operating segments	Inter-segment elimination	Total
Type of goods or services							
Sales of goods	42,292,130	51,729,483	7,184,216	151,540,471	449,058	(69,122,016)	184,073,342
Transportation services	—	—	—	3,768,342	—	(2,181,096)	1,587,246
Total	42,292,130	51,729,483	7,184,216	155,308,813	449,058	(71,303,112)	185,660,588
Geographical markets							
Mainland China	42,292,130	51,729,483	7,184,216	146,666,981	449,058	(71,303,112)	177,018,756
Outside of Mainland China	—	—	—	8,641,832	—	—	8,641,832
Total	42,292,130	51,729,483	7,184,216	155,308,813	449,058	(71,303,112)	185,660,588
Timing of revenue recognition							
Goods transferred at a point in time	42,292,130	51,729,483	7,184,216	151,540,471	449,058	(69,122,016)	184,073,342
Services transferred over time	—	—	—	3,768,342	—	(2,181,096)	1,587,246
Total	42,292,130	51,729,483	7,184,216	155,308,813	449,058	(71,303,112)	185,660,588

	For the year ended December 31, 2019 (Restated)						
	Alumina segment	Primary Aluminum segment	Energy Segment	Trading	Corporate and other operating segments	Inter-segment elimination	Total
Type of goods or services							
Sales of goods	43,722,845	49,043,864	7,335,347	156,158,740	492,624	(68,001,241)	188,752,179
Transportation services	—	—	—	2,724,083	—	(1,578,779)	1,145,304
Total	43,722,845	49,043,864	7,335,347	158,882,823	492,624	(69,580,020)	189,897,483
Geographical markets							
Mainland China	43,722,845	49,043,864	7,335,347	153,106,808	492,624	(69,580,020)	184,121,468
Outside of Mainland China	—	—	—	5,776,015	—	—	5,776,015
Total	43,722,845	49,043,864	7,335,347	158,882,823	492,624	(69,580,020)	189,897,483
Timing of revenue recognition							
Goods transferred at a point in time	43,722,845	49,043,864	7,335,347	156,158,740	492,624	(68,001,241)	188,752,179
Services transferred over time	—	—	—	2,724,083	—	(1,578,779)	1,145,304
Total	43,722,845	49,043,864	7,335,347	158,882,823	492,624	(69,580,020)	189,897,483

(i) The following table shows the amounts of revenue recognized in the current reporting period that were included in the contract liabilities at the beginning of the reporting period:

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5 REVENUE AND SEGMENT INFORMATION (CONTINUED)

(a) Revenue (Continued)

(j) Disaggregated revenue information (Continued)

	For the years ended December 31	
	2020	2021
Revenue recognized that was included in contract liabilities at the beginning of the reporting period:		
Sale of goods	1,565,285	1,151,341
Others	73,541	88,090
	1,638,826	1,239,431

(ii) Performance obligations

Information about the Group's performance obligations is summarized below:

Revenue from sales of products (including sales of the other materials)

The performance obligation is satisfied upon delivery of the industrial products and payment is generally due within 30 to 90 days from delivery, except for new customers, where advance is normally required.

Sales of goods were made in a short period of time and the performance obligation was mostly satisfied in one year or less at the end of each year, thus the Group applied the expedient of not to disclose the transaction price allocated to unsatisfied performance obligation.

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5 REVENUE AND SEGMENT INFORMATION (CONTINUED)

(a) Revenue (Continued)

(i) Disaggregated revenue information (Continued)

Transportation service

The performance obligation is satisfied over time as services are rendered and payment is generally due upon completion of the relevant services.

Amounts expected to be recognized as revenue for remaining contract performance obligation:

	For the years ended December 31	
	2020	2021
Within one year	1,399,340	2,177,072
After one year	182,859	108,545
	1,582,199	2,285,617

The remaining performance obligations expected to be recognized in more than one year relate to rendering of services that are to be satisfied within 1–10 years. All the other remaining performance obligations are satisfied in one year or less at the end of each year.

(b) Segment information

The executive presidents committee of the Company have been identified as the chief operating decision makers. The committee is responsible for the review of the internal reports in order to allocate resources to operating segments and assess their performance.

The committee considers the business from a product perspective comprising alumina, primary aluminum and energy for the Group's manufacturing business, which are identified as separate reportable operating segments. In addition, the Group's trading business is identified as a separate reportable operating segment. The Group's reportable operating segments also include corporate and other operating segments.

The committee assesses the performance of operating segments based on profit or loss before income tax in related periods. The manner of assessment used by the committee is consistent with that applied to the consolidated financial information for the year ended December 31, 2020. Management has determined the reportable operating segments based on the reports reviewed by the committee that are used to make strategic decisions.

The Group's five reportable operating segments are summarized as follows:

- The alumina segment, which consists of mining and purchasing bauxite and other raw materials, refining bauxite into alumina, and selling alumina both internally to the Group's aluminum enterprises and trading enterprises and externally to customers outside the Group. This segment also includes the production and sale of multi-form alumina bauxite.

- The primary aluminum segment, which consists of procuring alumina and other raw materials, supplemental materials and electricity power, smelting alumina to produce primary aluminum which is sold to the Group's trading enterprises and external customers, including Chinalco and its subsidiaries. This segment also includes the production and sale of carbon products and aluminum alloy and other aluminum products.

(Amounts expressed in thousands of RMB unless otherwise stated)

5 REVENUE AND SEGMENT INFORMATION (CONTINUED)

(b) Segment information (Continued)

- The trading segment, which consists of the trading of alumina, primary aluminum, aluminum fabrication products, other non-ferrous metal products, coal products and raw materials and supplemental materials and logistics and transport services to internal manufacturing plants and external customers. The products are sourced from fellow subsidiaries and international and domestic suppliers of the Group. Sales of products manufactured by the Group's manufacturing business are included in the total revenue of the trading segment and are eliminated with the segment revenue of the respective segments which supplied the products to the trading segment.
- The energy segment mainly includes coal mining, electricity generation by thermal power, wind power and solar power, new energy related equipment manufacturing business. Sales of coals are mainly to the Group's internal and external coal consuming customers; electricity is sold to regional power grid corporations.
- Corporate and other operating segments, which mainly include management of corporate, research and development activities and others.

Prepaid current income tax and deferred tax assets are excluded from segment assets, and income tax payable and deferred tax liabilities are excluded from segment liabilities. All sales among the reportable operating segments were conducted on terms mutually agreed among group companies, and have been eliminated upon consolidation.

	Year ended December 31, 2021						
	Alumina	Primary aluminum	Energy	Trading	Corporate and other operating segments	Inter-segment elimination	Total
Total revenue	56,545,788	72,644,206	7,915,219	220,447,914	483,739	(88,288,634)	269,748,232
Inter-segment revenue	(37,981,574)	(8,657,079)	(240,575)	(41,287,709)	(121,697)	88,288,634	—
Sales of self-produced products (i)				28,054,635			
Sales of products sourced from external suppliers				151,105,570			
Revenue from external customers	18,564,214	63,987,127	7,674,644	179,160,205	362,042	—	269,748,232
Segment profit /(loss) before income tax	4,049,058	7,402,039	(234,808)	1,230,756	(1,849,784)	(418,481)	10,178,780
Income tax expense							(2,389,761)
Profit for the year							7,789,019
Other items							
Finance income	116,660	62,292	38,313	50,318	8,413	—	275,996
Finance costs	(1,034,889)	(1,114,821)	(578,079)	(117,365)	(1,097,607)	—	(3,942,761)
Share of profits and losses of joint ventures	80,612	—	16,095	13,240	54,153	—	164,100
Share of profits and losses of associates	(5,976)	(1,969)	(633,467)	45,538	868,458	—	272,584
Depreciation of right-of-use assets	(334,825)	(199,086)	(32,088)	(128,043)	(50,469)	—	(744,511)
Depreciation and amortization (excluding the depreciation of right- of-use assets)	(2,959,908)	(3,016,367)	(1,889,351)	(33,617)	(70,628)	—	(7,969,871)
Losses on disposal of property, plant and equipment and intangible assets	(583,142)	(58,699)	(9,772)	3,222	(2,320)	—	(650,711)
Realized loss on futures contracts, net	—	—	—	(132,354)	(413,171)	—	(545,525)
Other income	11,909	32,541	56,022	47,836	91	—	148,399
Impairment loss on property, plant and equipment	(1,854,694)	(470,004)	(3,433)	—	—	—	(2,328,131)
Unrealized losses on futures contracts, net	—	—	—	(30,552)	(28,657)	—	(59,209)
Losses on disposal of a subsidiaries	—	—	(27,404)	—	—	—	(27,404)
Changes for impairment of inventories	(18,737)	(114,171)	12,250	(13,039)	(2,601)	—	(136,298)
Provision for impairment of receivables	(122,370)	(37,400)	(176,715)	(328,754)	(719,649)	—	(1,384,888)
Dividends of equity investments at fair value through other comprehensive income	—	—	—	3,333	7,579	—	10,912
Derecognition of financial assets	—	(8,055)	(83,293)	—	—	—	(91,348)
Investments in associates	81,784	526,831	759,194	371,499	7,897,326	—	9,636,634
Investments in joint ventures	1,076,120	—	353,177	55,712	1,865,950	—	3,350,959
Additions during the period:							
Intangible assets	72,735	20,779	—	140	—	—	93,654
Right-of-use assets	3,400,546	2,721,001	377	212,812	266,342	—	6,601,078
Property, plant and equipment (ii)	1,170,356	621,694	391,894	26,231	94,686	—	2,304,861

(i) The sales of self-produced products include sales of self-produced alumina amounting to RMB18,552 million, sales of self-produced primary aluminum amounting to RMB7,087 million, and sales of self-produced other products amounting to RMB2,416 million.

(ii) The additions to property, plant and equipment under sale and leaseback contracts are not included.

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ALUMINUM CORPORATION OF CHINA LIMITED

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5 REVENUE AND SEGMENT INFORMATION (CONTINUED)

(b) Segment information (Continued)

	Year ended December 31, 2020 (Restated)						
	Alumina	Primary aluminum	Energy	Trading	Corporate and other operating segments	Inter-segment elimination	Total
Total revenue	42,378,421	51,889,084	7,184,216	155,392,357	449,611	(71,303,112)	185,990,577
Inter-segment revenue	(29,436,854)	(11,458,500)	(243,788)	(30,058,138)	(105,832)	71,303,112	—
Sales of self-produced products (i)				21,492,083			
Sales of products sourced from external suppliers				103,842,136			
Revenue from external customers	12,941,567	40,430,584	6,940,428	125,334,219	343,779	—	185,990,577
Segment profit /(loss) before income tax	1,435,129	2,023,168	(77,235)	582,083	(1,705,175)	(68,699)	2,189,271
Income tax expense							(590,023)
Profit for the year							1,599,248
Other items							
Finance income	43,192	58,437	36,333	72,632	16,607	—	227,201
Finance costs	(826,521)	(1,364,606)	(995,572)	(170,937)	(1,062,892)	—	(4,420,528)
Share of profits and losses of joint ventures	75,405	-	35,308	5,011	64,778	—	180,502
Share of profits and losses of associates	4,930	(35,328)	(17,905)	38,683	155,357	—	145,737
Depreciation of right-of-use assets	(364,655)	(234,387)	(96,967)	(21,075)	(50,469)	—	(767,553)
Depreciation and amortization (excluding the depreciation of right- of-use assets)	(2,944,255)	(2,937,761)	(1,867,632)	(99,179)	(71,281)	—	(7,920,108)
(Losses)/gain on disposal of property, plant and equipment and intangible assets	(25,489)	442,089	(99,363)	1,911	648	—	319,796
Realized loss on futures, forward and option contracts, net	—	—	—	675,442	(152,064)	—	523,378
Other income	21,549	11,087	55,561	33,207	18,147	—	139,551
Impairment loss on property, plant and equipment	(23,136)	(388,755)	—	(4,951)	—	—	(416,842)
Unrealized (losses)/gains on futures contracts, net	—	—	—	(27,705)	17,311	—	(10,394)
Gain on disposal of a subsidiaries	—	—	—	—	11,305	—	11,305
Changes for impairment of inventories	(121,286)	103,524	(15,642)	2,184	981	—	(30,239)
Provision for impairment of receivables	(59,105)	(14,417)	(108,059)	(414,342)	(383,238)	—	(979,161)
Dividends from other financial assets measured at fair value	—	—	—	—	82,794	—	82,794
Investments in associates	88,356	539,058	1,565,235	396,454	6,584,307	—	9,173,410
Investments in joint ventures	1,076,085	—	334,763	43,258	1,920,447	—	3,374,553
Additions during the period:							
Intangible assets	2,157	3,546	—	1,413	266	—	7,382
Right-of-use assets	12,001	—	59,010	2,875	2,893	—	76,779
Property, plant and equipment(ii)	2,317,271	1,069,086	881,810	328,033	25,119	—	4,621,319

(i) The sales of self-produced products include sales of self-produced alumina amounting to RMB12,465 million, sales of self-produced primary aluminum amounting to RMB8,784 million, and sales of self-produced other products amounting to RMB243 million.

(ii) The additions to property, plant and equipment under sale and leaseback contracts are not included.

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5 REVENUE AND SEGMENT INFORMATION (CONTINUED)

	Year ended December 31, 2019 (Restated)						
	Alumina	Primary aluminum	Energy	Trading	Corporate and other operating segments	Inter-segment elimination	Total
Total revenue	43,931,832	49,089,019	7,345,971	158,935,656	492,940	(69,580,020)	190,215,398
Inter-segment revenue	(29,605,251)	(11,694,382)	(236,136)	(27,877,188)	(167,063)	69,580,020	—
Sales of self-produced products (i)				24,380,771			
Sales of products sourced from external suppliers				106,677,697			
Revenue from external customers	14,326,581	37,394,637	7,109,835	131,058,468	325,877	—	190,215,398
Segment profit/(loss) before income tax	591,491	687,246	403,479	958,007	(987,704)	213,085	1,865,604
Income tax expense							(631,512)
Profit for the year							1,234,092
Other items							
Finance income	61,645	53,252	35,093	105,664	5,540	—	261,194
Finance costs	(651,238)	(1,328,730)	(1,064,769)	(224,292)	(1,652,512)	—	(4,921,541)
Share of profits and losses of joint ventures	86,245	-	(22,272)	3,767	202,375	—	270,115
Share of profits and losses of associates	(6,319)	11,621	(32,660)	36,579	39,546	—	48,767
Depreciation of right-of-use assets	(495,693)	(338,975)	(146,139)	(45,541)	(49,477)	—	(1,075,825)
Depreciation and amortization (excluding the depreciation of right-of-use assets)	(2,836,142)	(3,235,356)	(1,488,077)	(79,365)	(81,467)	—	(7,720,407)
(Losses)/gains on disposal of property, plant and equipment and intangible assets	(576,669)	833,288	(3,982)	7,271	(224)	—	259,684
Realized gain on futures, forward and option contracts, net	—	—	60,671	—	—	—	60,671
Other income	21,252	716	11,382	47,666	3,595	—	84,611
Impairment on property, plant and equipment	(8,742)	(247,112)	—	(3,500)	—	—	(259,354)
Unrealized gain on futures, forward and option contracts, net	—	—	—	(9,851)	—	—	(9,851)
Gain on share of associates' net assets	—	—	—	—	295,288	—	295,288
Gain on disposal of subsidiaries	118	—	3,014	2,738	255,317	—	261,187
Gain on disposal of associates	—	—	159,514	—	—	—	159,514
Changes for impairment of inventories	69,740	166,331	34,136	(19,076)	—	—	251,131
Reversal of/(provision for) impairment of receivables, net of bad debts recovered	6,837	1,088	(53,227)	(122,420)	(3,294)	—	(171,016)
Dividends from other financial assets measured at fair value	—	—	1,000	—	96,775	—	97,775
Investments in associates	83,424	574,385	362,757	2,021,964	6,469,871	—	9,512,401
Investments in joint ventures	1,076,085	—	79,199	298,991	1,931,307	—	3,385,582
Additions during the year:							
Intangible assets	209,366	949,013	(5,062)	1,869	200	—	1,155,386
Right-of- use assets	1,080,285	131,797	8,411	27,365	—	—	1,247,858
Property, plant and equipment (ii)	6,490,041	2,381,644	1,454,659	132,841	165,832	—	10,625,017

(i) The sales of self-produced products include sales of self-produced alumina amounting to RMB13,330 million, sales of self-produced primary aluminum amounting to RMB10,689 million, and sales of self-produced other products amounting to RMB362 million.

(ii) The additions to property, plant and equipment under sale and leaseback contracts are not included.

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For the years ended December 31, 2019 ,2020 and 2021
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5 REVENUE AND SEGMENT INFORMATION (CONTINUED)

(b) Segment information (Continued)

	As of December 31, 2021					
	Alumina	**Primary aluminum**	**Energy**	**Trading**	**Corporate and other operating segments**	**Total**
Segment assets	90,345,545	63,578,662	35,261,548	20,961,774	49,644,646	259,792,175
Reconciliation:						
Elimination of inter-segment receivables						(67,940,192)
Other eliminations						(920,811)
Corporate and other unallocated assets:						
Deferred tax assets						1,386,147
Prepaid income tax						59,578
Total assets						192,376,897
Segment liabilities	48,065,682	33,688,693	25,419,575	13,511,644	64,899,888	185,585,482
Elimination of inter-segment payables						(67,940,192)
Corporate and other unallocated liabilities:						
Deferred tax liabilities						1,378,519
Income tax payable						569,591
Total liabilities						119,593,400

	As of December 31, 2020 (Restated)					
	Alumina	**Primary aluminum**	**Energy**	**Trading**	**Corporate and other operating segments**	**Total**
Segment assets	87,549,047	62,050,175	39,671,083	20,520,759	44,594,935	254,385,999
Reconciliation:						—
Elimination of inter-segment receivables						(60,582,399)
Other eliminations						(360,498)
Corporate and other unallocated assets:						
Deferred tax assets						1,481,235
Prepaid income tax						116,574
Total assets						195,040,911
Segment liabilities	48,888,621	39,204,713	26,197,235	12,815,610	55,475,215	182,581,394
Elimination of inter-segment payables						(60,582,399)
Corporate and other unallocated liabilities:						
Deferred tax liabilities						1,437,087
Income tax payable						299,665
Total liabilities						123,735,747

ALUMINUM CORPORATION OF CHINA LIMITED
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5 REVENUE AND SEGMENT INFORMATION (CONTINUED)

(b) Segment information (Continued)

The Group mainly operates in Mainland China. Geographical information on operating segments is as follows:

	For the years ended December 31		
	2019 (Restated)	2020 (Restated)	2021
Segment revenue from external customers			
– Mainland China	184,439,383	177,348,745	256,941,514
– Outside of Mainland China	5,776,015	8,641,832	12,806,718
	190,215,398	185,990,577	269,748,232

	December 31, 2021	December 31, 2020 (Restated)
Non-current assets (excluding financial assets and deferred tax assets)		
– Mainland China	139,348,364	142,746,232
– Outside Mainland China	2,576,957	2,890,338
	141,925,321	145,636,570

For the year ended December 31, 2021, revenues of approximately RMB53,205 million (2020: RMB46,262 million, 2019: RMB40,567 million) were derived from entities directly or indirectly owned or controlled by the PRC government including Chinalco. These revenues are mainly attributable to the alumina, primary aluminum, energy and trading segments. There were no individual customers that contributed 10% or more of the Group's revenue during the years ended December 31, 2019, 2020 and 2021.

(Amounts expressed in thousands of RMB unless otherwise stated)

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6 INTANGIBLE ASSETS

	Goodwill	Mining rights	Mineral exploration rights	Computer Software, production quota and others	Total
Year ended December 31, 2021					
Opening net carrying amount	3,509,857	7,425,833	988,374	1,524,240	13,448,304
Additions	—	91,412	—	2,242	93,654
Disposals	—	(3,639)	—	—	(3,639)
Impairment (i)	—	(11,340)	(185,086)	—	(196,426)
Amortization	—	(326,052)	—	(51,662)	(377,714)
Transfer from property, plant and equipment (Note 7)	—	17,595	—	10,346	27,941
Currency translation differences	(342)	(1,692)	(2,225)	(985)	(5,244)
Closing net carrying amount	3,509,515	7,192,117	801,063	1,484,181	12,986,876
As of December 31, 2021					
Cost	3,509,515	9,972,299	984,092	1,929,188	16,395,094
Accumulated amortization and impairment	—	(2,780,182)	(183,029)	(445,007)	(3,408,218)
Net carrying amount	3,509,515	7,192,117	801,063	1,484,181	12,986,876

(i) The Group made the decision in 2021 to discontinue its exploration activities in Laos due to the continuous impact of Covid-19 on the feasibility of further exploration and development on the related mining properties. As a result, the total carrying amount of the mineral exploration rights amounting to RMB185 million was fully impaired.

	Goodwill	Mining rights	Mineral exploration rights	Computer Software, production quota and others	Total
Year ended December 31, 2020					
Opening net carrying amount	3,510,892	7,972,911	1,001,332	1,279,325	13,764,460
Additions	—	—	—	7,382	7,382
Disposals	—	(277,715)	—	—	(277,715)
Impairment	—	—	—	(416)	(416)
Amortization	—	(412,599)	—	(46,883)	(459,482)
Business combination	—	—	—	89	89
Transfer from property, plant and equipment (Note 7)	—	149,544	—	284,743	434,287
Currency translation differences	(1,035)	(6,308)	(12,958)	—	(20,301)
Closing net carrying amount	3,509,857	7,425,833	988,374	1,524,240	13,448,304
As of December 31, 2020					
Cost	3,509,857	9,876,722	988,374	1,932,329	16,307,282
Accumulated amortization and impairment	—	(2,450,889)	—	(408,089)	(2,858,978)
Net carrying amount	3,509,857	7,425,833	988,374	1,524,240	13,448,304

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ALUMINUM CORPORATION OF CHINA LIMITED

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For the years ended December 31, 2019 ,2020 and 2021
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6 INTANGIBLE ASSETS (CONTINUED)

For the years ended December 31, 2019, 2020 and 2021, the amortization expenses of intangible assets recognized in profit or loss were analyzed as follows:

	For the years ended December 31		
	2019	2020	2021
Cost of sales	294,766	371,616	305,484
General and administrative expenses	44,172	87,866	72,230
	338,938	459,482	377,714

As of December 31 2021, the Group pledged mining rights and mineral exploration rights with a net carrying value amounting to RMB1,400 million (December 31, 2020: RMB960 million) for interest-bearing loans and borrowings as set out in Note 24.

Impairment testing of goodwill

The lowest level within the Group at which goodwill is monitored for internal management purposes is the operating segment before aggregation. Therefore, goodwill is allocated to the Group's CGUs and groups of CGUs that are expected to benefit from the synergies of the relevant business combination. A summary of goodwill allocation is presented below:

	December 31, 2021		December 31, 2020	
	Alumina	Primary aluminum	Alumina	Primary aluminum
Qinghai Branch	—	217,267	—	217,267
Guangxi Branch	189,419	—	189,419	—
Lanzhou Aluminum Co., Ltd.	—	1,924,259	—	1,924,259
PT. Nusapati Prima ("PTNP")	14,621	—	14,963	—
Shanxi Huaxing	1,163,949	—	1,163,949	—
	1,367,989	2,141,526	1,368,331	2,141,526

The recoverable amount of a CGU is determined based on value-in-use calculations. These calculation of VIU use pre-tax cash flow projections based on financial budgets approved by management covering a five-year period. Cash flows beyond the 5-year period are extrapolated using the estimated growth rate of 2% (2020: 2%) not exceeding the long-term average growth rate for the businesses in which the CGU operates. Other key assumptions applied in the impairment testing include future prices of aluminum and alumina and the discount rate. Management determined these key assumptions based on past performance and their expectations on market development. Furthermore, the Group adopts a nominal pre-tax rate of 12.62% (2020: 12.62%) that reflects specific risks related to CGUs and groups of CGUs and an underlying inflation rate of 2% as the discount rate. The assumptions above are used in analyzing the recoverable amounts of CGUs and groups of CGUs within operating segments. These estimates and judgments may be affected by unexpected changes in the future market or economic conditions.

Based on their assessment, there was no impairment of goodwill as of December 31, 2021 and December 31, 2020.

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For the years ended December 31, 2019 ,2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

7 PROPERTY, PLANT AND EQUIPMENT

	Buildings and infrastructure	Machinery	Transportation facilities	Office and other equipment	Construction in progress	Total
Year ended December 31, 2021						
Opening net carrying amount	42,265,254	53,034,976	1,163,307	362,167	3,886,719	100,712,423
Reclassifications and internal transfers	1,443,486	1,435,604	105,359	63,774	(3,048,223)	—
Transfer to intangible assets (Note 6)	—	—	—	—	(27,941)	(27,941)
Transfer from right-of-use assets and non-current assets (i)	143,646	1,398,593	—	85	—	1,542,324
Transfer to investment properties (Note 8)	(139,377)	—	—	—	—	(139,377)
Transfer to right-of-use assets (Note 20(a))	—	—	—	—	(68,377)	(68,377)
Additions	27,528	230,516	7,947	4,318	2,034,552	2,304,861
Government grants	(447)	(81,171)	—	—	—	(81,618)
Disposals	(122,110)	(699,493)	(12,441)	(4,545)	(275,835)	(1,114,424)
Depreciation	(1,798,811)	(5,360,059)	(181,204)	(35,485)	—	(7,375,559)
Impairment loss	(1,163,722)	(1,000,412)	(2,182)	(46)	(161,769)	(2,328,131)
Currency translation differences	21,368	(18,141)	(198)	(181)	—	2,848
Closing net carrying amount	40,676,815	48,940,413	1,080,588	390,087	2,339,126	93,427,029
As of December 31, 2021						
Cost	64,118,401	111,919,569	2,731,095	892,122	2,555,618	182,216,805
Accumulated depreciation and impairment	(23,441,586)	(62,979,156)	(1,650,507)	(502,035)	(216,492)	(88,789,776)
Net carrying amount	40,676,815	48,940,413	1,080,588	390,087	2,339,126	93,427,029

(i) This includes the right-of-use assets recognized previously under sale and leaseback contracts of RMB1,343 million that were classified from property, plant and equipment, upon initial adoption of IFRS 16. After the expiration of those contracts, they were recognized as property, plant and equipment.

	Buildings and infrastructures	Machinery	Transportation facilities	Office and other equipment	Construction in progress	Total
Year ended December 31, 2020 (Restated)						
Opening net carrying amount	40,777,430	49,569,408	429,581	355,094	12,361,039	103,492,552
Reclassifications and internal transfers	3,301,076	7,114,160	809,433	47,546	(11,272,215)	—
Transfer to intangible assets (Note 6)	—	—	—	—	(434,287)	(434,287)
Transfer from right-of-use assets and non-current assets	—	1,982,812	—	—	—	1,982,812
Transfer to investment properties (Note 8)	(78,135)	—	—	—	—	(78,135)
Transfer to other non-current assets	—	—	—	—	(38,430)	(38,430)
Transfer to right-of-use assets (Note 20(a))	(140,254)	—	—	—	(744,887)	(885,141)
Additions	296,395	182,427	48,607	10,659	4,083,231	4,621,319
Business combination	1,290	52,357	(18)	(28)	—	53,601
Government grants	(1,646)	(40,676)	—	—	—	(42,322)
Disposals	(120,386)	(173,788)	(27,145)	(918)	(58,659)	(380,896)
Depreciation	(1,689,772)	(5,325,096)	(96,999)	(49,609)	—	(7,161,476)
Impairment loss	(80,641)	(326,445)	(125)	(558)	(9,073)	(416,842)
Currency translation differences	(103)	(183)	(27)	(19)	—	(332)
Closing net carrying amount	42,265,254	53,034,976	1,163,307	362,167	3,886,719	100,712,423
As of December 31, 2020 (Restated)						
Cost	63,188,384	114,561,974	2,844,604	871,037	4,007,082	185,473,081
Accumulated depreciation and impairment	(20,923,130)	(61,526,998)	(1,681,297)	(508,870)	(120,363)	(84,760,658)
Net carrying amount	42,265,254	53,034,976	1,163,307	362,167	3,886,719	100,712,423

(Amounts expressed in thousands of RMB unless otherwise stated)

7 PROPERTY, PLANT AND EQUIPMENT (CONTINUED)

For the year ended December 31, 2019, 2020 and 2021, depreciation expenses recognized in profit or loss are analyzed as follows:

	For the years ended December 31		
	2019 (Restated)	2020 (Restated)	2021
Cost of sales	6,936,008	6,877,532	6,998,349
General and administrative expenses	164,150	123,521	183,934
Research and development expenses	—	155,288	185,108
Selling and distribution expenses	6,607	5,135	8,168
	7,106,765	7,161,476	7,375,559

As of December 31, 2021, the Group was in the process of applying for the ownership certificates of buildings with a net carrying value of RMB6,609 million (December 31, 2020: RMB7,616 million). There has been no litigations, claims or assessments against the Group for compensation with respect to the use of these buildings as of the date of approval of these financial statements.

For the year ended December 31, 2021, interest expenses of RMB2 million (2020: RMB124 million, 2019: RMB289 million) (Note 29) arising from borrowings attributable to the construction of property, plant and equipment during the year were capitalized at an annual rate of 4.00% (2020: 4.00% to 6.68%, 2019: 4.00% to 6.96)% (Note 29), and were included in additions to property, plant and equipment.

As of December 31, 2021, the Group pledged property, plant and equipment with a net carrying value amounting to RMB5,111 million (December 31, 2020: RMB5,191 million) for interest-bearing loans and borrowings as set out in Note 24.

As of December 31, 2021, the carrying value of temporarily idle property, plant and equipment of the Group was RMB723 million (December 31, 2020: RMB750 million).

Impairment testing for property, plant and equipment

As of December 31, 2021, certain CGUs of the Group are discontinued or in status of temporarily idle or insufficient utilization of capacity, due to the adjustment of overall production allocation within the Group or other specific adverse changes in circumstances related to the respective CGUs. The Group considered these CGUs had impairment indications and therefore performed impairment test on them. As a result, provision of impairment of RMB2,328 million was made for property, plant and equipment for the year ended December 31, 2021.

When any indicators of impairment are identified, property, plant and equipment are reviewed for impairment based on each CGU. The CGU is an individual plant or entity. The carrying values of these individual plants or entities were compared to the recoverable amounts of the CGUs, which were based predominantly on value-in-use. Value-in-use calculations use pre-tax cash flow projections based on financial budgets approved by management covering a five-year period. Cash flows beyond the five-year period are extrapolated using the same cash flow projections of the fifth year. Other key assumptions applied in the impairment testing include the future prices of aluminum and alumina, expected production and sales volumes, production costs and operating expenses. Management determined these key assumptions based on past performance and their expectations on market development. Further, the Group adopts a real pre-tax rate (excluding inflation) of 10.16% to 11.91% (2020: 10.16%) that reflects specific risks related to the CGUs as discount rate. The assumptions above are used in analyzing the recoverable amounts of the CGUs within operating segments. These estimates and judgments may be affected by unexpected changes in the future market or economic conditions.

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8 INVESTMENT PROPERTIES

	Buildings	Land use rights	Total
Year ended December 31, 2021			
Opening net carrying amount	481,489	1,120,387	1,601,876
Transfer from property, plant and equipment (Note 7)	139,377	—	139,377
Transfer from right-of-use assets (Note 20(a))	—	90,314	90,314
Others	—	7,472	7,472
Depreciation	(11,900)	(12,550)	(24,450)
Closing net carrying amount	608,966	1,205,623	1,814,589
As of December 31, 2021			
Cost	779,253	1,346,953	2,126,206
Accumulated depreciation and impairment	(170,287)	(141,330)	(311,617)
Net carrying amount	608,966	1,205,623	1,814,589

	Buildings	Land use rights	Total
Year ended December 31, 2020			
Opening net carrying amount	414,168	1,089,098	1,503,266
Transfer from property, plant and equipment (Note 7)	78,135	—	78,135
Transfer from right-of-use assets (Note 20(a))	—	45,885	45,885
Disposal	—	(1,005)	(1,005)
Depreciation	(10,814)	(13,591)	(24,405)
Closing net carrying amount	481,489	1,120,387	1,601,876
As of December 31, 2020			
Cost	601,850	1,221,710	1,823,560
Accumulated depreciation and impairment	(120,361)	(101,323)	(221,684)
Net carrying amount	481,489	1,120,387	1,601,876

The Group's investment properties consist of land use rights held for rental income and buildings leased to third parties under operating leases.

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9 INVESTMENTS IN JOINT VENTURES AND ASSOCIATES

(a) Investments in joint ventures

Movements in investments in joint ventures are as follows:

	December 31, 2021	December 31, 2020
As of January 1	3,374,553	3,385,582
Capital injections	—	4,333
Share of profits for the year	164,100	180,502
Share of changes in reserves	60	1,491
Cash dividends declared	(187,754)	(197,355)
As of December 31	3,350,959	3,374,553

As of December 31, 2021, all joint ventures of the Group were unlisted.

As of December 31, 2021, particulars of the Group's material joint venture are as follows:

Name	Place of establishment and operation	Registered and paid-in capital	Principal activities	Effective equity interest held: Ownership interest	Voting power	Profit sharing
Guangxi Huayin Aluminum Co.,Ltd. ("Guangxi Huayin") (廣西華銀鋁業有限公司)	PRC/ Mainland China	2,441,987	Manufacturing	33.00 %	33.00 %	33.00 %

Guangxi Huayin, which is considered a material joint venture of the Group, is accounted for using the equity method.

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9 INVESTMENTS IN JOINT VENTURES AND ASSOCIATES (Continued)

(a) Investments in joint ventures (Continued)

The English name represents the best effort by management of the Group in translating the Chinese name of the company as it does not have any official English name.

The following table illustrates the summarized financial information in respect of Guangxi Huayin:

	December 31, 2021	December 31, 2020
Cash and cash equivalents	224,154	247,680
Other current assets	1,498,110	970,096
Current assets	1,722,264	1,217,776
Non-current assets	5,024,444	5,361,592
Current liabilities	1,844,884	1,522,700
Non-current liabilities	526,827	580,419
Net assets	4,374,997	4,476,249
Reconciliation to the Group's interest in the joint venture:		
Proportion of the Group's ownership	33.00 %	33.00 %
The Group's share of net assets of the joint venture	1,443,749	1,477,162
Carrying amount of the investment	1,443,749	1,477,162

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9 INVESTMENTS IN JOINT VENTURES AND ASSOCIATES (Continued)

(a) Investments in joint ventures (Continued)

	For the year ended December 31		
	2019	2020	2021
Revenue	5,226,893	4,631,737	5,126,994
Gross profit	1,303,254	800,965	890,301
Interest income	9,781	7,388	14,465
Depreciation and amortization	525,109	531,512	553,493
Interest expenses	63,351	51,855	40,506
Profit before income tax	621,315	195,189	246,447
Income tax	79,300	21,152	44,333
Other comprehensive income	—	—	—
Total comprehensive income for the year	542,015	174,037	202,114
Dividend received	198,000	99,000	99,000

The following table illustrates the aggregate financial information of the Group's joint ventures that are not individually material:

	December 31, 2021	December 31, 2020
Share of the joint ventures' profits and losses for the year	96,255	121,120
Share of the joint ventures' total comprehensive income	96,255	121,120
Aggregate carrying amount of the Group's investments in joint ventures	1,907,210	1,897,391

There were no material contingent liabilities relating to the Group's interests in the joint ventures and the joint ventures themselves.

(b) Investments in associates

Movements in investments in associates are as follows:

	December 31, 2021	December 31, 2020
As of January 1	9,173,410	9,512,401
Investment to Yunnan Aluminum	320,000	—
Capital injections, other than to Yunnan Aluminum	309,251	—
Subsidiaries changed into associates	—	7,473
Capital reduction	(83,984)	(14,850)
Share of profits for the year	272,584	145,737
Dividends declared	(378,998)	(480,397)
Share of changes in reserves	24,371	3,046
As of December 31	9,636,634	9,173,410

As of December 31, 2021, except for Yunnan Aluminum, all associates of the Group were unlisted.

As of December 31, 2021, no associate was individually material to the Group except for Yunnan Aluminum.

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9 INVESTMENTS IN JOINT VENTURES AND ASSOCIATES (CONTINUED)

(b) Investments in associates (Continued)

As of December 31, 2021, particulars of the Group's material associate are as follows:

Name	Place of establishment and operation	Registered and paid-in capital	Principal activities	Effective equity interest held		
				Ownership interest	Voting power	Profit sharing
Yunnan Aluminum	PRC/Mainland China	3,448,207	Manufacturing	10.10 %	10.10 %	10.10 %

Yunnan Aluminum, which is considered a material associate of the Group, is accounted for using the equity method.

The English name represents the best effort by management of the Group in translating the Chinese name of the company as it does not have any official English name.

The following table illustrates the summarized financial information in respect of Yunnan Aluminum:

	December 31, 2021	December 31, 2020
Cash and cash equivalents	1,622,638	1,186,778
Other current assets	3,762,507	4,848,942
Current assets	5,385,145	6,035,720
Non-current assets	37,267,619	39,960,249
Current liabilities	9,782,242	17,360,609
Non-current liabilities	7,869,719	10,658,126
Net assets	25,000,803	17,977,234
Non-controlling interests	3,286,333	2,504,346
Reconciliation to the Group's interest in the associate:		
Proportion of the Group's ownership	10.10 %	10.04 %
The Group's share of net assets of the associate	2,193,161	1,553,478
Carrying amount of the investment	2,193,161	1,553,478

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ALUMINUM CORPORATION OF CHINA LIMITED
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(Amounts expressed in thousands of RMB unless otherwise stated)

9 INVESTMENTS IN JOINT VENTURES AND ASSOCIATES (CONTINUED)

(b) Investments in associates (Continued)

	For the years ended December 31		
	2019	2020	2021
Revenue	24,283,623	29,567,864	41,668,819
Gross profit	3,241,005	4,084,535	9,440,917
Interest income	46,865	35,345	31,058
Depreciation and amortization	1,381,066	1,571,308	1,866,030
Interest expenses	945,786	649,600	607,126
Profit before income tax	596,546	1,032,497	3,527,700
Income tax	51,340	122,384	436,429
Other comprehensive income	28,183	(36,602)	23,321
Total comprehensive income for the year	573,389	873,511	3,114,592
Dividend received	—	—	—

The following table illustrates the aggregate financial information of the Group’s associates that are not individually material:

	December 31, 2021	December 31, 2020
Share of the associates’ profits and losses	(37,780)	83,519
Share of the associates’ total other comprehensive income	6,292	—
Share of the associates' total comprehensive income	(31,488)	83,519
Aggregate carrying amount of the Group’s investments in the associates	7,443,473	7,619,932

There were no material contingent liabilities relating to the Group’s interests in the associates and the associates themselves.

As of December 31, 2020, the Group had pledged investments in associates amounting to RMB396 million as set out in Note 24 to the financial statements.

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10 OTHER FINANCIAL ASSETS MEASURED AT FAIR VALUE

	December 31, 2021	December 31, 2020 (Restated)
Listed equity investments, at fair value		
Dongxing securities Co., Ltd.(東興證券股份有限公司)	7,674	8,812
Unlisted equity investments, at fair value		
Sanmenxia Dachang Mining Co., Ltd.(三門峽達昌礦業有限公司)	20,921	20,921
Inner Mongolia Ganqimaodu Port Development Co., Ltd.(內蒙古甘其毛都港務發展股份有限公司)	16,669	16,669
Yinchuan Economic and Technological Development Zone Investment Holding Co., Ltd. (銀川經濟技術開發區投資控股有限公司)	20,577	17,234
China Color International Alumina Development Co., Ltd.(中色國際氧化鋁開發有限公司)	5,998	6,636
Luoyang Jianyuan Mining Co., Ltd. (洛陽建元礦業有限公司)	4,975	4,975
NingXia Electric Power Trading Center Co., Ltd(寧夏電力交易中心有限公司)	4,305	4,305
Ningxia Ningdian Logistics Transportation Co., Ltd.(寧夏寧電物流運輸有限公司)	1,640	1,640
Chinalco Innovative Development Investment Company Limited (“Chinalco Innovative”) (中鋁創新開發投資有限公司) (ii)	—	329,234
Size Industry Investment Fund (四則產業投資基金) (i)	—	980,498
Fangchenggang Chisha Pier Co., Ltd.(防城港赤沙碼頭有限公司)	21,700	700
Xingxian Shengxing Highway Investment Management Co., Ltd. (興縣盛興公路投資管理有限公司)	135,079	135,079
	231,864	1,517,891
	239,538	1,526,703

The above equity investments were irrevocably designated at fair value through other comprehensive income as the Group considers these investments to be strategic in nature.

Note:

(i) During the year ended December 31,2021, the Group redeemed the investment in Size Industry Investment Fund with capital of RMB950 million, and dividend of RMB7 million received.

(ii) During the year ended December 31, 2021, the Group appointed one out of seven directors of the Board of Directors of Chinalco Innovative, resulting in the ability to exert significant influence on Chinalco Innovative. Accordingly, the investment in Chinalco Innovative became an investment in an associate.

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11 DEFERRED TAX

Deferred tax assets and liabilities are offset when there is a legally enforceable right to offset current income tax assets against current income tax liabilities and when the deferred taxes relate to the same tax authority.

The movements in deferred tax assets and liabilities during the year ended December 31, 2021 without taking into consideration the offsetting of balances within the same tax jurisdiction, are as follows:

Movements in deferred tax assets:

	Provision for impairment	Accrued expenses	Tax losses	Unrealised profit at consolidation	Others	Total
As of January 1, 2020	445,322	209,395	576,190	169,355	179,427	1,579,689
Acquisition of subsidiaries	—	—	—	—	36	36
Credit/(charged) to profit or loss	65,196	(99,810)	(105,811)	56,731	51,116	(32,578)
As of December 31, 2020	510,518	109,585	470,379	226,086	230,579	1,547,147
As of January 1, 2021	510,518	109,585	470,379	226,086	230,579	1,547,147
Credit/(charged) to profit or loss	185,470	(85,912)	(226,769)	67,564	(41,937)	(101,584)
As of December 31, 2021	695,988	23,673	243,610	293,650	188,642	1,445,563

Movements in deferred tax liabilities:

	Interest capitalisation	Fair value changes of financial assets	Depreciation and amortization and others	Fair value adjustments arising from acquisition of subsidiaries	Total
As of January 1, 2020	38,007	7,731	23,873	1,700,088	1,769,699
Exchange realignment	—	—	—	(1,406)	(1,406)
Charged to other comprehensive income	—	(3,066)	—	—	(3,066)
Acquisition of subsidiaries	—	—	—	1,274	1,274
Credited to profit or loss	(12,167)	4,235	13,234	(268,804)	(263,502)
As of December 31, 2020	25,840	8,900	37,107	1,431,152	1,502,999
As of January 1, 2021	25,840	8,900	37,107	1,431,152	1,502,999
Charged to other comprehensive income	—	(11,117)	—	—	(11,117)
Credited to profit or loss	(7,915)	4,059	34,860	(84,951)	(53,947)
As of December 31, 2021	17,925	1,842	71,967	1,346,201	1,437,935

The temporary differences associated with investments in the Group's associates and joint ventures, for which a deferred tax liability has not been recognized in the periods presented, aggregate to RMB437 million (2020: RMB317 million), considering dividends from investments in associates and joint ventures are exempted from the PRC income tax and the Group has no plan to dispose any of these investees in the foreseeable future.

ALUMINUM CORPORATION OF CHINA LIMITED

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11 DEFERRED TAX (CONTINUED)

For presentation purposes, certain deferred tax assets and liabilities have been offset in the consolidated statement of financial position. The following is an analysis of the deferred tax balances of the Group for financial reporting purposes:

	December 31, 2021	December 31, 2020
Net deferred tax assets	1,386,147	1,481,235
Net deferred tax liabilities	1,378,519	1,437,087

As of December 31, 2021, the Group has not recognized deferred tax assets of RMB1,514 million (December 31, 2020: RMB1,514 million) in respect of accumulated tax losses amounting to RMB6,930 million (December 31, 2020: RMB6,593 million) arising in Mainland China that can be carried forward for offsetting against future taxable income, and deferred tax assets of RMB2,633 million (December 31, 2020: RMB2,032 million) in respect of deductible temporary differences amounting to RMB12,051 million (December 31, 2020: RMB8,849 million) as it was considered not probable that those assets would be realized.

As of December 31, 2021, the expiry profile of these tax losses not recognized for deferred tax assets was analyzed as follows:

	December 31, 2021	December 31, 2020
Expiring in		
2021	—	213,992
2022	742,693	795,012
2023	590,293	536,394
2024	1,778,927	1,890,765
2025	2,405,862	2,590,350
2026 and beyond	1,412,128	566,997
	6,929,903	6,593,510

For the years ended December 31, 2019 ,2020 and 2021
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12 OTHER NON-CURRENT ASSETS

	December 31, 2021	December 31, 2020
Financial assets		
Long-term receivables	127,390	127,754
Less: impairment	(15,542)	—
	111,848	127,754
Prepayment for mining rights	806,534	809,722
Long-term prepaid expenses	593,011	654,291
Deferred losses for sale and leaseback transactions(i)	97,070	396,368
Input VAT to be deducted	294,420	388,271
Rent concessions	376,917	257,899
Others	195,146	531,615
	2,363,098	3,038,166
	2,474,946	3,165,920

(i) In previous years, the Group entered into several sale and leaseback agreements (Note 20(a)). The deferred losses arising from the sale are classified as other non-current assets and were amortized over the useful lives of the assets leased back.

As of December 31, 2021 and December 31, 2020, long-term receivables were denominated in RMB and non-interest bearing.

13 INVENTORIES

	December 31, 2021	December 31, 2020 (Restated)
Raw materials	5,628,872	7,450,822
Work-in-progress	8,732,604	7,290,838
Finished goods	4,310,607	4,835,098
Spare parts	645,564	789,136
Packaging materials and others	26,353	25,709
	19,344,000	20,391,603
Less: provision for impairment of inventories	(666,125)	(529,827)
	18,677,875	19,861,776

Movements in the provision for impairment of inventories are as follows:

	December 31, 2021	December 31, 2020
As of January 1	529,827	560,066
Provision for impairment of inventories	471,162	1,492,153
Reversal arising from increase in net realizable value	(14,624)	(170,766)
Written off upon sales of inventories	(320,240)	(1,351,626)
As of December 31	666,125	529,827

As of December 31, 2021 and 2020, the Group had no pledged inventories for bank and other borrowings.

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14 TRADE RECEIVABLES AND NOTES RECEIVABLE

	December 31, 2021	December 31, 2020 (Restated)
Trade receivables	4,025,441	5,687,100
Less: impairment	(958,787)	(933,890)
	3,066,654	4,753,210
Notes receivable	3,838,196	4,560,437
	6,904,850	9,313,647

As of December 31, 2021, other than trade and notes receivables amounting to RMB512 million which were denominated in USD (December 31,2020: RMB685 million which were denominated in USD), all other trade and notes receivables were denominated in RMB.

Trade and notes receivables due from the Group's joint ventures and associates amounted to RMB641 million (December 31, 2020: RMB741 million) and RMB11 million (December 31, 2020: RMB14 million) respectively, which are repayable on credit terms similar to those offered to the major customers of the Group.

As of December 31, 2021, the Group pledged trade and notes receivable amounting to RMB1,983 million (December 31, 2020: RMB2,748 million) as set out in Note 24 to the financial statements.

Trade receivables and notes receivable are non-interest bearing and generally with credit terms of 3 to 12 months. Certain of the Group's sales were on advance payments or documents against payment. In some cases, these terms are extended for qualifying long term customers that have met specific credit requirements. As of December 31, 2021, the ageing analysis of trade receivables based on invoice date was as follows:

	As of December 31 2021	2020 (Restated)
Within 1 year	2,367,787	2,984,665
Between 1 and 2 years	153,161	1,031,050
Between 2 and 3 years	225,796	183,288
Over 3 years	1,278,697	1,488,097
	4,025,441	5,687,100
Less: loss allowance for impairment	(958,787)	(933,890)
	3,066,654	4,753,210

An impairment analysis is performed at each reporting date using a provision matrix to measure expected credit losses. The provision rates are based on days past due for groupings of various customer segments with similar loss patterns (i.e., by geographical region, product type, customer type and rating, and coverage by letters of credit or other forms of credit insurance). The calculation reflects the probability-weighted outcome, the time value of money and reasonable and supportable information that is available at the reporting date about past events, current conditions and forecasts of future economic conditions. The Group also assesses impairment loss individually if there is evidence of significant increases in credit risk at an individual level.

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14 TRADE RECEIVABLES AND NOTES RECEIVABLE (CONTINUED)

Set out below is the information about the credit risk exposure on the Group's trade receivables using a provision matrix:

	As of December 31, 2021		
	Gross carrying amount	Expected credit losses	Expected credit losses loss rate (%)
Alumina and primary aluminum			
Within 1 year	172,625	1,574	0.91
Between 1 and 2 years	25,430	1,331	5.23
Between 2 and 3 years	3,146	1,708	54.29
Over 3 years	46,210	41,896	90.66
	247,411	46,509	
Trading			
Within 1 year	365,158	361	0.10
Between 1 and 2 years	6,131	103	1.68
Between 2 and 3 years	23	1	4.35
Over 3 years	2,918	1,525	52.26
	374,230	1,990	
Energy			
Within 1 year	1,108,505	52	0.00
Between 1 and 2 years	119,108	1,298	1.09
Between 2 and 3 years	138,660	3,332	2.40
Over 3 years	171,184	42,054	24.57
	1,537,457	46,736	
Corporate and other operating segments			
Within 1 year	10,138	610	6.02
Between 1 and 2 years	2,491	1,763	70.77
Between 2 and 3 years	1,887	1,792	94.97
Over 3 years	10,018	9,763	97.45
	24,534	13,928	
	2,183,632	109,163	
Individually assessed trade receivables	1,841,809	849,624	
	4,025,441	958,787	

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14 TRADE RECEIVABLES AND NOTES RECEIVABLE (CONTINUED)

Set out below is the information about individually assessed trade receivables:

	As of December 31, 2021		
	Gross carrying amount	Expected credit losses	Expected credit losses loss rate (%)
China Aluminum Zibo International Trading Co., Ltd	617,974	—	—
Zhuhai Hongfan nonferrous metal Chemical Co., Ltd	270,419	270,419	100.00
Aluminum Industry Co., Ltd., Luoyang, Henan	247,163	—	—
Xinjiang Jiarun Resources Holdings Co., Ltd.	213,293	213,293	100.00
Guizhou Jinpingguo Aluminum Rod Co., Ltd.	111,138	111,138	100.00
Others	381,822	254,774	66.73
	1,841,809	849,624	

The Group has no individual provision for impairment of notes receivables. The Group measures the provision for loss on the basis of expected credit losses. The Group considers that notes receivables are not exposed to significant credit risk and has limited default risk.

Movements in the loss allowance for impairment of trade receivables are as follows:

	2021	2020 (Restated)	2019
As of January 1	933,890	715,597	659,261
Impairment loss	364,120	403,633	237,504
Write off	(285,178)	(122,459)	(98,554)
Reversal	(36,989)	(64,661)	(83,095)
Others	(17,056)	1,780	481
As of December 31	958,787	933,890	715,597

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15 OTHER CURRENT ASSETS

	December 31, 2021	December 31, 2020 (Restated)
Financial assets		
— Deposits paid to suppliers	1,320,448	691,786
— Dividends receivable	373,252	412,736
— Receivables from disposal of businesses and assets	—	20,950
— Entrusted loans and loans receivable from third parties	1,466,236	1,530,452
— Entrusted loans and loans receivable from related parties	1,324,016	1,264,423
— Recoverable reimbursement for freight charges	251,113	381,866
— Receivable from disposal of aluminum capacity quota	—	538,655
— Other financial assets	693,068	1,365,951
	5,428,133	6,206,819
Less: impairment allowance	(3,153,226)	(2,224,511)
	2,274,907	3,982,308
Advances to employees	—	17,043
Deductible input value added tax receivables	529,760	1,379,288
Prepaid income tax	59,578	116,574
Prepayments to related parties for purchases	144,098	78,724
Prepayments to suppliers for purchases and others	870,762	726,487
Others	74,221	49,598
	1,678,419	2,367,714
Less: impairment allowance	—	(1,621)
	1,678,419	2,366,093
Total other current assets	3,953,326	6,348,401

As of December 31, 2021, except for amounts included in other current assets amounting to RMB99 million, which were denominated in USD (December 31, 2020: other current assets amounting to RMB152 million denominated in USD), remaining amounts in other current assets were denominated in RMB.

As of December 31, 2021 and 2020, except for entrusted loans and loans receivable which were interest-bearing assets, all amounts in other current assets were non-interest bearing.

As of December 31, 2021, the ageing analysis of financial assets included in other current assets was as follows:

	December 31, 2021	December 31, 2020 (Restated)
Within 1 year	1,832,596	2,385,470
Between 1 and 2 years	175,193	142,887
Between 2 and 3 years	36,709	191,228
Over 3 years	3,383,635	3,487,234
	5,428,133	6,206,819
Less: provision for impairment	(3,153,226)	(2,224,511)
	2,274,907	3,982,308

(Amounts expressed in thousands of RMB unless otherwise stated)

15 OTHER CURRENT ASSETS (CONTINUED)

Movements in the provision for impairment of in other current assets are as follows:

	2021	2020
As of January 1	2,226,132	1,699,450
Impairment loss	1,046,565	657,200
Write off	(135,049)	(113,507)
Reversal	(4,524)	(17,011)
Others	20,102	—
As of December 31	3,153,226	2,226,132

Financial assets included in other current assets at amortized cost are subject to impairment under the general approach and they are classified within the following stages for measurement of ECLs.

As of December 31, 2021	Gross carrying amount	Expected credit losses
Stage 1 – 12 months expected credit loss	1,943,470	2,988
Stage 2 – life time expected credit loss	188,324	7,713
Stage 3 – life time expected credit loss with credit-impaired	3,296,339	3,142,525
	5,428,133	3,153,226

December 31, 2020 (Restated)	Gross carrying amount	Expected credit losses
Stage 1 – 12 months expected credit loss	2,218,072	5,961
Stage 2 – life time expected credit loss	578,213	14,966
Stage 3 – life time expected credit loss with credit-impaired	3,410,534	2,203,584
	6,206,819	2,224,511

During the year ended December 31, 2021, RMB937 millions of provision for bad debt was made for certain long-aged stage 3 receivables, mainly due to further decreased in the value of securities for the related receivables based on the Group's assessment as of December 31, 2021.

16 CASH AND CASH EQUIVALENTS AND RESTRICTED CASH

	December 31, 2021	December 31, 2020 (Restated)
Restricted cash	1,324,748	1,056,037
Cash and cash equivalents	17,853,244	9,671,477
	19,177,992	10,727,514

Reconciliation to the consolidated statement of cash flow:

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16 CASH AND CASH EQUIVALENTS AND RESTRICTED CASH (CONTINUED)

The above figures reconcile to the amount of cash and cash equivalent shown in the consolidated statement of cash flows at the end of the financial year as follows:

	December 31, 2021	December 31, 2020
		(Restated)
Balances as above	17,853,244	9,671,477
Bank overdrafts	—	(899,955)
Balances per statement of cash flows	17,853,244	8,771,522

Restricted cash mainly represented deposits held for use in issuing notes payable and letters of credit.

As of December 31, 2021, cash and cash equivalent and restricted cash of the Group were denominated in the following currencies:

	December 31, 2021	December 31, 2020
		(Restated)
RMB	17,605,127	9,621,499
USD	1,557,373	1,095,713
HKD	7,314	2,763
EUR	1,957	2,055
Others	6,221	5,484
	19,177,992	10,727,514

Cash at banks earns interest at floating rates based on daily bank deposit rates. The bank balances, time deposits and restricted cash are deposited with creditworthy banks with no recent history of default.

17 SHARE CAPITAL

As of December 31, 2020 and December 31, 2021, all issued shares were registered and fully paid. Both A shares and H shares rank pari passu with each other.

The number of the Company's authorised and issued ordinary shares was 17,022,672,951 at par value of RMB1.00 per share as of December 31, 2021.

	December 31, 2021	December 31, 2020
Listed A shares	13,078,707	13,078,707
Listed H shares	3,943,966	3,943,966
	17,022,673	17,022,673

18 RESERVES

The amounts of the Group's reserves and the movements therein for the current and prior years are presented in the consolidated statement of changes in equity of the financial statements.

As approved in the 2021 Annual General Meeting, the Company made up for the accumulated losses with the surplus reserve of RMB4,230 million in 2021.

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19 INTEREST-BEARING LOANS AND BORROWINGS

	December 31, 2021	December 31, 2020
Long-term loans and borrowings		
Lease liabilities (Note 20 (b))	12,594,455	7,086,151
Medium-term notes and bonds (Note 19(b))		
– Unsecured	19,222,586	18,975,379
Long-term bank and other loans (Note 19(a))		
– Secured (Note 19(f))	11,008,215	9,216,299
– Guaranteed (Note 19(e))	3,132,529	4,846,446
– Unsecured	27,984,442	28,951,819
	42,125,186	43,014,564
Total long-term loans and borrowings	73,942,227	69,076,094
Current portion of lease liabilities	(987,664)	(828,272)
Current portion of medium-term notes and bonds	(2,999,599)	(7,100,711)
Current portion of long-term bank and other loans	(5,859,115)	(3,629,014)
	(9,846,378)	(11,557,997)
Non-current portion of long-term loans and borrowings	64,095,849	57,518,097

	December 31, 2021	December 31, 2020
Short-term loans and borrowings		
Bank and other loans (Note 19(c))		
– Secured (Note 19(f))	513,100	863,738
– Guaranteed (Note 19(e))	—	50,000
– Unsecured	8,706,230	19,824,292
	9,219,330	20,738,030
Short-term bonds, unsecured (Note 19(d))	5,440,414	2,411,256
Current portion of lease liabilities	987,664	828,272
Current portion of medium-term notes and bonds	2,999,599	7,100,711
Current portion of long-term bank and other loans	5,859,115	3,629,014
	15,286,792	13,969,253
Total short-term borrowings and current portion of long-term loans and borrowings	24,506,122	34,707,283

As of December 31, 2021, except for loans and borrowings of the Group amounting to RMB11 million (December 31, 2020: RMB15 million) and RMB1,333 million (December 31, 2020:RMB1,312 million) which were denominated in JPY and USD, respectively, all loans and borrowings were denominated in RMB.

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19 INTEREST-BEARING LOANS AND BORROWINGS (CONTINUED)

As of December 31, 2021, included in the Group's interest-bearing loans and borrowings are loans provided by subsidiaries of Chinalco RMB13,029 million (December 31, 2020: RMB8,887 million), as set out in Note 36(b). There were no interest-bearing loans and borrowings obtained from joint ventures and associates as of December 31, 2021 and 2020.

As of December 31, 2021, Shangdong Huayu Alloy Materials Co. Ltd. ("Shangdong Huayu"), a subsidiary of the Company did not repay short-term secured bank loans with principal amount of RMB113 million, which resulted in an event of default and there is no further impact extended to the Group.

(a) Long-term bank and other loans

The maturity of long-term bank and other loans is set out below:

	Loans from banks and other financial institutions		Other loans		Total of long-term bank and other loans	
	December 31, 2021	December 31, 2020	December 31, 2021	December 31, 2020	December 31, 2021	December 31, 2020
Within 1 year	5,856,967	3,626,564	2,148	2,450	5,859,115	3,629,014
Between 1 and 2 years	11,835,504	6,700,238	2,148	2,450	11,837,652	6,702,688
Between 2 and 5 years	9,764,992	15,630,738	6,445	7,350	9,771,437	15,638,088
Over 5 years	14,656,982	17,042,324	—	2,450	14,656,982	17,044,774
	42,114,445	42,999,864	10,741	14,700	42,125,186	43,014,564

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19 INTEREST-BEARING LOANS AND BORROWINGS (CONTINUED)

(b) Medium-term notes and bonds

Outstanding medium-term bonds and private placement notes of the Group as of December 31, 2021 are summarized as follows:

	Face value /maturity	Effective interest rate	December 31, 2021	December 31, 2020
2018 Medium-term notes	2,000,000RMB/2021	5.84 %	—	1,998,802
2019 Medium-term notes	2,000,000RMB/2024	4.31 %	1,989,090	1,985,264
2020 Medium-term notes	900,000RMB/2023	3.04 %	898,866	897,972
2021 Medium-term notes	1,000,000RMB/2024	3.21 %	997,028	—
2018 Medium-term bonds	1,100,000RMB/2021	4.66 %	—	1,099,284
2018 Medium-term bonds	900,000RMB/2023	5.06 %	899,323	898,807
2018 Medium-term bonds	1,400,000RMB/2021	4.30 %	—	1,398,160
2018 Medium-term bonds	1,600,000RMB/2023	4.57 %	1,597,988	1,597,071
2019 Medium-term bonds	2,000,000RMB/2022	3.84 %	1,999,809	1,999,196
2019 Medium-term bonds	2,000,000RMB/2029	4.57 %	1,997,440	1,997,265
2019 Medium-term bonds	1,000,000RMB/2022	3.52 %	999,790	999,623
2020 Medium-term bonds	500,000RMB/2025	3.31 %	499,876	499,853
2020 Medium-term bonds	1,000,000RMB/2023	3.07 %	999,787	999,617
2018 Hong Kong Medium-term bonds	400,000USD/2021	5.25 %	—	2,604,465
2021 Hong Kong Medium-term bonds	500,000USD/2024	1.74 %	3,173,180	—
2021 Hong Kong Medium-term bonds	500,000USD/2026	2.24 %	3,170,409	—
			19,222,586	18,975,379

Medium-term notes and bonds were issued for capital expenditure and operating cash flows purposes, as well as for the purpose of re-financing of bank loans.

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19 INTEREST-BEARING LOANS AND BORROWINGS (CONTINUED)

(c) Short-term bank and other loans

The weighted average annual interest rate of short-term bank and other loans for the year ended December 31, 2021 was 3.03% (2020: 3.46%).

(d) Short-term bonds

Outstanding short-term bonds as of December 31, 2021 are summarized as follows:

	Face value /maturity	Effective interest rate	December 31, 2021	December 31, 2020
short-term bonds	400,000RMB/2021	2.46 %	—	405,997
short-term bonds	500,000RMB/2021	1.52 %	—	501,781
short-term bonds	1,000,000RMB/2021	2.45 %	—	1,002,925
short-term bonds	500,000RMB/2021	1.61 %	—	500,553
short-term bonds	400,000RMB/2022	2.70 %	406,036	—
short-term bonds	2,000,000RMB/2022	2.59 %	2,022,571	—
short-term bonds	1,000,000RMB/2022	2.55 %	1,006,240	—
short-term bonds	2,000,000RMB/2022	2.80 %	2,005,567	—
			5,440,414	2,411,256

All the above short-term bonds were issued for working capital needs.

(e) Guaranteed interest-bearing loans and borrowings

Details of guarantors for the Group's loans and borrowings are set out as follows:

Guarantors	December 31, 2021	December 31, 2020
Long-term loans		
The Company	1,053,744	2,092,761
Baotou Aluminum Limited Company(包頭鋁業有限公司) and Baotou Communications Investment Group Limited Company(包頭交通投資集團有限公司) (i)	825,000	1,137,500
Ningxia Energy (ii)	935,000	1,134,400
The Company and COSCO SHIPPING BULK Limited company (中遠海運散貨運輸有限公司) (iii)	318,785	318,785
Yinyi Fengdian, Neimenggu, Alashan (ii)	—	144,000
Yinxing Energy (ii)	—	19,000
	3,132,529	4,846,446
Short-term loans		
Ningxia Energy (ii)	—	50,000
	3,132,529	4,896,446

Notes:

(i) The guarantors are a subsidiary of the Company and a related party respectively.

(ii) The guarantor is a subsidiary of the Company.

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19 INTEREST-BEARING LOANS AND BORROWINGS (CONTINUED)

(e) Guaranteed interest-bearing loans and borrowings (Continued)

(iii) The joint guarantors are the Company and a third party.

The English names represent the best effort by management of the Group in translating the Chinese names of the companies as they do not have any official English names.

(f) Details of the assets pledged for bank and other borrowings were set out in Note 24 to the financial statements.

20 LEASE

The Group as a lessee

The Group has lease contracts for various items of plant and machinery, motor vehicles, other equipment and land use rights used in its operations.

(a) Right-of-use assets

The carrying amounts of the Group's right-of-use assets and the movements during 2021 and 2020 are as follows:

	Buildings	Machinery	Land use rights	Total
As of January 1, 2021	235,169	1,764,196	12,288,473	14,287,838
Additions	8,547	6,424	109,927	124,898
Transfer from property, plant and equipment (Note 7)	—	—	68,377	68,377
Lease modification	377,873	—	5,769,223	6,147,096
Transfer to property, plant and equipment	(143,646)	(1,199,382)	—	(1,343,028)
Transfer to investment properties (Note 8)	—	—	(90,314)	(90,314)
Disposal	—	—	(17,774)	(17,774)
Depreciation	(121,955)	(128,617)	(493,939)	(744,511)
Impairment losses	—	(67,744)	(22,346)	(90,090)
Currency translation differences	(23)	—	3,667	3,644
As of December 31, 2021	**355,965**	**374,877**	**17,615,294**	**18,346,136**

	Buildings	Machinery	Land use rights	Total
As of January 1, 2020	287,255	3,756,305	11,846,877	15,890,437
Additions	15,023	8,831	52,925	76,779
Transfer from property, plant and equipment (Note 7)	—	—	885,141	885,141
Lease modification	(12,301)	—	(43,496)	(55,797)
Transfer to property, plant and equipment	—	(1,663,686)	—	(1,663,686)
Transfer to investment properties (Note 8)	—	—	(45,885)	(45,885)
Disposal	—	—	(15,792)	(15,792)
Depreciation	(54,792)	(321,464)	(391,297)	(767,553)
Impairment losses	—	(15,790)	—	(15,790)
Currency translation differences	(16)	—	—	(16)
As of December 31, 2020	**235,169**	**1,764,196**	**12,288,473**	**14,287,838**

As of December 31, 2021, the Group has pledged land use rights at a net carrying value amounting to RMB180 million (December 31, 2020: RMB273 million) for bank and other borrowings as set out in Note 24 to the financial statements.

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20 LEASE (CONTINUED)

The Group as a lessee (Continued)

(b) Lease liabilities

The carrying amount of lease liabilities (included under interest-bearing bank and other borrowings) and the movements during the year are as follows:

	Year ended December 31, 2021
Carrying amount as of January 1	7,086,151
New leases	122,354
Lease modification (i)	6,147,096
Accretion of interest recognized during the year	366,858
Payments	(1,128,004)
Carrying amount as of December 31	12,594,455
Analyzed into:	
Current portion	987,664
Non-current portion	11,606,791

(i) Pursuant to the framework lease contract entered into between the Company and Chinalco in 2001 (Note 3(g)), the annual consideration for certain lands leased by the Group from Chinalco for the period commencing January 1, 2022 was re-negotiated between contract parties, which constitute lease modifications as of December 31, 2021 and results in remeasurement of the lease liabilities and a corresponding adjustment to the right-of-use assets.

(c) The amounts recognized in profit or loss in relation to leases are as follows:

	2021	2020	2019
Interest on lease liabilities	366,858	466,796	487,249
Depreciation charge of right-of-use assets	744,511	767,553	1,075,825
Expense relating to short-term leases and leases of low-value assets	51,739	91,537	65,426
Total amount recognized in profit or loss	1,163,108	1,325,886	1,628,500

(d) The total cash outflow for leases is disclosed in Notes 35(c), to the financial statements.

The Group as a lessor

Rental income recognized by the Group during the year was RMB299 million (2020: RMB330 million, 2019: RMB318 million), details of which are included in Note 5 to the financial statements. In the opinions of the directors, the undiscounted lease payments receivable by the Group in future periods under non-cancellable operating leases are not material.

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21 OTHER NON-CURRENT LIABILITIES

	December 31, 2021	December 31, 2020
Financial liabilities		
–Long-term payables for mining rights	798,204	1,014,169
–Other financial liabilities	82,660	22,748
	880,864	1,036,917
Obligations in relation to early retirement schemes (i)	205,802	217,864
Deferred government grants	153,290	182,221
Deferred gain relating to sales and leaseback agreements	50,630	58,844
Contract liabilities	108,545	182,859
Provision for rehabilitation	393,896	316,812
Others	145,213	152,041
	1,057,376	1,110,641
	1,938,240	2,147,558

Note:

(i) Obligations in relation to early retirement schemes

Since 2014, certain subsidiaries and branches implemented termination retirement benefit schemes which allow qualified employees to early retire on a voluntary basis. The Group undertakes the obligations to pay the termination retirement employees' living expenses for a period of no more than five years in the future on a monthly basis according to the termination retirement benefit schemes, in addition to the social insurance and housing fund pursuant to the regulation of the local Social Security Office. Living expenses, social insurance and the housing fund are together referred to as "the Payments". The Payments are forecasted to increase by 3% per annum with reference to the inflation rate and adjusted based on the average death rate in China. The Payments are discounted at the treasury bond rate as of December 31, 2021. As of December 31, 2021, the current portion of the Payments payable within one year is included in "Other payables and accrued liabilities".

As of December 31, 2021 and 2020, obligations in relation to retirement benefits under the Group's early retirement schemes are as follows:

	December 31, 2021	December 31, 2020
As of January 1	497,334	843,253
Provision made during the year (Note 30)	269,895	53,339
Interest costs	4,612	11,582
Payment during the year	(343,362)	(410,840)
As of December 31	428,479	497,334
Non-current	205,802	217,864
Current (Note 22)	222,677	279,470
	428,479	497,334

(Amounts expressed in thousands of RMB unless otherwise stated)

22 OTHER PAYABLES AND ACCRUED LIABILITIES

	December 31, 2021	December 31, 2020 (Restated)
Financial liabilities		
– Payable for capital expenditures	2,990,377	4,677,705
– Interest payable	485,426	533,382
– Deposits	1,653,524	1,748,356
– Dividends payable by subsidiaries to non-controlling shareholders	369,465	289,791
– Consideration payable for investment projects	38,255	23,740
– Current portion of payables for mining rights (Note 21)	182,959	460,101
– Payable of the government levies on self-operated power plants	411,021	423,728
– Others	1,035,189	809,149
	7,166,216	8,965,952
Output value-added tax payable	263,297	271,963
Taxes other than income taxes payable (i)	1,298,548	798,481
Accrued payroll and bonus	123,981	72,289
Staff welfare payables	213,305	323,214
Current portion of obligations in relation to termination retirement schemes (Note 21)	222,677	279,470
Contribution payable for pension insurance	19,278	22,935
Others	46,391	21,375
	2,187,477	1,789,727
	9,353,693	10,755,679

(i) Taxes other than income taxes payable mainly comprise accruals for value-added tax, resource tax, city construction tax and education surcharge.

As of December 31, 2021, except for other payables and accrued liabilities of the Group amounting to RMB1.24 million and RMB0.16 million which were denominated in USD and HKD, respectively (December 31, 2020: RMB92 million and RMB0.16 million which were denominated in USD and HKD, respectively), all remaining balances of payables and accrued liabilities were denominated in RMB.

23 TRADE AND NOTES PAYABLES

	December 31, 2021	December 31, 2020 (Restated)
Trade payables	10,946,272	9,976,432
Notes payable	4,559,171	5,467,922
	15,505,443	15,444,354

As of December 31, 2021, except for trade and notes payables of the Group amounting to RMB241 million which were denominated in USD (December 31, 2020: RMB35 million in USD), all remaining balances of trade and notes payables were denominated in RMB.

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23 TRADE AND NOTES PAYABLES (CONTINUED)

The ageing analysis of trade and notes payables is as follows:

	December 31, 2021	December 31, 2020 (Restated)
Within 1 year	14,941,793	14,926,948
Between 1 and 2 years	131,152	210,587
Between 2 and 3 years	129,356	119,587
Over 3 years	303,142	187,232
	15,505,443	15,444,354

The trade and notes payables are non-interest bearing and are normally settled within one year.

24 PLEDGE OF ASSETS

The Group has pledged various assets as collateral against certain secured borrowings as set out in Note 19. As of December 31, 2021, a summary of these pledged assets was as follows:

	December 31, 2021	December 31, 2020
Property, plant and equipment (Note 7)	5,111,165	5,191,185
Right-of-use assets (Note 20(a))	179,683	273,451
Intangible assets (Note 6)	1,399,972	960,000
Trade receivables and notes receivables (Note 14)	1,982,986	2,747,768
Investments in joint ventures and associates (Note 9)	—	395,610
	8,673,806	9,568,014

As of December 31, 2021, in addition to the loans and borrowings which were secured by the above assets, the current portion of long-term loans and borrowings amounting to RMB1,525 million (December 31, 2020: RMB1,209 million), and the non-current portion of long-term loans and borrowings amounting to RMB7,959 million (December 31, 2020: RMB10,265 million) were secured by the contractual right to charge users for electricity generated in the future.

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25 EXPENSE BY NATURE

	For the years ended December 31		
	2019 (Restated)	2020 (Restated)	2021
Purchase of inventories in relation to trading activities	104,928,962	102,515,791	149,177,935
Raw materials and consumables used, and changes in work-in-progress and finished goods	35,550,482	32,935,620	45,735,508
Power and utilities	16,755,424	16,766,950	24,283,691
Depreciation of right-of-use assets (Note 20)	1,075,825	767,553	744,511
Depreciation and amortization (other than depreciation of right-of-use assets) expenses	7,720,407	7,920,108	7,969,871
Employee benefit expenses (Note 30)	7,777,692	7,877,451	8,878,784
Repairs and maintenance	1,867,160	1,595,880	2,797,464
Transportation expenses and logistic cost	3,420,360	4,079,157	5,662,341
Taxes other than income tax expense (i)	1,431,587	1,601,728	2,247,649
Inventory impairment loss	1,163,272	1,321,387	456,538
Research and development expenses	940,828	1,014,604	1,842,295
Auditors' remuneration			
-The Company's auditor			
-Audit services	25,444	18,170	18,170
-Non-audit services	2,388	700	870
-Other auditors	5,505	12,436	2,746
Others	1,978,911	1,154,102	1,332,875
	184,644,247	179,581,637	251,151,248

Note:

(i) Taxes other than income tax expense mainly comprise surcharges, land use tax, property tax and stamp duty.

26 NET IMPAIRMENT LOSSES ON FINANCIAL ASSETS

	For the years ended December 31		
	2019	2020 (Restated)	2021
Impairment losses on other non-current assets (Note 12)	—	—	15,716
Impairment losses on trade and notes receivables (Note 14)	154,409	338,972	327,131
Impairment losses on other current assets (Note 15)	16,607	640,189	1,042,041
	171,016	979,161	1,384,888

27 OTHER INCOME

For the year ended December 31, 2021, government grants amounting to RMB148 million (2020: RMB140 million, 2019: RMB85 million) were recognized as income for the year to facilitate the Group's development. There are no unfulfilled conditions or contingencies attached to the grants.

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28 OTHER (LOSSES)/GAINS-NET

	For the years ended December 31		
	2019 (Restated)	2020	2021
(Loss)/gain on disposal of subsidiaries (Note 40)	261,187	11,305	(27,404)
Realized and unrealized gains on futures, forward and option contracts, net(i)	50,820	512,984	(604,734)
(Loss)/gain on disposal of property, plant and equipment and intangible assets, net (ii)	259,684	319,796	(650,711)
(Loss)/gain on acquisition of associates (iii)	295,288	—	—
Losses on derecognition of financial assets measured at amortized cost	—	—	(91,348)
Gain on disposal of investment in a joint venture (iv)	159,514	—	—
Others	(44,816)	59,786	(249,306)
	981,677	903,871	(1,623,503)

(i) The Group does not apply hedge accounting for these futures, forward and option contracts.

(ii) During the year ended December 31, 2021, the Group abandoned or replaced certain idle or inefficient property, plant and equipment in the process of production line improvement or disposal, resulting in a loss of RMB651 million.

During the year ended December 31, 2020, the aluminum capacity quota of Shandong Huayu has been disposed of, and the Group recognized the disposal gain of RMB539 million.

During the year ended December 31, 2019, the electrolytic aluminum capacity quota was transferred from Shanxi Huasheng Co., Ltd. to Yixin Aluminum with a gain of RMB800 million recorded. The fixed assets related to the electrolytic aluminum production line of Guizhou Branch have been disposed of, and the Company recognized the disposal loss of RMB541 million.

(iii) During the year ended December 31, 2019, the Group recognized a gain of RMB204 million and a gain of RMB91 million on barging purchase of associates Yunnan Aluminum and Yixin Aluminum, respectively.

(iv) In March 2019, Ningxia Energy transferred, through an auction transaction, its 50% equity interest in Ningxia Zhongning Power Co., Ltd. to Ningxia Tianyuan Manganese Industry Group Co., Ltd. A gain of RMB159 million from disposal of investment in a joint venture was recorded by the Group.

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29 FINANCE INCOME/FINANCE COSTS

An analysis of finance income/finance costs is as follows:

	For the years ended December 31		
	2019 (Restated)	2020 (Restated)	2021
Finance income-interest income	(261,194)	(227,201)	(275,996)
Interest expense	4,665,537	3,986,264	3,522,241
Less: Interest expense capitalized in property, plant and equipment (Note 7)	(289,499)	(123,571)	(1,727)
Interest expense, net of capitalized interest	4,376,038	3,862,693	3,520,514
Interest on lease liability and amortization of unrecognized finance expenses	547,820	481,512	401,927
Exchange losses/(gains), net	(2,317)	76,323	20,320
Finance costs	4,921,541	4,420,528	3,942,761
Finance costs, net	4,660,347	4,193,327	3,666,765
Capitalization rate during the year (Note 7)	4.00% to 6.96%	4.00% to 6.68%	4.00%

30 EMPLOYEE BENEFIT EXPENSE

An analysis of employee benefit expenses is as follows:

	For the years ended December 31		
	2019 (Restated)	2020 (Restated)	2021
Salaries and bonuses	4,942,843	5,327,833	5,563,500
Housing fund	488,901	532,842	558,392
Staff welfare and other expenses*	2,037,041	1,955,447	2,435,282
Employment expense in relation to early retirement schemes (Note 21)	210,428	53,339	269,895
Employment expenses in relation to termination benefits	98,479	7,990	51,715
	7,777,692	7,877,451	8,878,784

(i) Staff welfare and other expenses include staff welfare, staff union expenses, staff education expenses and unemployment insurance expenses etc.

In 2020, the group entities in Mainland China were exempt from payment of employee social benefits during the period from February to December in 2020 under national Covid-19 supportive policies.

Employee benefit expenses include remuneration payables to directors, supervisors and senior management as set out in Note 31.

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31 DIRECTORS' AND SUPERVISORS' REMUNERATION

(a) Directors' and supervisors' remuneration

Directors' and supervisors' remuneration for the year, disclosed pursuant to the Listing Rules, section 383(1)(a), (b), (c) and (f) of the Hong Kong Companies Ordinance and Part 2 of the Companies Regulation (Disclosure of Information about Benefits of Directors), is as follows:

	For the years ended December 31		
	2019	2020	2021
Fees	780	683	579
Basic salaries, housing fund, other allowances and benefits in kind	4,665	3,996	4,526
Pension costs	513	207	449
	5,958	4,886	5,554

The remuneration of each director and supervisor of the Company for the year ended December 31, 2021 is set out below:

Names of directors and supervisors	Fees	Salaries	Discretionary bonuses	Pension costs	Total
Executive Directors:					
Liu Jianping (ii)	—	—	—	—	—
Zhu Runzhou	—	1,176	—	93	1,269
Ou Xiaowu (iii)	—	973	—	93	1,066
Jiang Tao (iv)	—	837	—	77	914
	—	2,986	—	263	3,249
Non-executive Directors:					
Ao Hong (i)	—	—	—	—	—
Zhang Jilong (iv)	—	—	—	—	—
Wang Jun	—	—	—	—	—
Chen Lijie (x)	95	—	—	—	95
Lie-A-Cheong Tai-Chong, David(x)	95	—	—	—	95
Hu Shihai(x)	95	—	—	—	95
Qiu Guanzhou(vi)	98	—	—	—	98
Chan Yuen Sau Kelly (viii)	98	—	—	—	98
Yu Jingsong (vii)	98	—	—	—	98
	579	—	—	—	579
Supervisors:					
Ye Guohua	—	—	—	—	—
Shan Shulan	—	—	—	—	—
Guan Xiaoguang	—	770	—	93	863
Yue Xuguang	—	770	—	93	863
Lin Ni (ix)	—	—	—	—	—
Total	—	1,540	—	186	1,726

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31 DIRECTORS' AND SUPERVISORS' REMUNERATION (CONTINUED)

(a) Directors' and supervisors' remuneration (Continued)

The remuneration of each director and supervisor of the Company for the year ended December 31, 2020 is set out below:

Names of directors and supervisors	Fees	Salaries	Discretionary bonuses	Pension costs	Total
Executive Directors:					
Lu Dongliang	—	—	—	—	—
He Zhihui	—	866	—	37	903
Jiang Yinggang	—	562	—	31	593
Zhu Runzhou	—	894	—	44	938
	—	2,322	—	112	2,434
Non-executive Directors:					
Ao Hong(i)	—	—	—	—	—
Wang Jun	50	—	—	—	50
Chen Lijie(x)	211	—	—	—	211
Lie-A-Cheong Tai-Chong, David(x)	211	—	—	—	211
Hu Shihai(x)	211	—	—	—	211
	683	—	—	—	683
Supervisors:					
Ye Guohua	—	—	—	—	—
Ou Xiaowu(iii)	—	134	—	7	141
Shan shulan	—	—	—	—	—
Guan Xiaoguang	—	770	—	44	814
Yue Xuguang	—	770	—	44	814
Total	—	1,674	—	95	1,769

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31 DIRECTORS' AND SUPERVISORS' REMUNERATION (CONTINUED)

(a) Directors' and supervisors' remuneration (Continued)

The remuneration of each director and supervisor of the Company for the year ended December 31, 2019 is set out below:

Names of directors and supervisors	Fees	Salaries	Discretionary bonuses	Pension costs	total
Executive Directors:					
Lu Dongliang	—	—	—	—	—
He Zhihui	—	885	—	73	958
Jiang Yinggang	—	889	—	88	977
Zhu Runzhou	—	833	—	88	921
	—	2,607	—	249	2,856
Non-executive Directors:					
Ao Hong(i)	—	—	—	—	—
Wang Jun	150	—	—	—	150
Chen Lijie(x)	210	—	—	—	210
Lie-A-Cheong Tai-Chong, David(x)	210	—	—	—	210
Hu Shihai(x)	210	—	—	—	210
	780	—	—	—	780
Supervisors:					
Ye Guohua	—	—	—	—	—
Ou Xiaowu(iii)	—	—	—	—	—
Shan shulan	—	—	—	—	—
Guan Xiaoguang	—	710	—	88	798
Yue Xuguang	—	770	—	88	858
Wu Zuoming	—	578	—	88	666
Total	—	2,058	—	264	2,322

Notes:

(i) On June 29, 2021, Mr. Ao Hong was resigned as an non-executive Director of the Company.

(ii) On June 29, 2021, Mr. Liu Jianping was appointed as an executive Director of the Company in the seventh session of the Board of the Company.

(iii) On June 29, 2021, Mr. Ou Xiaowu was appointed as an executive Director in the seventh session of the Board of the Company.

(iv) On June 29, 2021, Mr. Jiang Tao was appointed as an executive Director of the Company in the seventh session of the Board of the Company.

(v) On June 29, 2021, Mr. Zhang Jilong was appointed as an non-executive Director of the Company in the seventh session of the Board of the Company.

(vi) On June 29, 2021, Mr. Qiu Guanzhou was appointed as an independent non-executive Director in the seventh session of the Board of the Company.

(vii) On June 29, 2021, Mr. Yu Jinsong was appointed as an independent non-executive Director in the seventh session of the Board of the Company.

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31 DIRECTORS' AND SUPERVISORS' REMUNERATION (CONTINUED)

(a) Directors' and supervisors' remuneration (Continued)

(viii) On June 29, 2021, Ms. Chan Yuen Sau Kelly was appointed as an independent non-executive Director in the seventh session of the Board of the Company

(ix) On December 21, 2021, Ms. Lin Ni was appointed as the supervisor in the seventh session of the supervisory Committee of the Company.

(x) On June 29, 2021, Ms. Chen Lijie, Mr. Hu Shihai and Mr. Lie-A-Cheong Tai-Chong, David were resigned as non-executive Directors of the Company.

The remuneration of the directors and supervisors of the Company fell within the following band:

	Number of individuals		
	December 31, 2019	December 31, 2020	December 31, 2021
Nil to RMB1,000,000	14	14	14

During the year, no options were granted to the directors or the supervisors of the Company (2020: Nil, 2019: Nil).

During the year, no emoluments were paid to the directors or the supervisors of the Company (among which included the five highest paid employees) as an inducement to join or upon joining the Company or as compensation for loss of office (2020: Nil, 2019: Nil).

Director Wang Jun waived his director's remuneration with effect from May 2020. The annual remuneration before tax as a non-executive director of the Company is RMB150,000 for 2021.

(b) Five highest paid individuals

During the year ended December 31, 2021, the five highest paid individuals of the Group include three directors (2020: three directors, 2019: three directors) whose remuneration is reflected in the analysis presented above. The remuneration payable to the remaining two individuals during 2021 (2020: two, 2019: two) is as follows:

	For the years ended December 31		
	2019	2020	2021
Basic salaries, housing fund, other allowances and benefits in kind	1,670	1,594	1,699
Discretionary bonuses	—	—	—
Pension costs	137	88	186
	1,807	1,682	1,885

The number of the remaining two highest paid individuals during 2021 (2020: two) whose remuneration fell within the following band is as follows:

	Number of individuals		
	December 31, 2019	December 31, 2020	December 31, 2021
Nil to RMB1,000,000	2	2	2

(Amounts expressed in thousands of RMB unless otherwise stated)

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32 INCOME TAX EXPENSE

	For the years ended December 31		
	2019 (Restated)	2020 (Restated)	2021
Current income tax expense	726,198	820,947	2,342,124
Deferred tax benefit	(94,686)	(230,924)	47,637
	631,512	590,023	2,389,761

In general, the Group's PRC entities are subject to PRC corporate income tax at the standard rate of 25% (2020: 25%, 2019: 25%) on their respective estimated assessable profits for the year. Certain branches and subsidiaries of the Company located in the western regions of the PRC are granted tax concessions including a preferential tax rate of 15% (2020: 15%, 2019: 15%).

A reconciliation of the tax expense applicable to profit before tax at the statutory rates for the countries in which the Company and the majority of its subsidiaries are domiciled to the tax expense at the effective tax rates, and a reconciliation of the applicable rates to the effective tax rates, are as follows:

	For the years ended December 31		
	2019 (Restated)	2020 (Restated)	2021
Profit before income tax	1,865,604	2,189,271	10,178,780
Tax expense calculated at the statutory tax rate of 25% (2020: 25%, 2019: 25%)	466,401	547,318	2,544,695
Tax effects of:			
Different income tax rates applicable to certain branches and subsidiaries	(464,912)	(357,018)	(1,018,602)
Impact of change in income tax rate	4,594	(52,177)	32,107
Net impact of unrecognized temporary differences and tax losses for current and prior years	861,896	620,001	1,166,082
Expenses subject to additional deduction	(50,921)	(42,958)	(142,326)
Interest expenses of perpetual bonds	—	(86,034)	(76,807)
Expenses not deductible for tax purposes	56,448	51,583	42,786
Non-taxable income	(173,686)	—	—
Profits and losses attributable to joint ventures and associates	(79,720)	(70,577)	(156,762)
Others	11,412	(20,115)	(1,412)
Income tax expense	631,512	590,023	2,389,761
Effective tax rate	34 %	27 %	23 %

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33 EARNINGS PER SHARE ATTRIBUTABLE TO OWNERS OF THE COMPANY

	For the years ended December 31		
	2019 (Restated)	2020 (Restated)	2021
Profit attributable to owners of the Company (in thousands of RMB)	595,643	764,306	5,079,562
Adjustment: cumulative distribution reserved of other equity instruments (in thousands of RMB)	(219,249)	(261,168)	(209,500)
Adjusted profit attributable to ordinary shares holders of the Company	376,394	503,138	4,870,062

For the purpose of calculating basic earnings per share, the Group adjusted the profit attributable to owners of the Company by deducting the after-tax amounts of cumulative distribution reserved for the year for other equity instruments, which were issued by the Group and classified as equity instrument (Note 41).

Number of ordinary shares in issue (thousands) as of January 1	14,903,798	17,022,673	17,022,673
Issuance of share capital (thousands)	2,118,875	—	—
Weighted average number of ordinary shares in issuance	17,022,673	17,022,673	17,022,673
Basic earnings per share (RMB)	0.022	0.030	0.286

The Group had no potentially dilutive ordinary shares in issuance during the years ended December 31, 2021, 2020 and 2019, thus the diluted earnings per share were the same as basic earnings per share.

Basic earnings per share was calculated by dividing the adjusted profit attributable to ordinary shares holders of the Company by the weighted average number of shares in issue during the year.

34 DIVIDENDS

According to the articles of association of the Company, the Company considers the maximum limit of profit appropriation to its shareholders is the lowest of:

(i) the sum of the net profit less statutory surplus reserve and the opening retained earnings for the current period in accordance with IFRSs;

(ii) the sum of the net profit less statutory surplus reserve and the opening retained earnings for the current period in accordance with the PRC Accounting Standards for Business Enterprises; and

(iii) the amount limited by the Company Law of the PRC.

According to the resolution of the Board of Directors dated March 22, 2022, the directors proposed a final dividend of RMB545 million for the year ended December 31, 2021.

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35 NOTES TO THE CONSOLIDATED STATEMENT OF CASH FLOWS

(a) Reconciliation of profit before taxation to cash generated from operations

	Notes	For the years ended December 31 2019 (Restated)	2020 (Restated)	2021
Cash flows generated from operating activities				
Profit before income tax		1,865,604	2,189,271	10,178,780
Adjustments for:				
Share of profits of joint ventures	9 (a)	(270,115)	(180,502)	(164,100)
Share of profits of associates	9 (b)	(48,767)	(145,737)	(272,584)
Depreciation of property, plant and equipment	7	7,106,765	7,161,476	7,375,559
Depreciation of investment properties	8	26,559	24,405	24,450
Depreciation of right-of-use assets	20	1,075,825	767,553	744,511
Amortization of intangible assets	6	338,938	459,482	377,714
Amortization of prepaid expenses included in other non-current assets		248,145	274,745	192,148
Loss/(gain) on write-off and disposal of property, plant and equipment and intangible assets, net		(243,622)	(319,796)	650,711
Impairment loss on property, plant and equipment		259,354	416,842	2,328,131
Impairment loss of investment properties		87	—	—
Impairment loss of intangible assets		—	416	196,426
Impairment loss of right-of-use assets	20	1,448	15,790	90,090
Impairment loss of inventory		1,163,272	1,321,387	456,538
Impairment loss of trade and notes receivables		154,409	338,972	327,131
Impairment loss of other currents assets		16,607	640,189	1,042,041
Impairment loss of non-current assets		—	—	15,716
Realized and unrealized gains on futures, option and forward contracts	28	(50,820)	(512,984)	604,734
Loss/(gain) on disposal of subsidiaries	28	(261,187)	(11,305)	27,404
Loss on factoring of accounts receivable		—	—	83,293
Gain on disposal of investment in a joint venture		(159,514)	—	—
Gain on acquisition of associates		(295,288)	—	—
Dividends from other financial assets measured at fair value		(97,775)	(82,794)	(10,912)
Finance cost	29	4,921,541	4,420,438	3,846,101
Others		(146,171)	5,106	127,680
		15,605,295	16,782,954	28,241,562
Changes in working capital:				
Decrease/(increase) in inventories		(233,278)	(1,667,622)	727,363
Increase in trade and notes receivables		(1,173,422)	(4,524,806)	(1,294,952)
Decrease/ (increase) in other current assets		(382,938)	230,869	125,731
Decrease in restricted cash		859,507	249,744	(268,711)
(Increase)/decrease in other non-current assets		547,856	(70,637)	25,803
Increase/(decrease) in trade and notes payables		(1,400,318)	3,004,899	1,318,486
Increase/(decrease) in other payables and accrued liabilities		(555,890)	1,884,283	1,702,821
(Decrease)/increase in other non-current liabilities		(206,354)	(177,045)	(62,592)
Cash generated from operations		13,060,458	15,712,639	30,515,511
PRC corporate income taxes paid		(554,582)	(805,171)	(2,285,126)
Net cash generated from operating activities		12,505,876	14,907,468	28,230,385
Major non-cash transactions of investing activities and financing activities				
Acquisition of minority interests for nil consideration		149,322	—	—
Notes receivables endorsed as payment for purchase of property, plant and equipment and lease liabilities		1,504,162	2,276,782	3,135,322
Acquisition of other financial assets measured at fair value through other comprehensive income by exchanging equity in a subsidiary		350,911	—	—
Increase/(decrease) of right of use assets		—	(7,361)	6,269,450
Acquisition of business		—	42,230	—
		2,004,395	2,311,651	9,404,772

(b) Reconciliation of liabilities arising from financing activities

The table below details changes in the Group's liabilities from financing activities, including both cash and non-cash changes. Liabilities arising from financing activities are liabilities for which cash flows was, or future cash flows will be, classified in the Group's consolidated statement of cash flows as cash flows from financing activities.

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35 NOTES TO THE CONSOLIDATED STATEMENT OF CASH FLOWS (CONTINUED)

(b) Reconciliation of liabilities arising from financing activities (Continued)

	Liabilities from financing activities					Other assets	
	Borrowings	Medium-term notes and bonds	Leases	Other payables arising from financing activities	Sub Total	Cash/bank Overdraft	Total
Net debt as of January 1, 2020	60,074,053	33,086,852	8,369,262	10,791,507	112,321,674	—	112,321,674
Financing cash flows	2,909,944	(11,689,958)	(1,748,202)	(4,021,065)	(14,549,281)	—	(14,549,281)
New leases and modification of contract	—	—	(7,361)	—	(7,361)	—	(7,361)
Foreign exchange adjustments	(131,358)	(178,972)	—	—	(310,330)	—	(310,330)
Other changes	—	—	—	—	—	—	—
Non-cash financing activities	—	168,713	472,452	4,282,403	4,923,568	—	4,923,568
Transfer between bank deposits and overdrafts	—	—	—	—	—	899,955	899,955
Net debt as of December 31, 2020	62,852,639	21,386,635	7,086,151	11,052,845	102,378,270	899,955	103,278,225
Financing cash flows	(11,477,586)	3,276,882	(639,675)	(3,966,393)	(12,806,772)	—	(12,806,772)
New leases and modification of contract	—	—	6,269,450	—	6,269,450	—	6,269,450
Foreign exchange adjustments	(30,537)	(143,597)	—	—	(174,134)	—	(174,134)
Other changes	—	—	—	—	—	—	—
Non-cash financing activities	—	143,080	(121,471)	3,677,507	3,699,116	—	3,699,116
Transfer between bank deposits and overdrafts	—	—	—	—	—	(899,955)	(899,955)
Net debt as of December 31, 2021	51,344,516	24,663,000	12,594,455	10,763,959	99,365,930	—	99,365,930

(c) Total cash outflow for leases

The total cash outflow for leases included in the statement of cash flows is as follows:

	For the years ended December 31		
	2019	2020	2021
Within operating activities	65,426	91,537	51,739
Within financing activities	3,032,106	1,748,202	639,675
	3,097,532	1,839,739	691,414

36 SIGNIFICANT RELATED PARTY TRANSACTIONS AND BALANCES

The Company is controlled by Chinalco, the parent company and a state-owned enterprise established in Mainland China. Chinalco itself is controlled by the PRC government, which also owns a significant portion of the productive assets in Mainland China. In accordance with IAS 24 Related Party Disclosures, government-related entities and their subsidiaries, directly or indirectly controlled, jointly controlled or significantly influenced by the PRC government are defined as related parties of the Group. On that basis, related parties include Chinalco and its subsidiaries (other than the Group), other government-related entities and their subsidiaries ("other state-owned enterprises"), other entities and corporations over which the Company is able to control or exercise significant influence and key management personnel of the Company and Chinalco as well as their close family members.

For the purposes of the related party transaction disclosures, the directors of the Company consider that meaningful information in respect of related party transactions has been adequately disclosed.

In addition to the related party information and transactions disclosed elsewhere in the consolidated financial statements, the following is a summary of significant related party transactions in the ordinary course of business between the Group and its related parties during the year.

(Amounts expressed in thousands of RMB unless otherwise stated)

36 SIGNIFICANT RELATED PARTY TRANSACTIONS AND BALANCES (CONTINUED)

(a) Significant related party transactions

	Notes	For the years ended December 31 2019	2020 (Restated)	2021
Sales of goods and services rendered:				
Sales of materials and finished goods to:	(i)			
Chinalco and its subsidiaries	(ix)	13,612,817	13,986,133	19,261,538
Associates of Chinalco		514,414	520,485	1,497,639
Joint ventures		5,676,548	6,694,824	9,071,474
Associates		3,812,565	9,232,432	672,403
Non-controlling shareholder of a subsidiary and its subsidiaries		—	42,298	—
		23,616,344	30,476,172	30,503,054
Provision of utility services to:	(ii)			
Chinalco and its subsidiaries	(ix)	687,290	1,104,542	910,655
Associates of Chinalco		4,062	3,268	14,380
Joint ventures		263,436	470,984	250,525
Associates		35,650	18,568	375
		990,438	1,597,362	1,175,935
Rental revenue of land use rights and buildings from:	(vi)			
Chinalco and its subsidiaries	(ix)	52,571	39,284	34,221
Associates of Chinalco		65	237	237
Joint ventures		1,967	1,426	1,446
Associates		775	365	507
		55,378	41,312	36,411
Purchases of goods and services:				
Purchases of engineering, construction and supervisory services from:	(iii)			
Chinalco and its subsidiaries	(ix)	2,949,866	1,755,092	746,966
Associates of Chinalco		—	265	192
Joint ventures		69,332	—	251
Associates		218,616	12,233	12,413
		3,237,814	1,767,590	759,822
Provision of social services and logistics services by:	(v)			
Chinalco and its subsidiaries	(ix)	309,180	475,532	480,828
		309,180	475,532	480,828
Purchases of primary and auxiliary materials, equipment and finished goods from:				
Chinalco and its subsidiaries	(iv)	8,161,223	6,176,513	5,526,965
Associates of Chinalco	(ix)	18	2,586	37,187
Joint ventures		2,647,234	5,501,158	8,141,929
Associates		1,893,449	10,576,907	7,407,805
Non-controlling shareholder of a subsidiary and its subsidiaries		—	30,101	—
		12,701,924	22,287,265	21,113,886
Purchases of utility services from:	(ii)			
Chinalco and its subsidiaries	(ix)	763,812	644,638	731,222
Associates of Chinalco		100,835	85,469	98,966
Joint ventures		280,523	443,290	820,031
Associates		8,326	—	—
		1,153,496	1,173,397	1,650,219
Purchases of other services by:	(vii)			
A joint venture		272,220	373,655	270,972
		272,220	373,655	270,972
Rental expense of land use rights and buildings from:	(vi)			
Chinalco and its subsidiaries	(ix)	499,191	661,888	734,097
		499,191	661,888	734,097

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36 SIGNIFICANT RELATED PARTY TRANSACTIONS AND BALANCES (CONTINUED)

(a) Significant related party transactions (Continued)

	Notes	For the years ended December 31 2019	2020 (Restated)	2021
New right-of-use assets in current period				
Additions				
Chinalco and its subsidiaries		1,950	22,936	83,249
Contract modification				
Chinalco and its subsidiaries		(91,351)	(43,395)	6,147,096
Other significant related party transactions:				
Borrowing from subsidiaries of Chinalco	(viii), (ix)	3,890,000	1,925,000	3,370,000
Repayment of borrowings from subsidiaries of Chinalco	(viii)	4,677,000	1,676,000	5,318,000
Interest expense on borrowings, discounted notes and factoring arrangement from subsidiaries of Chinalco		141,991	87,985	61,878
Investment in subsidiaries of Chinalco		2,137,608	—	320,000
Disposal of aluminum capacity quota to a subsidiary of Chinalco		800,000	—	—
Disposal of assets under a sale and leaseback contract to a subsidiary of Chinalco	(x)	500,000	—	—
Finance lease under a sale and leaseback contract from a subsidiary of Chinalco	(x), (ix)	558,924	—	—
Trade receivable factoring arrangement from a subsidiary of Chinalco	(ix)	136,656	—	1,566,707
Interest income from cash and cash equivalents deposited	(viii)	68,455	51,163	67,269
Discounted notes receivable to a subsidiary of Chinalco	(viii)	679,517	36,750	128,000
Provision of financial guarantees to a joint venture		12,450	—	—

All transactions with related parties were conducted at prices and on terms mutually agreed by the parties involved, which are determined as follows:

(i) Sales of materials and finished goods comprised sales of alumina, primary aluminum, copper and scrap materials. Transactions entered into are covered by general agreements on a mutual provision of production supplies and ancillary services. The pricing policy is summarized below:

1. The price prescribed by the PRC government ("state-prescribed price") is adopted;
2. If there is no state-prescribed price, state-guidance price is adopted;
3. If there is neither state-prescribed price nor state-guidance price, then the market price (being price charged to and from independent third parties) is adopted; and
4. If none of the above is available, then the adoption of a contractual price (being reasonable costs incurred in providing the relevant services plus not more than 5% of such costs is adopted).

(ii) Utility services, including electricity, gas, heat and water, are provided at the state-prescribed price.

(iii) Engineering, project construction and supervisory services were provided for construction projects. The state-guidance price or prevailing market price (including the tender price where by way of tender) is adopted for pricing purposes.

(iv) The pricing policy for purchases of key and auxiliary materials (including bauxite, limestone, carbon, cement and coal) is the same as that set out in (i) above.

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36 SIGNIFICANT RELATED PARTY TRANSACTIONS AND BALANCES (CONTINUED)

(a) Significant related party transactions (Continued)

(v) Social services and logistics services provided by Chinalco Group cover public security, fire services, education and training, school and hospital services, cultural and physical education, newspaper and magazines, broadcasting and printing as well as property management, environmental and hygiene, greenery, nurseries and kindergartens, sanatoriums, canteens and offices, public transport and retirement management and other services. Provisions of these services are covered by the Comprehensive Social and Logistics Services Agreement. The pricing policy is the same as that set out in (i) above.

(vi) Pursuant to the Land Use Right Lease Agreements entered into between the Group and Chinalco Group, operating leases for industrial or commercial land are charged at the market rent rate. The Group also entered into a building rental agreement with Chinalco Group and paid rents based on the market rate for its lease of buildings owned by Chinalco.

(vii) Other services are environmental protection operation services. The prevailing market price is adopted for pricing purposes.

(viii) Chinalco Finance Company Limited (“Chinalco Finance”) (中鋁財務有限責任公司), a wholly-owned subsidiary of Chinalco and a non-bank financial institution established in the PRC, provides deposit services, credit services and miscellaneous financial services to the Group. The terms for the provision of financial services to the Group are no less favorable than those of the same type of financial services provided by Chinalco Finance to Chinalco and other members of its group or those of the same type of financial services that may be provided to the Group by other financial institutions.

As of December 31, 2021, the Group derecognized accounts receivable of RMB1,650 million (December 31, 2020: Nil, December 31 2019: RMB137 million) by factoring transaction with Chinalco Finance, and the related fees incurred were RMB83 million recognized in other losses (December 31, 2020: Nil, December 31 2019: RMB5 million).

(ix) These related party transactions also constitute connected transactions or continuing connected transactions as defined in Chapter 14A of the Listing Rules.

In September 2021, Pursuant to the agreement entered into between China Rare Earth Co., Ltd. (“China Rare Earth”, “中國稀有稀土有限公司”，a subsidiary of Chinalco), Zunyi Aluminum Co., Ltd. (“Zunyi Aluminum”, “遵義鋁業股份有限公司”, “ a subsidiary of the Company”), Chalco Mining Co., Ltd. (“Chalco Mining”, “中鋁礦業有限公司”, “a subsidiary of the Company”), the Group acquired the gallium business of China Rare Earth for a consideration of RMB396 million in cash. This transaction is regarded as a business combination under common control.

The English names represent the best effort made by management of the Group in translating the Chinese names of the companies as they do not have any official English names.

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36 SIGNIFICANT RELATED PARTY TRANSACTIONS AND BALANCES (CONTINUED)

(b) Balances with related parties

Other than those disclosed elsewhere in the consolidated financial statements, the outstanding balances with related parties at the year-end are as follows:

	December 31, 2020 (Restated)	December 31, 2021
Cash and cash equivalents deposited with		
A subsidiary of Chinalco (i)	3,561,997	7,832,441
Trade and notes receivables		
Chinalco and its subsidiaries	762,489	1,476,833
Associates of Chinalco	44,958	45,180
Joint ventures	761,392	628,231
Associates	2,287	1
Non-controlling shareholder of a subsidiary and its subsidiaries	46,450	24,465
	1,617,576	2,174,710
Provision for impairment of receivables	(103,592)	(80,102)
	1,513,984	2,094,608

(i) On August 26, 2011, the Company entered into an agreement with Chinalco Finance, pursuant to which, Chinalco Finance agreed to provide deposit services, credit services and other financial services to the Group. On August 24, 2012, April 28, 2015, October 26, 2017 and April 27, 2020, the Company renewed the financial service agreement with Chinalco Finance with a validation term of three years ending October 25, 2023.

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36 SIGNIFICANT RELATED PARTY TRANSACTIONS AND BALANCES (CONTINUED)

(b) Balances with related parties (Continued)

	December 31, 2020 (Restated)	December 31, 2021
Other current assets		
Chinalco and its subsidiaries	818,318	325,247
Associates of Chinalco	21,753	21,820
Joint ventures	1,364,615	1,486,510
Associates	421,947	359,917
Non-controlling shareholder of a subsidiary and its subsidiaries	11,700	7,450
Provision for impairment of other current assets	(496,703)	(1,310,379)
	2,141,630	890,565
Other non-current assets		
Associates	111,845	111,845
Interest-bearing loans and borrowings:		
Subsidiaries of Chinalco (including lease liabilities)	8,887,422	13,028,565
Associates of Chinalco	—	2,245
	8,887,422	13,030,810
Trade and notes payables		
Chinalco and its subsidiaries	437,732	301,386
Associates of Chinalco	1,511	26,288
Joint ventures	561,508	229,994
Associates	10,562	32,668
Non-controlling shareholder of a subsidiary and its subsidiaries	—	105,174
	1,011,313	695,510
Other payables and accrued liabilities		
Chinalco and its subsidiaries	2,193,344	1,054,724
Associates of Chinalco	1,019	42,659
Associates	28,424	19,926
Joint ventures	3,940	49,618
	2,226,727	1,166,927
Contract liabilities:		
Chinalco and its subsidiaries	17,460	150,730
Associates of Chinalco	13,453	27,190
Associates	79	139
Joint ventures	519	535
Non-controlling shareholder of subsidiary and its subsidiaries	656	—
	32,167	178,594

As of December 31, 2021, included in long-term loans and borrowings and short-term loans and borrowings were from other state-owned enterprises amounting to RMB37,287 million (December 31, 2020: RMB35,029 million) and RMB4,906 million (December 31, 2020: RMB29,781 million), respectively.

The terms of all balances were unsecured.

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36 SIGNIFICANT RELATED PARTY TRANSACTIONS AND BALANCES (CONTINUED)

(c) Compensation of key management personnel

	For the years ended December 31		
	2019	**2020**	**2021**
Fees	780	683	580
Basic salaries, housing fund, other allowances and benefits in kind	6,945	5,810	6,225
Pension costs	715	301	634
	8,440	6,794	7,439

Key management includes directors, supervisors and members of senior management.

(d) Commitments with related parties

As of December 31, 2021 and 2020, except for the other capital commitments disclosed in Note 43(b) to these financial statements, the Group had no significant commitments with related parties.

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37 FINANCIAL AND CAPITAL RISK MANAGEMENT

37.1 Financial risk management

The Group's activities expose it to a variety of financial risks, including market risk (including foreign currency risk, interest rate risk and commodity price risk), credit risk and liquidity risk. The Group's overall risk management program focuses on the unpredictability of financial markets and seeks to minimize the potential adverse effects on the Group's financial performance.

Risk management is carried out by the treasury management department (the "Group Treasury") under policies approved by the Board of Directors of the Company. The Group Treasury identifies, evaluates and hedges financial risks through close cooperation with the Group's operating units.

(a) Market risk

(i) Foreign currency risk

The Group's foreign currency risk arose from transaction conducted in currency other than the functional currency of the group entities. The Group's foreign currency risk primarily arises from foreign currency deposits, trade receivables, trade payables and short-term and long-term loans denominated in United States dollars ("USD"), Euro ("EUR"), Japanese yen ("JPY"), and Hong Kong dollars ("HKD"). Related exposures are disclosed in Notes 16, 14, 23, 15 and 19 to the financial statements, respectively. The Group Treasury closely monitors the international foreign currency market on the change of exchange rates and takes these into consideration when investing in foreign currency deposits and borrowing loans. As of December 31, 2021, the Group only had significant exposure to USD.

As of December 31, 2021, if RMB had strengthened/weakened by 5% against USD with all other variables held constant, the profit for the year would have been approximately RMB28 million higher/lower (2020: RMB74 million higher/lower), mainly as a result of foreign exchange gains and losses arising from translation of USD denominated borrowings, other payables and medium term notes.

As the assets and liabilities denominated in other foreign currencies other than USD were relatively minimal to the total assets and liabilities of the Group, the directors of the Company are of the opinion that the Group was not exposed to significant foreign currency risk arising from other assets and liabilities denominated in currency other than the functional currency of the group entities as of December 31, 2021 and 2020.

(Amounts expressed in thousands of RMB unless otherwise stated)

37 FINANCIAL AND CAPITAL RISK MANAGEMENT (CONTINUED)

37.1 Financial risk management (Continued)

(a) Market risk (Continued)

(ii) Interest rate risk

As of December 31, 2021 and 2020, as the Group had no significant interest-bearing assets or liabilities except for bank deposits (Note 16), entrusted loans (Note 15) and Interest-bearing loans (Note 19).

Most of the bank deposits are maintained in savings and time deposit accounts in the PRC. The interest rates are regulated by the People's Bank of China and the Group Treasury closely monitors the fluctuation on such rates periodically. The interest rates of entrusted loans are fixed. As the interest rates applied to the entrusted loans were fixed, the directors of the Company are of the opinion that the Group was not exposed to any significant interest rate risk for its financial assets held as of December 31, 2021 and 2020.

The interest rate risk for the Group's financial liabilities primarily arises from interest-bearing loans. Loans borrowed at floating interest rates expose the Group to cash flow interest rate risk. The Group enters into debt obligations to support general corporate purposes including capital expenditures and working capital needs. The Group Treasury closely monitors market interest rates and maintains a balance between variable rate and fixed rate borrowings in order to reduce the exposures to the interest rate risk described above.

As of December 31, 2021, if interest rates had been 100 basis points (December 31, 2020: 100 basis points) higher/lower for bank and other loans borrowed at floating interest rates with all other variables held constant, net profit for the year would have been RMB421 million lower/higher (2020: RMB430 million), respectively, mainly as a result of the higher/ lower interest expense on floating rate borrowings.

The fair value interest rate risk of the Group mainly arises from medium term notes and short term bonds issued at fixed rates. As the fluctuation of comparable interest rates of corporate bonds with similar terms was relatively low, the directors of the Company are of the opinion that the Group was not exposed to any significant fair value interest rate risk for its fixed interest rate borrowings held as of December 31, 2021 and 2020.

(iii) Commodity price risk

The Group uses futures and option contracts to reduce its exposure to fluctuations in the price of primary aluminum and other products. The Group uses the futures contract for offsetting other than speculation. With reference to the hedging of primary aluminum, production company hedges the output of primary aluminum and trading company hedges the quantities of buyout and self-supporting.

The Group uses mainly futures contracts and option contracts traded on the Shanghai Futures Exchange and London Metal Exchange ("LME") to hedge against fluctuations in primary aluminum prices. As of December 31, 2021, the fair values of the outstanding futures contracts amounting to RMB0 million (December 31, 2020: RMB17 million) and RMB69 million (December 31, 2020: RMB27 million) were recognized in financial assets and financial liabilities at fair value through profit or loss, respectively.

As of December 31, 2021, if the commodity futures prices had increased/ decreased by 3% (December 31, 2020: 3%) and all other variables held constant, profit for the year would have changed by the amounts shown below:

	December 31, 2021	December 31, 2020
Primary aluminum	Decrease/increase RMB6 million	Decrease/increase RMB5 million

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37 FINANCIAL AND CAPITAL RISK MANAGEMENT (CONTINUED)

37.1 Financial risk management (Continued)

(b) Credit risk

Credit risk arises from balances with banks and financial institutions, trade and notes receivables, other current and non-current receivables as well as credit exposures of customers, including outstanding receivables and committed transactions.

The Group maintains substantially all of its bank balances and cash and short-term investments in several major state-owned banks in the PRC. With strong support from the PRC government to these state-owned banks, the directors of the Company are of the opinion that there is no significant credit risk on such assets being exposed to losses.

The Group applies the simplified approach to most of its trade receivables to provide for expected credit losses prescribed by IFRS 9, which permits the use of the lifetime expected loss provision for trade receivables. The Group has made individual assessment for trade receivables from clients with top rating and those receivables with pledged assets separately and impairment provisions are made.

To measure the expected credit losses of trade receivables other than those assessed individually as mentioned above, trade receivables have been grouped based on shared credit risk characteristics and the days past due. The expected credit loss model also incorporates forward-looking information.

For other current and non-current receivables, the Group considers the probability of default upon initial recognition of an asset and whether there has been a significant increase in credit risk on an ongoing basis throughout each reporting period. To assess whether there is a significant increase in credit risk the company compares the risk of a default occurring on the asset as of the reporting date with the risk of default as of the date of initial recognition. It considers available reasonable and supportive forwarding-looking information. Especially the following indicators are incorporated:

- internal credit rating
- external credit rating
- actual or expected significant adverse changes in business, financial or economic conditions that are expected to cause a significant change to the borrower’s ability to meet its obligations
- actual or expected significant changes in the operating results of individual clients
- significant changes in the expected performance and behavior of the clients

The Group measures expected credit loss rates on the basis of a loss rate approach by segmenting its portfolio into appropriate groupings based on shared credit risk characteristics. At the end of each year, the Group updates its historical loss information with forward-looking information. As the historical credit loss rates were comparatively stable and no significant changes were expected to the forward-looking information after the consideration of reasonable and supportable forecasts of comparatively stable customer relationship and customers’ credit ratings, the expected credit loss rates remained consistent during 2021.

(Amounts expressed in thousands of RMB unless otherwise stated)

37 FINANCIAL AND CAPITAL RISK MANAGEMENT (CONTINUED)

37.1 Financial risk management (Continued)

(b) Credit risk (Continued)

The table below shows the credit quality and the maximum exposure to credit risk based on the Group's credit policy, which is mainly based on past due information unless other information is available without undue cost or effort, and year-end staging classification as of December 31, 2021. The amounts presented are carrying amounts for financial assets and the exposure to credit risk for the financial guarantee contracts.

	Stage 1	Stage 2	Stage 3	Simplified	Total
Trade receivables	—	—	—	3,066,654	3,066,654
Financial assets in other current assets	1,940,482	180,611	153,814	—	2,274,907
Restricted cash	1,324,748	—	—	—	1,324,748
Notes receivable	—	—	—	3,838,196	3,838,196
Cash and cash equivalents	17,853,244	—	—	—	17,853,244
Financial assets in other non-current assets	111,848	—	—	—	111,848
Total	21,230,322	180,611	153,814	6,904,850	28,469,597

The carrying amounts of short-term investments and these receivables included in Notes 12, 14, 15 and 16 represent the Group's maximum exposure to credit risk in relation to its financial assets. The directors of the Company are of the opinion that the Group was not exposed to any significant concentration of credit risk as of December 31, 2021 and 2020.

(c) Liquidity risk

Cash flow forecast is performed in the operating entities of the Group and aggregated by the Group Treasury. The Group Treasury monitors rolling forecasts of the Group's liquidity requirements to ensure it has sufficient cash to meet operational needs while maintaining sufficient headroom on its undrawn committed borrowing facilities at all times so that the Group does not breach borrowing limits or covenants (where applicable) on any of its borrowing facilities. This forecast takes into consideration of the Group's debt financing plans, covenant compliance, compliance with internal balance sheet ratio targets and, if applicable, external regulatory or legal requirements, for example, currency restrictions.

Management also monitors rolling forecasts of the Group's liquidity reserve on the basis of expected cash flows.

As of December 31, 2021, the Group's current liabilities exceeded its current assets by approximately RMB3,467 million (December 31, 2020 (restated): RMB16,364 million), please refer to Note 2.1.2 for the assessment made by the Company.

The table below analyses the maturity profile of the Group's financial liabilities as of the end of the reporting period. The amounts disclosed in the table are the contractual undiscounted cash flows.

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37 FINANCIAL AND CAPITAL RISK MANAGEMENT (CONTINUED)

37.1 Financial risk management (Continued)

(c) Liquidity risk (Continued)

	Within 1 year	1 to 2 years	2 to 5 years	Over 5 years	Total
As of December 31, 2021					
Lease liabilities, including current portion	1,590,204	1,473,711	4,347,713	15,394,370	22,805,998
Long-term bank and other loans, including current portion	5,859,115	11,837,652	9,771,437	14,656,982	42,125,186
Medium-term notes and bonds, including current portion	3,000,000	4,400,000	9,875,700	2,000,000	19,275,700
Short-term bonds	5,400,000	—	—	—	5,400,000
Short-term bank and other loans	9,219,330	—	—	—	9,219,330
Interest payables for loans and borrowings	2,620,867	2,147,795	3,941,541	1,680,396	10,390,599
Financial liabilities at fair value through profit or loss	68,871	—	—	—	68,871
Financial liabilities included other payables and accrued liabilities, excluding accrued interest	6,497,831	—	—	—	6,497,831
Financial liabilities included in other non-current liabilities	234,900	202,231	147,002	885,208	1,469,341
Trade and notes payables	15,505,443	—	—	—	15,505,443
	49,996,561	20,061,389	28,083,393	34,616,956	132,758,299

	Within 1 year	1 to 2 years	2 to 5 years	Over 5 years	Total
As of December 31, 2020 (Restated)					
Lease liabilities, including current portion	1,151,332	473,410	1,263,824	9,708,710	12,597,276
Long-term bank and other loans, including current portion	3,629,014	6,702,688	15,638,088	17,044,774	43,014,564
Medium-term notes and bonds, including current portion	7,109,960	3,000,000	6,900,000	2,000,000	19,009,960
Short-term bonds	2,400,000	—	—	—	2,400,000
Short-term bank and other loans	20,738,030	—	—	—	20,738,030
Interest payables for loans and borrowings	2,935,356	2,105,844	4,046,106	2,039,075	11,126,381
Financial liabilities at fair value through profit or loss	26,684	—	—	—	26,684
Financial liabilities included other payables and accrued liabilities, excluding accrued interest	7,972,469	—	—	—	7,972,469
Financial liabilities included in other non-current liabilities	460,101	194,609	74,367	767,941	1,497,018
Trade and notes payables	15,444,354	—	—	—	15,444,354
	61,867,300	12,476,551	27,922,385	31,560,500	133,826,736

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37 FINANCIAL AND CAPITAL RISK MANAGEMENT (CONTINUED)

37.2 Financial instruments

(a) Financial instruments by category

The carrying amounts of each of the categories of financial instruments of the Group as of the end of the reporting period are as follows:

Financial assets

	As of December 31, 2021				
	Financial assets at fair value through profit or loss-held for trading	Financial assets at amortized cost	Equity instruments at fair value through other comprehensive income	Debt instruments at fair value through other comprehensive income	Total
Current					
Trade receivables	—	3,066,654	—	—	3,066,654
Notes receivable	—	1,140,930	—	2,697,266	3,838,196
Restricted cash	—	1,324,748	—	—	1,324,748
Cash and cash equivalents	—	17,853,244	—	—	17,853,244
Financial assets included in other current assets	—	2,274,907	—	—	2,274,907
Subtotal	—	25,660,483	—	2,697,266	28,357,749
Non-current					
Other financial assets measured at fair value	—	—	239,538	—	239,538
Other non-current assets	—	111,848	—	—	111,848
Subtotal	—	111,848	239,538	—	351,386
Total	—	25,772,331	239,538	2,697,266	28,709,135

Financial liabilities

	As of December 31, 2021		
	Financial assets at fair value through profit or loss-held for trading	Financial liabilities at amortized cost	Total
Current			
Financial liabilities at fair value through profit or loss	68,871	—	68,871
Interest-bearing loans and borrowings	—	24,506,122	24,506,122
Financial liabilities included in other payables and accrued liabilities (Note 22)	—	7,166,216	7,166,216
Trade and notes payables	—	15,505,443	15,505,443
Subtotal	68,871	47,177,781	47,246,652
Non-current			
Financial liabilities included in other non-current liabilities (Note 21)	—	880,864	880,864
Interest-bearing loans and borrowings	—	64,095,849	64,095,849
Subtotal	—	64,976,713	64,976,713
Total	68,871	112,154,494	112,223,365

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37 FINANCIAL AND CAPITAL RISK MANAGEMENT (CONTINUED)

37.2 Financial instruments (Continued)

(a) Financial instruments by category (Continued)

Financial assets

	As of December 31, 2020 (Restated)				
	Financial assets at fair value through profit or loss-held for trading	Financial assets at amortized cost	Equity instruments at fair value through other comprehensive income	Debt instruments at fair value through other comprehensive income	Total
Current					
Trade receivables	—	4,753,210	—	—	4,753,210
Notes receivable	—	—	—	4,560,437	4,560,437
Financial assets at fair value through profit or loss	17,311	—	—	—	17,311
Restricted cash	—	1,056,037	—	—	1,056,037
Cash and cash equivalents	—	9,671,477	—	—	9,671,477
Financial assets included in other current assets	—	3,982,308	—	—	3,982,308
Subtotal	17,311	19,463,032	—	4,560,437	24,040,780
Non-current					
Other financial assets measured at fair value	—	—	1,526,703	—	1,526,703
Other non-current assets	—	127,754	—	—	127,754
Subtotal	—	127,754	1,526,703	—	1,654,457
Total	17,311	19,590,786	1,526,703	4,560,437	25,695,237

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37 FINANCIAL AND CAPITAL RISK MANAGEMENT (CONTINUED)

37.2 Financial instruments (Continued)

(a) Financial instruments by category (Continued)

Financial Liabilities

	As of December 31, 2020 (Restated)		
	Financial assets at fair value through profit or loss- held for trading	Financial liabilities at amortized cost	Total
Current			
Financial liabilities at fair value through profit or loss	26,684	—	26,684
Interest-bearing loans and borrowings	—	34,707,283	34,707,283
Financial liabilities included in other payables and accrued liabilities (Note 22)	—	8,965,952	8,965,952
Trade and notes payables	—	15,444,354	15,444,354
Subtotal	26,684	59,117,589	59,144,273
Non-current			
Financial liabilities included in other non- current liabilities (Note 21)	—	1,036,917	1,036,917
Interest-bearing loans and borrowings	—	57,518,097	57,518,097
Subtotal	—	58,555,014	58,555,014
Total	26,684	117,672,603	117,699,287

(b) Fair value and fair value hierarchy

Fair value

The carrying amounts and fair values of the Group's financial instruments at amortized cost, other than those with carrying amounts that reasonably approximate to fair values and those carried at fair value, are as follows:

	Carrying amounts		Fair values	
	December 31, 2020	December 31, 2021	December 31, 2020	December 31, 2021
Financial liabilities				
Financial liabilities included in other non-current liabilities (Note 21)	880,864	1,036,917	767,922	903,141
Long-term interest-bearing loans and borrowings, excluding lease liability (Note 19)	52,489,058	51,260,218	49,233,629	49,729,548
	53,369,922	52,297,135	50,001,551	50,632,689

Except for financial assets and financial liabilities mentioned above, management has assessed that the fair values of cash and cash equivalents, restricted cash and time deposits, trade and notes receivables, financial assets included in other current assets, entrusted loans, trade and notes payables, financial liabilities included in other payables and accrued liabilities, short-term and the current portion of interest-bearing loans and borrowings, interest payable and the current portion of long-term payables approximate to their carrying amounts largely due to the short term maturities of these instruments.

The fair values of the financial assets and liabilities are included at the amount at which the instrument could be exchanged in a current transaction between willing parties, other than in a forced or liquidation sale.

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37 FINANCIAL AND CAPITAL RISK MANAGEMENT (CONTINUED)

37.2 Financial instruments (Continued)

(b) Fair value and fair value hierarchy (Continued)

The fair values of the financial assets included in other non-current assets and financial liabilities included in other non-current liabilities and long-term interest bearing loans and borrowings have been calculated by discounting the expected future cash flows using rates currently available for instruments on with similar terms, credit risk and remaining maturities.

The Group's own non-performance risk for financial liabilities included in other non-current liabilities and long-term interest-bearing loans and borrowings as of December 31, 2021 and 2020 were assessed to be insignificant.

Fair value hierarchy

The following tables illustrate the fair value measurement hierarchy of the Group's financial instruments:

Assets measured at fair value

As of December 31, 2021	Fair value measurement using			
	Quoted prices in active markets (Level 1)	Significant observable inputs (Level 2)	Significant unobservable inputs (Level 3)	Total
Financial assets at fair value through profit or loss:				
Notes receivable	—	—	2,697,266	2,697,266
Listed equity investments	7,674	—	—	7,674
Other unlisted investment	—	—	231,864	231,864
	7,674	—	2,929,130	2,936,804

As of December 31, 2020	Fair value measurement using			
	Quoted prices in active markets (Level 1)	Significant observable inputs (Level 2)	Significant unobservable inputs (Level 3)	Total
Financial assets at fair value through profit or loss:				
Futures contracts	17,311	—	—	17,311
Notes receivable	—	—	3,343,880	3,343,880
Listed equity investments	8,812	—	—	8,812
Other unlisted investment	—	—	1,517,891	1,517,891
	26,123	—	4,861,771	4,887,894

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37 FINANCIAL AND CAPITAL RISK MANAGEMENT (CONTINUED)

37.2 Financial instruments (Continued)

(b) Fair value and fair value hierarchy (Continued)

Liabilities measured at fair value

As of December 31, 2021	Fair value measurement using Quoted prices in active markets (Level 1)	Significant observable inputs (Level 2)	Significant unobservable inputs (Level 3)	Total
Financial liabilities at fair value through profit or loss: Futures contracts	68,871	—	—	68,871
	68,871	—	—	68,871

As of December 31, 2020	Fair value measurement using Quoted prices in active markets (Level 1)	Significant observable inputs (Level 2)	Significant unobservable inputs (Level 3)	Total
Financial liabilities at fair value through profit or loss: Futures contracts	26,684	—	—	26,684
	26,684	—	—	26,684

Liabilities for which fair values are disclosed：

As of December 31, 2021	Fair value measurement using Quoted prices in active markets (Level 1)	Significant observable inputs (Level 2)	Significant unobservable inputs (Level 3)	Total
Financial liabilities at amortized cost:				
Financial liabilities included in other non-current liabilities	—	767,922	—	767,922
Long-term interest-bearing loans and borrowings	—	49,233,629	—	49,233,629
	—	50,001,551	—	50,001,551

As of December 31, 2020	Fair value measurement using Quoted prices in active markets (Level 1)	Significant observable inputs (Level 2)	Significant unobservable inputs (Level 3)	Total
Financial liabilities at amortized cost:				
Financial liabilities included in other non-current liabilities	—	903,141	—	903,141
Long-term interest-bearing loans and borrowings	—	49,729,548	—	49,729,548
	—	50,632,689	—	50,632,689

During the year ended December 31, 2021 the Group had no transfers of fair value measurements between Level 1 and Level 2 and no transfers into or out of Level 3 for both financial assets and financial liabilities (2020: Nil).

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37 FINANCIAL AND CAPITAL RISK MANAGEMENT (CONTINUED)

37.2 Financial instruments (Continued)

(b) Fair value and fair value hierarchy (Continued)

Below is a summary of significant unobservable inputs to the valuation of financial instruments as of December 31, 2021:

	Valuation Technique	Significant unobservable input
Other equity investments		
December 31, 2021	Discounted Cashflow model	Discounted rate
Notes receivable		
December 31, 2021	Discounted Cashflow model	Discounted rate

37.3 Capital risk management

The Group's capital management objectives are to safeguard the Group's ability to continue as a going concern in order to provide returns for shareholders and benefits for other stakeholders, and to maintain an optimal capital structure to reduce the cost of capital.

In order to maintain or adjust the capital structure, the Group may adjust the amount of dividends paid to shareholders, issue new shares or sell assets to reduce debts.

Consistent with other entities in the industry, the Group monitors capital on the basis of its gearing ratio. This ratio is calculated as net debt divided by total capital. Net debt is calculated as total liabilities (excluding deferred tax liabilities, income tax payable and deferred government grants) less restricted cash, time deposits and cash and cash equivalents. Total capital is calculated as equity, as shown in the consolidated statement of financial position, plus net debt less non-controlling interests.

The gearing ratio as of December 31, 2020 and 2021 are as follows:

	December 31, 2020 (Restated)	December 31, 2021
Total liabilities (excluding deferred tax liabilities, income tax payable and deferred government grants)	121,816,774	117,492,000
Less: Restricted cash and cash and cash equivalents	10,727,514	19,177,992
Net debt	111,089,260	98,314,008
Total equity	71,305,164	72,783,497
Add: Net debt	111,089,260	98,314,008
Less: Non-controlling interests	16,855,847	15,518,810
Total capital attributable to owners of the Company	165,538,577	155,578,695
Gearing ratio	67 %	63 %

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38 NON - CONTROLLING INTERESTS

Other than the senior perpetual securities issued by a subsidiary of the Group that presented as non-controlling interests in the consolidated financial statements and disclosed in Note 40, details of the Group's subsidiaries that have material non-controlling interests are set out below:

	December 31, 2020	December 31, 2021
Percentage of equity interest held by non-controlling interests		
Ningxia Energy	29.18 %	29.18 %
Shanxi Zhongrun	60.00 %	60.00 %
Guizhou Huaren	60.00 %	60.00 %
Profit/(loss) for the year allocated to non-controlling interests		
Ningxia Energy	48,040	(90,237)
Shanxi Zhongrun	147,747	745,212
Guizhou Huaren	420,737	558,020
Dividends distributed to non-controlling interests		
Ningxia Energy	—	115,380
Shanxi Zhongrun	—	—
Guizhou Huaren	—	252,837
Accumulated balances of non-controlling interests at the year end		
Ningxia Energy	5,178,314	5,055,069
Shanxi Zhongrun	1,277,602	2,020,621
Guizhou Huaren	1,359,716	1,642,061

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38 NON - CONTROLLING INTERESTS (CONTINUED)

The following tables illustrate the summarized financial information of the above subsidiaries. The amounts disclosed are before any inter-company eliminations:

	Ningxia Energy	
	2020	2021
Revenue	6,932,708	7,670,316
Total expenses	6,768,073	7,979,557
Profit for the year	164,635	(309,241)
Total comprehensive (loss)/ income for the year	164,635	(309,241)
Current assets	6,037,632	2,912,805
Non-current assets	31,242,070	29,086,775
Current liabilities	9,779,461	8,256,229
Non-current liabilities	16,256,073	12,710,354
Net cash flows from operating activities	2,617,463	5,458,921
Net cash flows used in investing activities	(652,297)	(802,678)
Net cash flows used in financing activities	(1,792,661)	(5,381,480)
Effect of foreign exchange rate changes, net	—	—
Net (decrease)/increase in cash and cash equivalents	172,505	(725,237)

	Shanxi Zhongrun	
	2020	2021
Revenue	3,561,831	8,028,780
Total expenses	3,315,585	6,786,760
Profit for the year	246,246	1,242,020
Total comprehensive income for the year	246,246	1,242,020
Current assets	643,121	375,567
Non-current assets	4,138,211	3,945,351
Current liabilities	2,595,397	890,245
Non-current liabilities	45,365	25,773
Net cash flows from operating activities	418,528	1,895,610
Net cash flows used in investing activities	(188,504)	(365,340)
Net cash flows used in financing activities	(404,548)	(1,530,330)
Effect of foreign exchange rate changes, net	—	—
Net decrease in cash and cash equivalents	(174,524)	(60)

ALUMINUM CORPORATION OF CHINA LIMITED
NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

For the years ended December 31, 2019 ,2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

38 NON - CONTROLLING INTERESTS (CONTINUED)

	Guizhou Huaren	
	2020	2021
Revenue	6,094,811	7,284,585
Total expenses	5,393,582	6,354,551
Profit for the year	701,229	930,034
Total comprehensive income for the year	701,229	930,034
Current assets	1,610,363	2,150,014
Non-current assets	2,601,807	2,529,274
Current liabilities	1,003,650	1,026,955
Non-current liabilities	932,570	530,531
Net cash flows from operating activities	992,304	1,677,338
Net cash flows used in investing activities	(27,475)	(16,069)
Net cash flows used in financing activities	(612,892)	(974,588)
Effect of foreign exchange rate changes, net	—	—
Net increase in cash and cash equivalents	351,937	686,681

39 BUSINESS COMBINATION UNDER COMMON CONTROL

(a) Acquisition of gallium business

In September 2021, Pursuant to the agreement entered into between China Rare Earth, Zunyi Aluminum and Chalco Mining, the Group acquired the gallium business of China Rare Earth, a subsidiary of Chinalco, for a cash consideration of RMB396 million. This transaction is regarded as a business combination under common control. The consolidated financial statements for the year ended December 31, 2021 has combined the financial statements of the acquired gallium business from the beginning of the earliest period presented (Note 2.3(a)). The comparative financial data have been restated accordingly.

Revenue and net profit of the gallium business for the period from January 1, 2021 to the acquisition date and for the year ended December 31, 2020 are as follows:

	For the period from January 1, 2021 to the acquisition date	2020
Revenue	178,229	112,428
Net profit	32,315	26,219

Details of the purchase consideration, the net assets acquired are as follows:

Purchase consideration:	
Cash paid	395,624
Total purchase consideration	395,624

ALUMINUM CORPORATION OF CHINA LIMITED
NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

For the years ended December 31, 2019 ,2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

39 BUSINESS COMBINATION UNDER COMMON CONTROL (CONTINUED)

(a) Acquisition of gallium business (continued)

The carrying amounts of assets, liabilities and equity of the gallium business at the acquisition date and December 31, 2020 are as follows:

	Acquisition date	December 31, 2020
Current assets	103,353	66,215
Non-current assets	70,660	74,270
Current liabilities	(3,770)	(7,037)
Non-current liabilities	(4,480)	—
Net assets – closing balance	165,763	133,448
Net assets – beginning balance	133,448	95,389

The adjustment on the beginning balance of the Group's total equity amounting to RMB95 million and RMB133 million for the year ended December 31, 2020 and 2021, respectively, represented the net assets of the gallium business at the same date which were combined to the consolidated balance sheet of the Group. The consideration of RMB396 million paid in 2021 was treated as a decrease in capital reserves.

(b) Acquisition of Henan Zhongzhou Logistics

In April 2020, pursuant to the agreement entered into between Chalco Logistics Group Zhongzhou Co., Ltd. ("Chalco Logistics Zhongzhou", "中鋁物流集團中州有限公司", a subsidiary of Chalco Logistics), Henan Zhongzhou Logistics Co., Ltd. ("Henan Zhongzhou Logistics", "河南中州物流有限公司", a subsidiary of Zhongzhou Aluminum Factory prior of the transaction), Chalco Logistics Group Co., Ltd. ("Chalco Logistics", "中鋁物流集團有限公司", a subsidiary of the Company), Henan Zhongzhou Aluminum Factory Co., Ltd. ("Zhongzhou Aluminum Factory", "河南中州鋁廠有限公司", a subsidiary of Chinalco) and Chalco Zhongzhou Aluminum Industry Co., Ltd. ("Zhongzhou Aluminum Industry", "中鋁中州鋁業有限公司"), Chalco Logistics Zhongzhou merged Henan Zhongzhou Logistics, which was a 100% owned subsidiary of Zhongzhou Aluminum Factory prior to the transaction, by issuing new shares of Chalco Logistics Zhongzhou to Zhongzhou Aluminum Factory.

(c) Acquisition of Chongqing Xinan Transportation

Pursuant to the agreement entered into between Chalco Logistics, Southwest Aluminum Industry (Group) Co., Ltd. ("Southwest Aluminum Industry", "西南鋁業（集團）有限責任公司", a subsidiary of Chinalco) and Chongqing Southwest Aluminum Transportation Co., Ltd. ("Southwest Aluminum Transportation", "重慶西南鋁運輸有限公司", a subsidiary of Southwest Aluminum Industry prior to the transaction), Chalco Logistics acquired Chongqing Xinan Transportation on June 30, 2020 by subscription of its 51% newly issued shares for a cash consideration of RMB8.189 million.

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ALUMINUM CORPORATION OF CHINA LIMITED
NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

For the years ended December 31, 2019 ,2020 and 2021
(Amounts expressed in thousands of RMB unless otherwise stated)

39 BUSINESS COMBINATION UNDER COMMON CONTROL (CONTINUED)

(d) Acquisition of Suzhou Zhongcai

On April 29, 2019, Chinalco Shanghai Company Limited ("Chinalco Shanghai") ("中鋁上海有限公司"), a subsidiary of the Company, entered into an equity transfer agreement with Zhongse Technology Co., Ltd.* ("Zhongse Technology") ("中色科技股份有限公司") and Suzhou Research Institute of Non-ferrous Metals Co., Ltd.* ("Suzhou Research Institute") ("蘇州有色金屬研究院有限公司"), pursuant to which, Chinalco Shanghai acquired 70% and 30% equity interests in Suzhou Zhongse Metal Materials Technology Co., Ltd.* ("Suzhou Zhongcai") ("蘇州中色金屬材料科技有限公司") from Zhongse Technology and Suzhou Research Institute, respectively. The consideration for the acquisition was RMB237 thousand, which was determined based on the appraisal value of the 100% equity interest in Suzhou Zhongcai. Chinalco Shanghai has paid the consideration in full as of June 30, 2019. The acquisition date was June 1, 2019, which was the date that the Group obtained control of Suzhou Zhongcai. Before and after the acquisition, both Suzhou Zhongcai and Chinalco Shanghai were controlled by Chinalco, and the control was not temporary. Thus, the acquisition of the 100% equity interest in Suzhou Zhongcai is considered to be a business combination under common control, other than significant influence or joint control.

The carrying amounts of the assets and liabilities of Suzhou Zhongcai as of the acquisition date and the comparative financial figures were as follows:

	December 31, 2018	June 1, 2019
Assets		
Property, plant and equipment	55,747	55,746
Land use rights	26,574	—
Right-of-use assets	—	26,318
Other current assets	2,561	2,229
Deferred tax assets	86	143
Trade and notes receivables	3,485	2,758
Cash and cash equivalents	183	136
Liabilities		
Deferred tax liabilities	111	—
Interest-bearing loans and borrowings	51,908	51,908
Other payables and accrued expenses	34,536	33,404
Trade and notes payables	1,664	1,564
Net assets	417	454
Non-controlling interests	—	—
Net assets acquired	—	454
Difference recognized in equity	—	(217)
Total purchase consideration	—	237

* The English names represent the best effort by management of the Group in translating the Chinese names of the companies as they do not have any official English names.

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40 DISPOSAL OF SUBSIDIARIES

(a) Disposal of 75% equity of Shandong Shanlv Electronic Ltd.

In July 2020, the Group entered into a Capital Contribution Agreement with a third party on disposal of 75% equity interest of Shandong Shanlv Electronic Ltd.. A gain of RMB10.72 million from partial disposal of the subsidiary was recognized.

(b) Disposal of 100% equity of China Aluminum Nanhai Alloy

In January 2019, the Company entered into a Capital Contribution Agreement with Chinalco and its subsidiary Chinalco Innovative, pursuant to which the Company shall make a capital contribution to Chinalco Innovative in form of its 100% equity interests in China Aluminum Nanhai Alloy Co., Ltd. ("China Aluminum Nanhai Alloy"). After the transaction, the Company holds 19.4852% in Chinalco Innovative. As of the date of deemed disposal, the Company re-measured the equity of China Aluminum Nanhai Alloy to a fair value of RMB350 million and recognized the fair value gain of RMB258 million accordingly.

(c) Disposal of 40% equity interest of Inner Mongolia Fengrong and disposal of 60% equity interest of Ningxia Fenghao

On February 20, 2019, Chalco Energy Co., Ltd., a wholly-owned subsidiary of the Company, entered into equity transfer agreements with Chinalco Environment Protection Co., Ltd. on the partial disposal of 40% equity interests in Inner Mongolia Fengrong Co., Ltd. and 60% equity interests in Ningxia Fenghao Co., Ltd., respectively. A gain of RMB3,014 thousands from partial disposal of the two subsidiaries was recorded by the Group.

(d) Deregistration of Shanghai Kailin

Chalco Trade, a subsidiary of the Company, held 100% equity interest of Shanghai Chalco Kailin Aluminum Co., Ltd. * (上海中鋁凱林鋁業有限公司) ("Shanghai Kailin"). In July 2019, Shanghai Kailin was deregistered, from which the Company recorded a gain of RMB160 thousands.

(e) Disposal of Ruzhou Jinhua

Zhongzhou Aluminum, a subsidiary of the Company, held a 51% equity interest in Ruzhou Chinalco Jinhua Mining Co., Ltd. * (汝州中鋁金華礦業有限公司) ("Ruzhou Jinhua"). In July 2019, Zhongzhou Aluminum disposed all of its equity interests of Ruzhou Jinhua, and a gain of RMB113 thousands from the disposal was included in other gains during the year ended December 31, 2019.

* The English name represents the best effort made by management of the Group in translating its Chinese name as it does not have any official English names.

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41 OTHER EQUITY INSTRUMENTS

On November 19, 2019, the Company issued RMB1,500 million perpetual medium-term notes with an initial distribution rate at 4.20% (the "2019 Perpetual Medium-term Notes"). The proceeds from the issuance of the 2019 Perpetual Medium-term Notes were RMB1,499 million. The proceeds were used for the repayment of interest-bearing loans and borrowings. Coupon payments of 4.20% per annum on the 2019 Perpetual Medium-term Notes have been made annually in arrears from November 19, 2019 and may be deferred at the discretion of the Company. The 2019 Perpetual Medium-term Notes have no fixed maturity date and are callable only at the Group's option on November 20, 2022 or any coupon distribution date after November 20, 2022 at their principal amounts together with any accrued, unpaid or deferred coupon distribution payments. The coupon distribution rate will be reset to a percentage per annum equal to the sum of (a) the initial spread of 1.31 percent, (b) the China Treasury Rate, and (c) a margin of maximum 300 Bps every five years after November 20, 2022. While any coupon distribution payments are unpaid or deferred, the Company cannot declare or pay dividends to shareholders or decrease the share capital or make material fixed asset investments.

On December 2, 2020, the Company issued RMB1,000 million perpetual medium-term notes with an initial distribution rate at 4.45% (the "2020 Perpetual Medium-term Notes"). The proceeds from the issuance of the 2020 Perpetual Medium-term Notes were RMB1,000 million. The proceeds were used for the repayment of interest-bearing loans and borrowings. Coupon payments of 4.45% per annum on the 2020 Perpetual Medium-term Notes have been made annually in arrears from December 2, 2020 and may be deferred at the discretion of the Company. The 2020 Perpetual Medium-term Notes have no fixed maturity date and are callable only at the Group's option on December 3, 2022 or any coupon distribution date after December 3, 2022 at their principal amounts together with any accrued, unpaid or deferred coupon distribution payments. The coupon distribution rate will be reset to a percentage per annum equal to the sum of (a) the initial spread of 1.42 percent, (b) the China Treasury Rate, and (c) a margin of maximum 300 Bps every five years after December 3, 2022. While any coupon distribution payments are unpaid or deferred, the Company cannot declare or pay dividends to shareholders or decrease the share capital or make material fixed asset investments.

Pursuant to the terms and conditions of the 2019 Perpetual Medium-term Notes and the 2020 Perpetual Medium-term Notes, the Group has no contractual obligations to repay their principal or to pay any coupon distributions. Thus, in the opinion of the directors of the Company, they do not meet the definition of financial liabilities according to IAS 32 Financial Instruments: Presentation, and are classified as equity and subsequent distributions declared will be treated as distributions to equity owners.

On October 21, 2021, the Group redeemed RMB2 billion of the 2018 Perpetual Medium-term Notes and paid the principal amounts together with any accrued, unpaid or deferred coupon distribution payments.

On November 7, 2021, the Group redeemed USD500 million of the 2016 Senior Perpetual Securities and paid the principal amounts together with any accrued, unpaid or deferred coupon distribution payments.

(Amounts expressed in thousands of RMB unless otherwise stated)

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42 CONTINGENT LIABILITIES

As of December 31, 2021 and the date of this report, the Group is in process of application with related government departments for re-verifying carbon emission data for certain coal-fired power plants to avoid unnecessary obligations of excessive emission, the conclusion of which will not result in material additional liabilities to be recognized by the Group.

The Group is a defendant in a number of lawsuits arising in the ordinary course of business. While the outcomes of such lawsuits cannot be determined at present, management believes that any resulting liabilities will not have a material adverse effect on the financial position or operating results the Group.

43 COMMITMENTS

(a) Capital commitments

	December 31, 2020 (Restated)	December 31, 2021
Property, plant and equipment	1,437,354	1,375,405

(b) Other capital commitments

As of December 31, 2021, the commitments to make capital contributions to the Group’s joint ventures and associates were as follows:

	December 31, 2020 (Restated)	December 31, 2021
Joint ventures and associates	761,800	441,800

44 EVENTS AFTER THE REPORTING PERIOD

(a) On January 19, 2022, the Group completed an issuance of short-term bonds with a total face value of RMB2 billion at par value of RMB100.00 per unit which will mature in October 2022 for working capital needs and repayment of bank borrowings. The fixed annual coupon interest rate of these bonds is 2.49%.

(b) On February 21, 2022, the Group completed an issuance of short-term bonds with a total face value of RMB1 billion at par value of RMB100.00 per unit which will mature in November 2022 for working capital needs and repayment of bank borrowings. The fixed annual coupon interest rate of these bonds is 2.20%.

(c) On January 26, 2022, the Group completed an issuance of medium-term bonds with a total face value of RMB2 billion, an annual interest rate of 3% which will mature in January 2025. The above medium-term notes will pay interest once a year from January 26, 2022, and the Company intends to use the proceeds from the offering to refinance existing debt.

(d) On February 22, 2022, the Group completed an issuance of medium-term bonds with a total face value of RMB400 million, an annual interest rate of 2.68% which will mature in February 2025. The above medium-term notes will pay interest once a year from February 23, 2022, and the Company intends to use the proceeds from the offering to refinance existing debt.

(e) On March 22, 2022, the Board of Directors proposed a final dividend of RMB545 million for the year ended December 31, 2021, which is subject to the approval of the shareholders of the Company at the forthcoming annual general meeting.

45 COMPARATIVE AMOUNT

Certain comparative amounts have been restated as a result of the business combinations under common control as disclosed in Note 39 and changes in accounting policies (Note 2.1.6).

46 APPROVAL OF THE FINANCIAL STATEMENT

The financial statements were approved and authorised for issue by the Board of Directors on April 22, 2022.

Exhibit 8.1

List of Subsidiaries of Aluminum Corporation of China Limited as of December 31, 2021

A list of Aluminum Corporation of China Limited's principal subsidiaries is provided in Note 1 to consolidated financial statements included in this annual report following Item 19.

Exhibit 12.1

CERTIFICATION

I, ZHU Runzhou, certify that:

1. I have reviewed this annual report on Form 20-F of Aluminum Corporation of China Limited (the "Company");
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the Company as of, and for, the periods presented in this report;
4. The Company's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the Company and have:
   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the Company, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
   (c) Evaluated the effectiveness of the Company's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
   (d) Disclosed in this report any change in the Company's internal control over financial reporting that occurred during the period covered by the annual report that has materially affected, or is reasonably likely to materially affect, the Company's internal control over financial reporting; and
5. The Company's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the Company's auditors and the audit committee of the Company's board of directors (or persons performing the equivalent functions):
   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the Company's ability to record, process, summarize and report financial information; and
   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the Company's internal control over financial reporting.

Date:	April 22, 2022
By:	/s/ Zhu Runzhou
Name:	Zhu Runzhou
Title:	Executive Director and President

Exhibit 12.2

CERTIFICATION

I, GE Xiaolei, certify that:

1. I have reviewed this annual report on Form 20-F of Aluminum Corporation of China Limited (the "Company");
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the Company as of, and for, the periods presented in this report;
4. The Company's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the Company and have:
   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the Company, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
   (c) Evaluated the effectiveness of the Company's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
   (d) Disclosed in this report any change in the Company's internal control over financial reporting that occurred during the period covered by the annual report that has materially affected, or is reasonably likely to materially affect, the Company's internal control over financial reporting; and
5. The Company's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the Company's auditors and the audit committee of the Company's board of directors (or persons performing the equivalent functions):
   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the Company's ability to record, process, summarize and report financial information; and
   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the Company's internal control over financial reporting.

Date:	April 22, 2022
By:	/s/ Ge Xiaolei
Name:	Ge Xiaolei
Title:	Chief Financial Officer and Secretary to the Board

Exhibit 13.1

CERTIFICATION

In connection with the annual report on Form 20-F of Aluminum Corporation of China Limited (the "Company") for the year ended December 31, 2021 as filed with the Securities and Exchange Commission on the date hereof, I, ZHU Runzhou, Executive Director and President of the Company, certify, pursuant to Rule 13a-14(b) under the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to the best of my knowledge:

(1) The annual report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the annual report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date:	April 22, 2022
By:	/s/ Zhu Runzhou
Name:	Zhu Runzhou
Title:	Executive Director and President

The foregoing certification is being furnished solely pursuant to Rule 13a-14(b) under the Exchange Act and 18 U.S.C. Section 1350 and will not be deemed "filed" for purposes of Section 18 of the Exchange Act, or otherwise subject to the liability of that section.

Exhibit 13.2

CERTIFICATION

In connection with the annual report on Form 20-F of Aluminum Corporation of China Limited (the "Company") for the year ended December 31, 2021 as filed with the Securities and Exchange Commission on the date hereof, I, GE Xiaolei, Chief Financial Officer and Secretary to the Board of the Company, certify, pursuant to Rule 13a-14(b) under the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to the best of my knowledge:

(1) The annual report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the annual report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date:	April 22, 2022
By:	/s/ Ge Xiaolei
Name:	Ge Xiaolei
Title:	Chief Financial Officer and Secretary to the Board

The foregoing certification is being furnished solely pursuant to Rule 13a-14(b) under the Exchange Act and 18 U.S.C. Section 1350 and will not be deemed "filed" for purposes of Section 18 of the Exchange Act, or otherwise subject to the liability of that section.

Exhibit 96.1

Technical Report Summary of Mineral Reserves and Mineral Resources for Boffa Mine in Guinea

April 2022

Declaration

I, Shengfa Tu, am a member of the Australasian Institute of Mining and Metallurgy (AusIMM) (Membership Number 320442). I have sufficient experience in estimating resources and reserves of weathered bauxite deposits and mine construction, which enables me to prepare the Technical Report Summary of Mineral Reserves and Mineral Resources for Boffa Mine in Guinea. I am regarded as a Qualified Person in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code 2012 Edition) and a Qualified Person as defined under Subpart 1300 of U.S. Securities and Exchange Commission Regulation S-K ("Regulation S-K 1300"). I have prepared this report based on relevant information and rules including Regulation S-K 1300 and Item 601(b)(96) of Regulation S-K, and I promise to be fully responsible for this report.

I have no financial interest with the registrant, such as equity interest, except the fees charged for technical services in preparing this report.

Signature:	/s/ Shengfa Tu
Title:	AusIMM Fellow
Date:	April 21, 2022

Contents

1 Executive Summary

1.1 Introduction to Mineral Properties

Boffa Bauxite Mine is located 8km north by east of the city of Boffa, Boffa Prefecture, BOKE Region in Guinea, consisting of the Boffa North and Boffa South mines (Fig. 1-1). The mining permit number of Boffa North is Presidential Decree No. D/2018/105/PRG/SGG, and the mining permit number of Boffa South is Presidential Decree No. D/2018/106/PRG/SGG. Boffa North covers an area of 653.55km^2, and Boffa South covers an area of 594.61km^2. Both mining permits are valid for 15 years (from July 9, 2018 to July 8, 2033), and the period can be extended. The single mined mineral is bauxite.

Chalco Guinea Ltd. possesses 85% stock shares and the Government of Guinea possesses the remaining 15%.

At present, the mine is a production mine. The produced bauxite ($AAl_2O_3 \geq 39\%$) is shipped to China. The produced bauxite ($35\% \leq AAl_2O_3 \leq 39\%$) is stored in situ, which will be treated in an alumina refinery planned to be built in the future.

The production scale of the mine is 12Mt per year of bauxite.

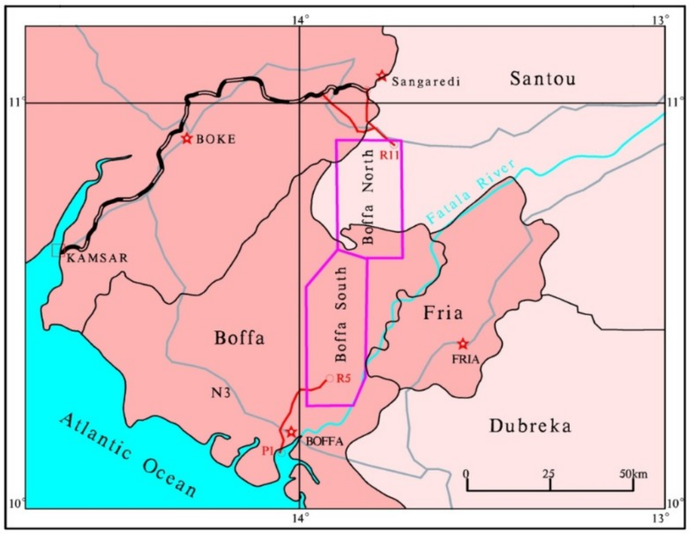


Fig.1-1 Distribution of Mineral Properties of Boffa Bauxite Mine

1.2 Geology of Deposit

Guinea is located in the West African Carton. Except Cenozoic cap-rocks and late Paleozoic terrigenous clastic rocks along the Western Atlantic coast, the rest are Precambrian basement strata. More than 90% of the surface is covered by weathering residual iron caps in the Boke region. The basement strata in this area consist of Precambrian metamorphic rock series and mixed granite and diabase belts. The Ordovician-Silurian/Devonian quartz sandstone and siltstone are the cap-rocks, forming the Wenduboru-Fria synclinal structure. In Mesozoic era, the magmatic activity in the area was intense, and the mafic hypabyssal intrusive rocks intruded into the Ordovician-Silurian/Devonian strata, with the distribution of mafic volcanic rocks. These mafic intrusive rocks and volcanic rocks are the ore-forming parent rocks of laterite bauxite. Under tropical humid climate, laterite bauxite was formed by weathering and oxidation, desiliconization and aluminum enrichment.

In the litho-logic profile of the Boffa bauxite, they are soil layer, upper red soil layer, bauxite layer, lower red soil layer and clay layer from top to bottom, and bauxite characteristic and grade are different in different areas.

The orebody is irregular in plane, and the Boffa North is composed of five ore-bodies of No.47, No.10, No.11, No.12 and No.26, and the Boffa South is composed of 10 ore-bodies of No.27, No.28 and No. 35, No.36, No.37, No.38, No.39, No.40, No.45 and No. 46, as shown in Fig. 1-2.

The section of the orebody is in stratiform or stratoid (Fig. 1-3).

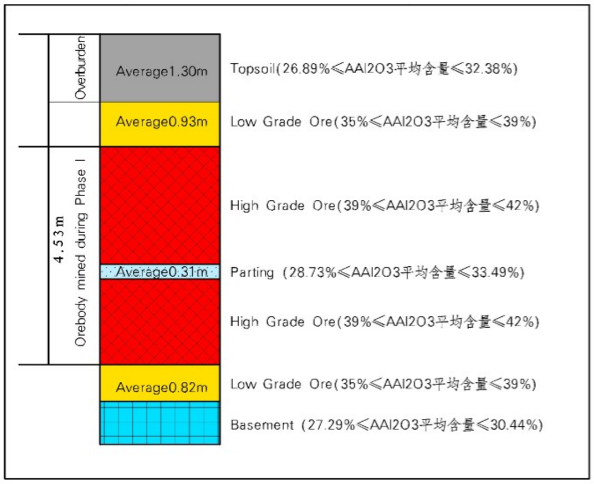


Fig. 1-3 Diagram of the Orebody in Boffa Mine

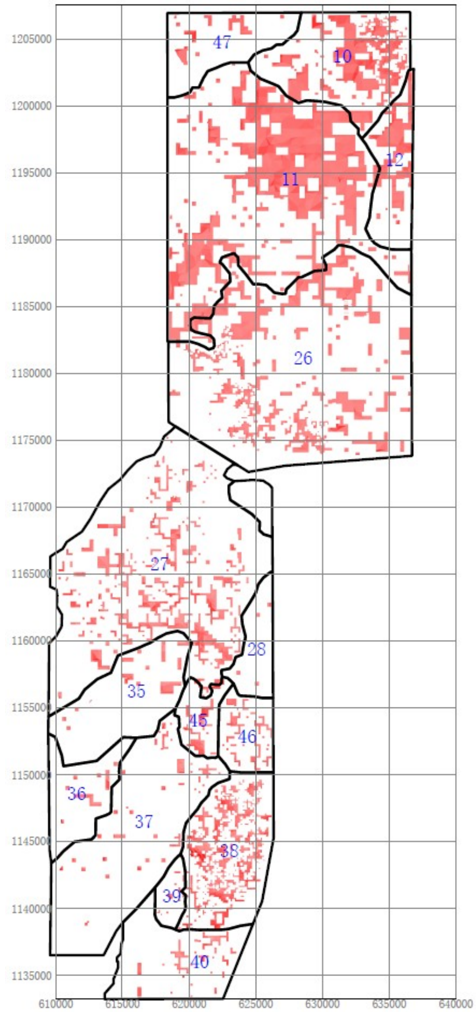


Fig.1-2. Orebody Distribution in Boffa Mine

The main mineral in the ore is gibbsite (61%), al-goethite (17%) and hematite (15%), kaolinite (3.5%), quartz (1%), anatase (1.5%) and rutile (1%).

The main chemical composition in the ore is Al_2O_3, Fe_2O_3, SiO_2, TiO_2, with a small amount of S, CaO, MgO, Na_2O, K_2O and P_2O_5. The associated beneficial element in the ore is Ga (the average content upon combination analysis is 0.0061%), the associated deleterious element is organic carbon (the average content upon combination analysis is 0.13%).

The ore structure is argillaceous and massive and earthy.

The average content of AAl_2O_3 is 26.89%- 32.38% and the average content of $RSiO_2$ is 0.28 - 3.28% in Topsoil Layer. The average content of AAl_2O_3 is 27.29% -30.44% and the average content of $RSiO_2$ is 1.85-5.40% in the Bottom.

The thickness of the intercalated rock of the orebody is 1-3m, the average thickness is 0.31m, in which the average AAl_2O_3 is 28.73% - 33.49% and the average $RSiO_2$ is 0.30-1.92%.

1.3 Exploration

In 2005-2012, BHP Billiton carried out geological exploration in Boffa, Santou and Houda blocks, with 13,596 boreholes (footage of 177,003.5m). Most of them were drilled by auger drills and a few were drilled by diamond drills.

The borehole grid in Boffa includes 150m × 150m, 300m × 300m and 600m × 600m. Most of the grid in orebody #38 reached 150m × 150m. The grid in 0.36km^2 area was in-filled to 50m × 50m and in the 0.09km^2 area was in-filled to 25m × 25m.

In 2012, BHP submitted Boffa Santou Houda Project Close Out Report, establishing orebody model and ore block model, estimating 3.14 billion tons of the bauxite resources in Boffa area, with 39.82% AAl_2O_3 and 1.06% $RSiO_2$.

In November 2016, a technical due diligence on the BOFFA bauxite project in Guinea was carried out by Mining One Consulting, commissioned by Chalco Hong Kong Limited. The Technical Due Diligence-Resource Assessment Report for the Boffa Bauxite Project was submitted in January 2017 on the basics of review of document and on-site investigations. Mining One developed a block model during due diligence to validate the resources in the BHP withdrawal report, estimating 3.52 billion tons of the bauxite resources in Boffa region, with 38.57% AAl_2O_3 and 0.84% $RSiO_2$.

The major findings of Mining One during due diligence are as follows:

1) Due to unavailability of the original laboratory assay data, the assay data in the database cannot be verified.

2) Due to unavailability of the original ore density test data, the ore density is assumed to be 2.1g/m^3.

3) Due to failure to provide original QAQC data, the QAQC in the BHP withdrawal report cannot be verified.

4) There are some deviations in the data accuracy of spectral test results, such as the higher AAl_2O_3 assay results and the lower $RSiO_2$ assay results.

From 15 February 2017 to 22 May 2017, CINF Engineering Co., Ltd. (“CINF”) conducted resource assessments.

(1) Collection of basic data

1) Boffa Santou Houda Project Close Out Report (BHP, 2012)

2) BHP Billiton Block model file (text file)

3) Borehole coordinates (PDF)

4) Borehole survey table (excel)

5) Assay data table (excel)

6) Logging of borehole

Without topographic and geological maps, profiles, solid models and block models.

(2) Completion of validation and submission of The Technical Report on Resources of Boffa Bauxite Development Project in Guinea

Including 25 verification boreholes of 255m, 5 of verification pits of 34m, 30 re-checking and surveying points, 300 basic analyses, 404 duplicate sample analyses, and 2 solubility tests.

The report passed the expert review organized by the Mineral Resources Management Department of Chalco and Chalco Hong Kong Limited.

(3) Main outcomes

① Coordinate survey of borehole

The original borehole coordinate accuracy has into three types. The plane and elevation errors of high-precision instruments are within 20cm respectively, medium-precision instruments within 4.58m and 2.12m, and low-precision instruments within 5m and 10m respectively.

② Validation boreholes and pits

Within 5.5m from original borehole, 30 boreholes were drilled with diamond drills for verification. The results are as follows:

The orebody thickness defined by the verification boreholes is 19.0% less than that defined by the original boreholes, which may be caused by the pollution of the original auger drills.

The average AAl_2O_3 content of the ore body defined by the verification boreholes is 42.05%, and 41.56% defined by the original boreholes, with absolute deviation of 0.49% and relative error of 1.17%. The orebody assay data of the original borehole is basically reliable.

③ Duplicate sample analysis

By comparing the analysis of 404 duplicate samples with the original samples, the results of two analyses in different AAl_2O_3 content intervals are close and the deviation is small. The comparative data show that the original assay data is reliable.

④ Dissolution test

The bauxite ore has good dissolution performance. The dissolution rate of alumina is over 85.0%, and the A/F in the dissolved red mud is about 0.22.

⑤ Verification of ore density

The ore density of wet ores taken from 4 pits in orebody #38 is 2.18 t/m^3, the average moisture content of 8 samples of bauxite beds is 8.28%, the calculated ore density of dry ores is 2.02 t/m^3.

⑥ Verification and analysis on rarefying of grid

The blocks with grid reaching 25m × 25m (0.09km^2) and 50m × 50m (0.36km^2) in orebody #38 are selected for verification and analysis. The verification results show that the grid of 150m×150m can meet the requirements of the measured resources, and the grid of 300m×300m can meet the requirements of the indicated resources.

⑦ 3D geological modeling and resource estimation

With the SURPAC software, a terrain model, orebody solid model and block model are built. Block estimation is carried out by Distance Power Inverse Ratio method. The measured + indicated + inferred resources (cut-off grade AAl_2O_3 35%) is estimated as 2107.97MT, with average AAl_2O_3 of 39.11% and average $RSiO_2$ of 1.11%.

⑧ Main problems

1) The geological exploration is generally low, and the ore orebody shape, geological continuity and resource may change to some extent.

2) The auger drills are used in BHP exploration, and the thickness of the delineated bauxite ore body may be slightly thicker.

3) The accuracy of the coordinates surveyed by medium precision and low precision device is not enough, which may cause the spatial position of the orebody to be changed

4) The ore density used in this resource estimation is 2.02 t/m^3, which is calculated by combining the weight of the samples from 4 verification pits in orebody #38 with the moisture content of the ore. The sample distribution and representativeness are insufficient.

5) The rainy season in Guinea is from June to October, with heavy precipitation. The laterite bauxite in the mine has water absorption nature. This field sampling is conducted during the dry season, so the moisture content of the tested ore is lower than that in the rainy season.

6) According to statistics, about 30% of the boreholes are intercalated with rock, with a thickness of 1 ~ 3m.

1.4 Development and Operations

In August 2017, CINF submitted the Feasibility Study Report of BOFFA Bauxite Mine Project in Guinea to Chalco Hong Kong Limited.

In May 2018, CINF submitted the Specifications for Detailed Design of the First Stage of BOFFA Bauxite Mine Project in Guinea to Chalco Hong Kong Limited. In the design, the open-pit mining was adopted, and the scale of 12Mt/a high-grade ore ($AAl_2O_3 \geq 39\%$) and the 11.04Mt/a dry ore was considered at the first stage of Phase I. The low-grade ore ($35\% \leq AAl_2O_3 < 39\%$) was temporarily stored on site for future treatment after the alumina refinery put into production. The total service life of the mine is 60a. A total of 775.04Mt of high-grade ore could be produced from BOFFA bauxite mine.

The project is commenced on October 28, 2018, and commissioned on April 30, 2020.

In April 2020, the 23km belt conveyor was commissioned successfully under load. The supporting port project was successfully completed. The output reached 8.06 million tons in 2020.

On March 20, 2021, the first 300,000 tons of high-grade bauxite were shipped to Rizhao Port in Shandong Province.

A total of 12,303,700 tons of high-grade Bauxite were produced in 2021, achieving the goal in terms of output, standard and efficiency 3 years ahead of schedule.

1.5 Mineral Resources

In May 2017, CINF submitted the Technical Report on Resources of Boffa Bauxite Development Project in Guinea. In December, 2021, apart from the reserves, the measured + indicated + inferred bauxite resources in Boffa mine is 1954.90Mt, with average AAl_2O_3 of 38.92 % and average $RSIO_2$ of 1.10%, as shown in Table 1-1.

Table 1-1 Resource Summary (December, 2021)

Mine	Classification	Resources(Mt)	AAl_2O_3(%)	$RSiO_2$(%)
Boffa North	Indicated	40.92	37.54	0.75
	Measured	28.66	37.25	0.81
	Inferred	1475.96	39	0.98
	Ind. + Mea.	69.58	37.42	0.77
	Ind.+ Mea. + Inf.	1545.54	38.93	0.97
Boffa South -Plateau #27	Indicated	0	0	0
	Measured	23.6	39	1.76
	Inferred	214.82	39.2	1.67
	Ind. + Mea.	23.6	39	1.76
	Ind.+ Mea. + Inf.	238.42	39.18	1.68
Boffa South -Plateau #38	Indicated	28.46	37.46	2.06
	Measured	26.47	37.43	1.08
	Inferred	116.01	38.99	1.38
	Ind. + Mea.	54.93	37.45	1.59
	Ind.+ Mea. + Inf.	170.94	38.5	1.45
Boffa South	Indicated	28.46	37.46	2.06
	Measured	50.07	38.17	1.4
	Inferred	330.83	39.12	1.56
	Ind. + Mea.	78.53	39.89	1.43
	Ind.+ Mea. + Inf.	409.36	39.27	1.53

Mine	Classification	Resources(Mt)	AAl_2O_3(%)	$RSiO_2$(%)
Boffa-in total	Indicated	69.38	37.51	1.29
	Measured	78.73	37.84	1.19
	Inferred	1806.79	39.02	1.09
	Ind. + Mea.	148.11	37.69	1.24
	Ind.+ Mea. + Inf.	1954.9	38.92	1.1

Note: the cut-off grade of AAl_2O_3 is ≥35%, and the loading price of bauxite is 22.02USD/WT.

1.6 Mineral Reserves

According to the design, Boffa South Block 38 was selected as the preferred stope. Part of the infrastructure has been completed at present. According to the geological continuity, mining, transportation conditions and modifying factors, the Measured resources have the conditions to be converted into the Proven reserves, and the Indicated resources have the conditions to be converted into the Probable reserves. Its reserves are shown in Table 1-2

Table 1-2 Reserve Summary (May 2017)

Mine	Orebody No.	AAl_2O_3(%)	Classification	Reserve (Mt)	AAl_2O_3(%)	$RSiO_2$(%)
Boffa North	10	≥39%	Proven	16.62	41.14	1.03
			Probable	11.59	41.46	1.18
	26	≥39%	Proven	16.61	41.35	0.81
			Probable	10.83	42.04	0.88
	Boffa North-in total	≥39%	Proven	33.22	41.24	0.92
			Probable	22.42	41.74	1.04
			Proven + Probable	55.64	41.44	0.97
Boffa South	27	≥39%	Probable	28.05	41.62	1.7
	37	≥39%	Probable	0.94	42.01	1.16
	38	≥39%	Proven	46.59	42.34	1.26
			Probable	15.95	42.01	1.26
			Proven + Probable	62.53	42.26	1.26
	39	≥39%	Proven	0.04	39.97	0.92
			Probable	0.09	40.05	1.29
			Proven + Probable	0.13	40.02	1.17
	45	≥39%	Probable	4.31	41.64	1.11
	46	≥39%	Probable	1.46	41.44	0.99
	Boffa South-in total	≥39%	Proven	46.63	42.34	1.26
			Probable	50.8	41.74	1.48
			Proven + Probable	97.43	42.03	1.37
Boffa	Total	≥39%	Proven	79.85	41.88	1.12
			Probable	73.22	41.74	1.34
			Proven + Probable	153.08	41.82	1.23

Note: the cut-off grade of AAl_2O_3 is ≥39%, and the loading price of bauxite is 22.02USD/WT.

From 2019 to the end of 2021, a total of 21.67Mt of high grade ore was produced in Boffa South - Block 38. By the end of 2021, Boffa mine had (Proven + probable) reserves of 131.41Mt, with average AAl_2O_3 of 41.82% and $RSiO_2$ of 1.23%, among which the Proven reserves were 58.19Mt with average AAl_2O_3 of

41.71% and $RSiO_2$ of 1.07%, and the probable reserves were 73.22Mt with average AAl_2O_3 of 41.74% and $RSiO_2$ of 1.35%.

1.7 Capital and Operating Costs

For cost estimation, the time node is August 2017, and the commodity price takes the average price in the past three to five years prior to August 2017.

The total investment of the project is 474,014.92KUSD, of which the construction investment is 435,292.22KUSD, the interest during the construction period is 14,382.05KUSD and the working capital is 24,340.64KUSD.

The average annual operating cost of the project is estimated to be 240,528KUSD /a, with 74,568KUSD /a for mining, 55,318KUSD for belt conveyor, 7,785KUSD for wharf yard, 22,980KUSD /a for administration, 5,285KUSD /a for business expenses, 2,708KUSD /a for financial and 22,242KUSD /a for value added tax, 17,570KUSD /a for export duty, 17,570KUSD /a for mineral tax, 10,318KUSD /a for income tax, and 4,184KUSD /a for stock dividend.

The ROI is 8.63%, and the ROE is 16.48%.

The financial internal rate of return before income tax is 11.85%, the payback period of investment is 8.44 years (including the construction period). The financial internal rate of return after income tax is 8.72%, the payback period is 10.10 years (including the construction period).

The financial internal rate of return on capital of the project is 10.16%.

The repayment period of the loan is 7.92 years (including the construction period) according to the maximum repayment ability of the project, which indicates that the project has good repayment ability.

1.8 Permitting

The mining permit is valid for 15 years (from July 9, 2018 to July 8, 2033), and can be renewed upon expiry. An EIA permit is granted to Chalco by the Government of Guinea, with a valid period of one year, and the period may be extended if the evaluation of the implementation of the Social Environmental Management Plan is acceptable.

1.9 Conclusions and Recommendations

The report summarizes the basic situation of mineral properties and the status of mining operation. This is an operating open-pit mine, whose products are sold to China. The designed annual capacity is 12Mt, and the service life is 60 years. The current reserves can meet the mine production for 12 years. The output in 2021 was 12.32Mt, reaching the designed production scale.

The quality of drilling and sampling, processing and testing is high, and the exploration data is credible. The principle of delineation of ore bodies and the resource classification are reasonable. The resource is estimated by the Distance Power Inverse Ratio method. The resource estimation data is reliable.

The feasibility study of the deposit and the design of the mine have been carried out, the comprehensive investigation of the modifying factors related to the reserve estimation has been carried out, and the mining design has been completed. The reserves have been estimated and the data are reliable.

This report reviewed the capital and operating cost of the mine. The principle of estimation and the selection of main parameters is reasonable, and the conclusion is credible. The precision requirement of the feasibility study is achieved.

The economic analysis of the project has been carried out, and the discount cash flow method is used in the analysis. The main parameters are demonstrated in detail. Major commodity prices have been demonstrated, using the average three to five-year prior to August 2017. The equipment price is quoted from the contract price. The conclusion is reliable.

It is estimated that the loading price of bauxite (water content 8%) is 22.02USD/t (wet basis).

The Bauxite is mainly sold to the alumina plant of Chalco, and the commodity market is guaranteed.

The construction fund and operation cost is as follows:

① The total investment of the project is 474,014.92KUSD, of which the construction investment is 435,292.22KUSD, the interest is 14,382.05KUSD and the working capital is 24,340.64KUSD.

② The ROI is 8.63% and the ROE is 16.48% .

③ The financial internal rate of return before income tax is 11.85%. The payback period of investment is 8.44 years (including the construction period). The financial internal rate of return after income tax is 8.72%, the payback period is 10.10 years (including the construction period).

④ The capital financial internal rate of return of this project is 10.16% .

⑤ The repayment period of the loan is 7.92 years (including the construction period) according to the maximum repayment ability of the project, which indicates that the project has good repayment ability.

All the above conclusions are reliable.

The main risk for the project is high political risk, however, the coup d'état happened in September 2021 in Guinea has little impact on the operation of the project.

The project market, economic and other risks is moderate and controllable.

2 Introduction

2.1 About the Registrant

Aluminum Corporation of China Limited (Chalco) was incorporated in the People's Republic of China on September 10, 2001, and is controlled by China Aluminum Group Co., Ltd. Chalco is a large-scale aluminum production and operation enterprise in China, which integrates exploration and exploitation of bauxite and coal resources, production, sale, technical research and development of alumina and aluminum alloy products. Chalco is listed at the New York Stock Exchange, the Hong Kong Stock Exchange and the Shanghai Stock Exchange (Stock code: New York ACH, Hong Kong 2600, Shanghai 601600).

Chalco Hong Kong Limited (hereinafter referred to as "Chalco Hong Kong") is the investor of the project, as designated and authorized by Chalco. Chalco Hong Kong is a wholly owned subsidiary of Chalco, which is responsible for the development of overseas bauxite resources and aluminum industry projects. Chalco Hong Kong will be the entity to sign the final agreement with the Government of Guinea.

2.2 Scope of Application of this Summary

Commissioned by Chalco, the purpose of this Summary is to prepare the annual report of the listed company and to disclose to the public the status of the bauxite resources of Year 2021 of Chalco.

2.3 Types and Sources of Data

The types of the data provided by the registrant are resource report, feasibility study report, mine project design report and their databases. The data comes from the original data and database provided by the Government of Guinea and the resource report, feasibility study report and mine project design report prepared by CINF

2.4 Qualifications and Declaration

The Qualified Person, Shengfa Tu, is a member of the Australasian Institute of Mining and Metallurgy (AusIMM) (Membership Number 320442). He has sufficient experience in estimating resources and reserves of weathered bauxite deposits and mine construction, which enables him to prepare this report. He is regarded as a Qualified Person in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code 2012 Edition).

The Qualified Person has no financial interest with the registrant, such as equity interest, except the fees charged for technical services in preparing the report.

The Qualified Person has consulted the resource report, the feasibility study report and the mine project design information, and has been informed of the mining permit, the requisite licenses, the relevant Guinean mining laws and regulations and tax laws. The coordinates survey of sampling engineering, sampling, processing and analysis QAQC and the existing problems are understood in detail. The process of the database verification, geological interpretation, orebody model, resource classification rules and resource estimation is understood. The consideration of modifying factor and the estimation of reserves in the process of reserves conversion are understood.

The focus is given to the chapters of market analysis and economic analysis in the feasibility study report, and comparison is made among the parameters, analysis process and analysis results of relevant economic analysis according to the requirements of the specification.

The mine is a production mine, and the construction of infrastructure, auxiliary facilities and production have been verified.

The references are:

① Technical Report on Resources of Boffa Bauxite Development Project in Guinea of Chalco Hong Kong Limited and its database submitted by CINF in May 2017.

② Feasibility Study Report of BOFFA Bauxite Mine Project in Guinea of Chalco Hong Kong Limited submitted by CINF in August 2017

③ Specifications for Detailed Design of the First Stage of BOFFA Bauxite Mine Project in Guinea of Chalco Hong Kong Limited submitted by CINF in May 2018.

④ Information submitted by CINF's BOFFA Bauxite Mine Exploration Team in terms of infrastructure and auxiliary facilities and recent production.

⑤ Information on adjacent mining property provided by registrant.

3 Property Description

Boffa Bauxite Mine is located in 8km north by east of the city of Boffa, the capital of Boffa Prefecture. The southwest corner of the mine is about 25km from the Atlantic Ocean.

On July 9, 2018, Guinean President Conte signed a decree granting mining permits for Boffa North (Presidential Decree No. D/2018/105/PRG/SGG) and Boffa South (Presidential Decree No. D/2018/106/PRG/SGG) to Chalco Guinea Ltd. Boffa North covers an area of 653.55km^2, and Boffa South covers an area of 594.61km^2. Both mining permits are valid for 15 years (from July 9, 2018 to July 8, 2033), and the period can be extended. The single mined mineral is bauxite.

Chalco Guinea Ltd. possesses 85% stock shares and the Government of Guinea possesses the remaining 15%.

Table 3-1 Coordinates of Mining Rights Inflection Point in Boffa Mine

	Latitude				Longitude				Area
	N	**Degree**	**Minute**	**Second**	**W**	**Degree**	**Minute**	**Second**	**km^2**
Boffa South									
1	N	10	18	57.37	W	-13	51	13.34	653.55
2	N	10	15	0.40	W	-13	52	50.34	
3	N	10	15	0.40	W	-13	59	59.34	
4	N	10	33	3.30	W	-13	59	59.33	
5	N	10	38	24.26	W	-13	54	59.32	
6	N	10	37	0.27	W	-13	50	44.32	
7	N	10	21	31.36	W	-13	50	44.33	
Boffa North									
1	N	10	55	0.15	W	-13	44	59.31	594.61
2	N	10	37	0.26	W	-13	44	59.32	
3	N	10	37	0.27	W	-13	50	44.32	
4	N	10	38	24.26	W	-13	54	59.32	
5	N	10	55	0.16	W	-13	54	59.31	

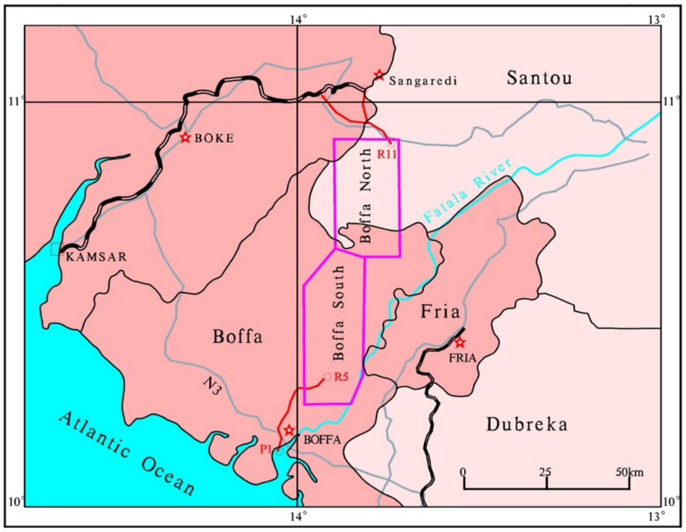


Fig. 3-1 Location of Boffa Property

4 Accessibility, Infrastructures and Physiography

4.1 Topography, Elevation and Vegetation

The mine is located in the low mountain area of Guinea, where the gully is developed and the landform is of the structure denudation and local accumulation landform.

The elevation of the mine changes from 40m south to 462m in the north of the BOFFA mine. The slope is between 0-10% in the south and more than 10% in the north.

The vegetation in the region is developed, mostly grasses and shrubs, gully bottom and hillside for secondary forest, the peak for grassland. Grasses and shrubs grow on iron bauxite.

4.2 Accessibility

The mine is located about 8km north by east of the city of Boffa, the capital of Boffa Prefecture (Fig. 3-1), about 86km from the capital Conakry, and about 25km from the Atlantic Ocean in the southwest corner of the mine. Conakry is connected to Boffa City by the highway N3, which is about 150km away and is an asphalt road with a surface width of about 6m. The southern part of the mine is connected to the highway N3 by a simple road, which is about 5km away.

There are two main railways in Guinea. A railway links Conakry and the Fria smelter at the east of BOFFA. The other railway, which runs from the CBG mine near Sangaredi to the port of Kamsar, has a large capacity.

Guinea has two major ports. One is the port of Conakry, adjacent to the City of Conakry. The port handles container shipments and exports alumina and bauxite. The other is Kamsar CBG, which exports bauxite and has two smaller terminals for other bulk cargo.

4.3 Climate

Guinea has a tropical marine climate, which is hot and humid, with two distinct seasons. November to May is the dry season, June to October is the rainy season. It has an annual average precipitation of 2,212mm, and an annual average evaporation of 1,473mm. The annual humidity in the region is relatively high, ranging from 70% to 78%.

The average monthly minimum temperature in the mine from January to December is about 24℃, and the average maximum is 30℃. The highest temperature was 44℃ in April, while the lowest temperature was 10℃ in January.

The extreme weather in the project area is mainly storms, which is normally accompanied by tornadoes and strong winds (more than 75 kilometers per hour). Severe storms usually occur at the beginning and end of the rainy season, with the strongest winds usually occurring in June and October.

The Boke region had an annual average of 72 storms in 1991-2000, with most of the rain between June and October (about 10 times per month). The highest annual storm rainfall recorded during this period was 102 in 1992; the lowest rainfall was 43 in 2000.

According to the most recent meteorological data collected from the mine, the rainy season lasts for five months, with about 20 days of daily rainfall above 10mm in July, August and September and about 10 days of daily rainfall above 10mm in June and October, all the rain in rainy season is heavy and lasts a short while. The weather turns to fine soon after the rain.

4.4 Infrastructures

Guinea has an underdeveloped electricity system and no large national grid. The Capital and main cities have regional grids, which are limited in supply scope. There is a lack of electricity in large areas outside the cities, and the main factories and mines rely on their own power generation. The local hydropower resources are abundant, but the utilization level is low.

The mine area consists of three watersheds: Cogon, Rio Nunez and Fatala, forming a dense network of waterways. Rain and dry seasons are distinct, the rainy season is full of water, the dry season almost has no rainfall, and streams are dried in dry season. In the sandstone and clastic rock area, there is good quality groundwater, which is used as water source for mine operation and local inhabitants.

There is no steel mill in Guinea, and domestic steel are provided for construction industry. All other steel products are imported. Guinea imports power fuel and has gas stations in towns and on major roads. There is no coal in Guinea, which needs to be imported.

Guinean has one civil airport, which is in the capital Conakry.

5 Exploration and Development History of the Mine

5.1 Prior and Current Operators

From August 2005 to May 2006, 10 exploration rights were granted to BHP Billiton in Guinea. The exploration rights are mainly distributed in Boffa (2,159km^2), Santou (2,014km^2) and Houda (202km^2). In 2008 and 2011, BHP Billiton applied to the Government of Guinea to reduce the area of the mine. In 2012, BHP Billiton submitted Boffa Santou Houda Project Close Out Report to the Government of Guinea and returned the exploration rights back to the Government of Guinea.

On 31 October 2016, Aluminum Corporation of China signed cooperation framework agreements with the Government of Guinea and Guinean State Mining Company for the development of the Boffa Mine. On June 8, 2018, Chalco Hong Kong Limited and the Guinean government signed a mining agreement for the Boffa project in Conakry, Guinea. Chalco Hong Kong Limited funded the establishment of Chalco Guinea Company in Guinea. On July 9, 2018, Guinean President Conte signed a decree granting mining permits of Boffa North and Boffa south to Chalco Guinea Company.

The Boffa Bauxite Project follows the principle of overall consideration and step-by-step implementation of bauxite-alumina integration. At first, only the high-grade bauxite is mined, at the same time, the feasibility study of building local alumina refinery is carried out. In accordance with the laws of Guinea, during the bauxite transportation of the mining project, the Guinean Government holds 15% of the shares, and Chalco Hong Kong holds 85% of the shares. When the project entered the alumina production stage, the Guinean Government accounts for 5% of the share and Chalco Hong Kong accounts for 95% of the share. Finally, it was arranged based on the mining agreement signed by both parties.

At present, only high-grade bauxite is produced. The Government of Guinea has 15% of the share and Chalco Hong Kong has 85% of the share.

5.2 Exploration and Development

5.2.1 BHP Exploration

In 2005-2012, BHP Billiton carried out five geological explorations in Boffa, Santou and Houda blocks, with 13,596 boreholes (footage of 177,003.5m). Most of them were drilled by auger drills and a few were drilled by diamond drills. The annual drilling is shown in tables 5-1 and 5-2.

Fourier Transform Infrared (FTIR) was used to analyze available aluminum and reactive silicon in most of the samples in 2006, 2007 and 2008. All samples in 2009 and 2010 were analyzed using the American Bayer Extractable Alumina (ABEA) method. In addition, 19,843 samples from 3,813 boreholes analyzed by FTIR in 2009 were analyzed by ABE method again.

Table 5-1 Annual Exploration and Drilling Works

Year	Number of boreholes	Footage (m)
2006	2,496	26,726.50
2007	3,170	40,099.00
2008	3,712	56,948.45
2009	2,172	25,214.20
2010	2,034	27,833.00
2011	12	182.3
Total	13,596	177,003.50

Table 5-2 Number of Different Types of Boreholes

Drilling method	Number of boreholes	Footage (m)
Auger drill	13,492	175,805
Diamond drill	89	1,101.45
Other methods	12	97
Total	13,596	177,003.50

A total of 7,821 boreholes were drilled in the Boffa mine. Among them, the borehole grid in # 38 mine, # 26 mine and # 10 mine generally reached 150m × 150m, and in # 27 mine 300m × 300m. The borehole grid in 0.36km^2 area of # 38 mine was infilled to 50m × 50m, and in 0.09km^2 area 25m × 25m. See Fig. 5-1.

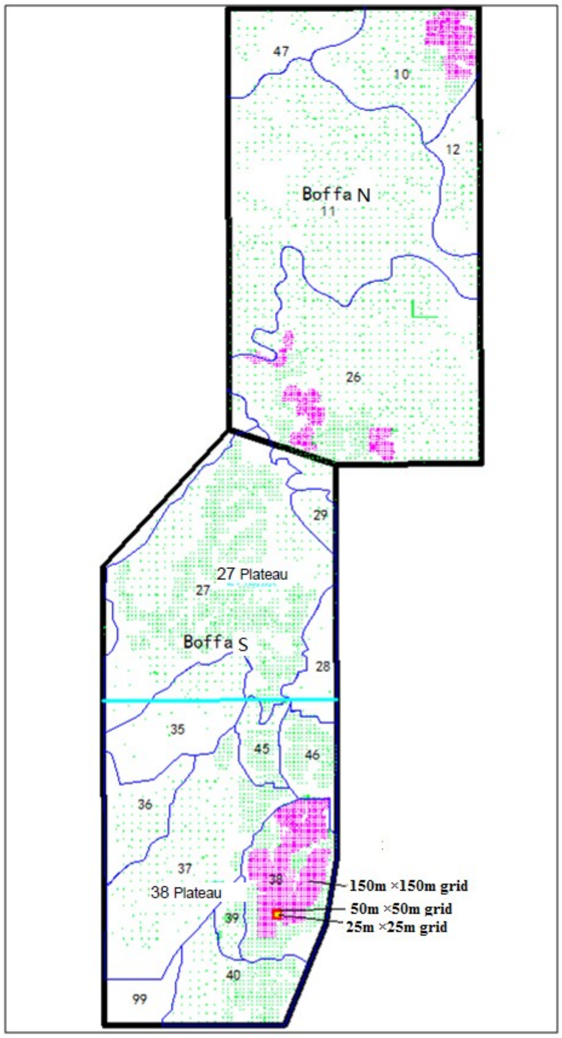


Fig.5-1 Distribution of Boreholes in Boffa Mine

(The area in purplish red is the borehole grid of 150m×150m)

In 2012, BHP submitted Boffa Santou Houda Project Close Out Report, establishing orebody model and block model, estimating the resources in Boffa South, Boffa North and Houda area.

Table 5-3 Bauxite Resources in BHP Exploration Area

Area	Cut-off grade (AAl_2O_3%)	Minimum minable thickness (m)	Resources (billion tons)	AAl_2O_3(%)	$RSiO_2$(%)
Boffa North, Boffa South and Houda	35	2	6～9	39～42	0.85～0.90

5.2.2 Due Diligence by Mining One

In November 2016, a technical due diligence on the BOFFA bauxite project in Guinea was conducted by Mining One Consulting, commissioned by Chalco Hong Kong. Based on literature review and field investigation, The Technical Due Diligence -Resource Assessment Report for the Boffa Bauxite Project was submitted in January 2017. Mining One due diligence establish a block model to validate the resources in the BHP withdrawal report, estimating 3.52 billion tons of bauxite resources in Boffa North and Boffa South, 38.57% of AAl_2O_3 and 0.84% of $RSiO_2$, as shown in Table 5-4.

Table 5-4 Boffa North and Boffa South Bauxite Resources

Area		Resources (Billion tons)	Grade(%)		Thickness(m)
			AAl_2O_3	$RSiO_2$	
Boffa North		2.48	38.74	0.59	3.9
Boffa South	Plateau #27	0.6	38.34	1.55	2.7
	Plateau #38	0.44	37.93	1.28	3.4
Total		3.52	38.57	0.84	

Note： AAl_2O_3 cut-off grade ≥35%，the minimum minable thickness≥ 1m.

5.2.3 CINF's Technical and Resource Report

From February to May 2017, CINF was commissioned by Chalco Hong Kong to prepare the technical and resource report, by carrying out 25 verification boreholes (diamond drilling) of 255m, 5 verification pits of 34m, 30 re-checking and surveying points, 300 core sampling analyses, 404 duplicate sample analyses, 2 solubility tests. On 22 May 2017, The Technical Report on Resources of Boffa Bauxite Development Project in Guinea was submitted, estimating the resources of Measured + Indicated + Inferred (cut-off grade AAl_2O_3≥35%) in the BOFFA mine of 2,410Mt, with average AAl_2o_3 39.09% and average $RSiO_2$ 1.10%.

5.2.4 CINF's Feasibility Study and Design

From March 2017 to May 2019, commissioned by Chalco Hong Kong, CINF undertook the feasibility study, basic design, and detail design of BOFFA project.

According to the design, the output of the first stage of Phase I is 12Mt/a high grade ore (AAl_2O_3≥39%) and 3Mt/a lower grade ore (35% ≤ AA_2O_3 < 39%). For Phase II, the output of the high-grade ore is 18Mt/a, the output of the lower grade ore is 12Mt/a, and the total output is 30Mt/a. The lower grade ore is temporarily stored on site for future treatment after the alumina refinery put into production. The mine is designed to be an open-pit mine with belt conveying system for hauling.

5.2.5 Mine Construction and Production of Chalco Guinea Company

On October 28, 2018, the construction of the BOFFA bauxite project was officially started. On October 6, 2019, the BOFFA bauxite project began filed mining operations. In 2021, a total of 12.3037Mt of high-grade bauxite was mined, achieving the production goal (Fig.5-2, Fig.5-3).

Fig.5-2 Boffa preferred stope

Fig. 5-3 Wharf and Wharf Yard in Boffa Mine

6 Geological Background and Mineralization Characteristics

6.1 Regional Geology

As Boke is located at the western edge of the West African Craton, more than 90% of the surface is covered by weathered eluvial gossan. The basement of the area is composed of Precambrian metamorphic rock series, mixed with granite and diabase zone. Overlying the bedrock, the Ordovician-Silurian/Devonian quartz sandstone and siltstone formed Wendubron-Fria syncline. In Mesozoic era, magmatic activity was intensive in the area, mafic hypabyssal intrusive rocks intrude into cap rocks and basement strata, where mafic volcanic rocks are distributed (Fig. 6-1).

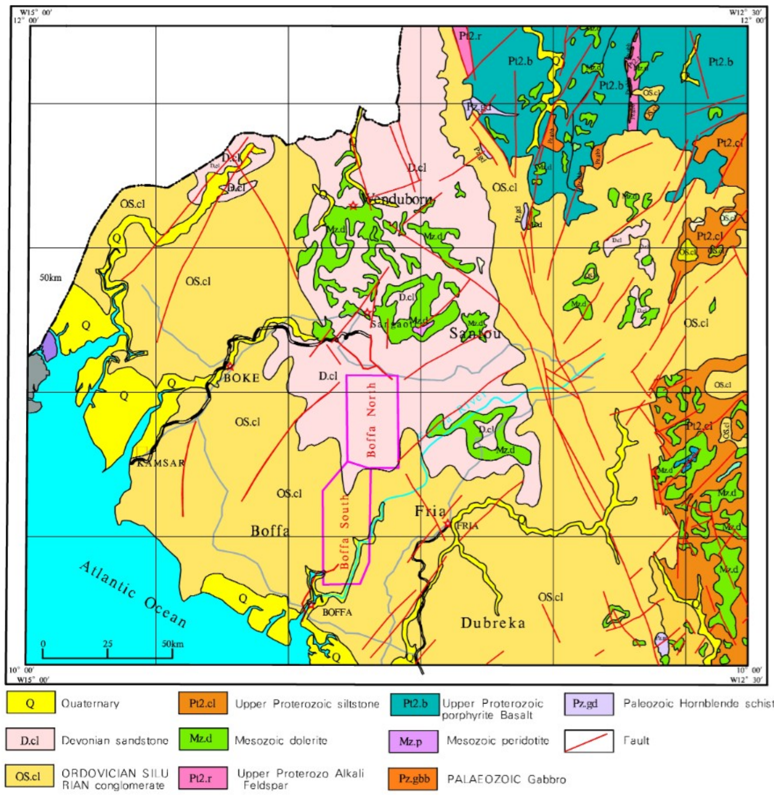


Fig. 6-1 Regional Geological Map of Boke

These mafic hypabyssal intrusive rocks and volcanic rocks are metallogenic mother rocks of laterite bauxite. The laterite bauxite was formed by oxidation weathering, desalinization and aluminum enrichment under tropical humid and hot climate.

6.2 Mine Geology

The Mesozoic mafic hypabyssal intrusive rocks and volcanic rocks are the mother rocks of laterite bauxite. In Quaternary, laterite bauxite was formed by oxidation weathering and desalinization and aluminum enrichment under the tropical humid and hot climate.

From top to bottom, the lithological characteristic of the bauxite profile in Boffa mine are: soil layer, upper laterite layer, bauxite layer, lower laterite layer and clay layer, and the typical lateritic profile is shown in Fig. 6-2.

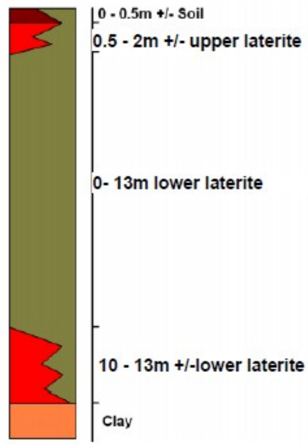


Fig. 6-2 Generalized Bauxite Profile in Boffa Mine

Boffa North is composed of 5 ore-bodies (Fig. 6-3) #47, #10, #11, #12 and #26. Boffa South-Plateau #27 is composed of 3 ore-bodies #27, #28 and #35, Boffa South-Plateau #38 is composed of 7 ore-bodies: #36, #37, #38, #39, #40, #45 and #46.

The ore-bodies are irregular in surface and stratified or quasi-stratified in cross section.

The smallest orebody in the area is #28 (with an area of $0.36km^2$), the largest one is #11 (with an area of $92.53km^2$). The orebody with the smallest thickness is #36 (with an average thickness of 1.31m), and with the largest one is #12 (with an average thickness of 6.11m). The orebody with the smallest overburden is #46 (with an average overburden thickness of 1.56m), and with the largest overburden is #36 (with an average overburden thickness of 2.95m); the orebody with the lowest average AAl_2O_3 content is #28 (with an average content of 36.29%), and with the highest average AAl_2O_3 content is #35 (with an average content of 40.49%). The orebody with the largest bauxite resources of 1,040.7068Mt is #11, and with the smallest bauxite resources of 1.1304Mt is #28, as shown in Table 6-1.

The characteristics of orebody #38, orebody #45 and orebody #46 in the preferred mine are as follows:

1) Orebody #38

Generally, the orebody is south-north trend, with a length 10.62km, and has unstable dip, with an angle of 0°-15°. The orebody has irregular surface and stratified and quasi-stratified cross section. The highest elevation is 211.26m and the lowest elevation are 31.84m. The thickness of the orebody in a single borehole is 1.0m-17.8m, and the average thickness is 4.32m, and the variation coefficient is 73.68%. The AAl_2O_3 content is 35.0-53.1% in a single borehole, the average AAl_2O_3 content is 39.73%, the variation coefficient is 8.14%; the $RSIO_2$ content is 0.10-7.95%, the average content is 1.37%, and the variation coefficient is 66.49%. The overburden thickness is 0m-14.0m and the average thickness is 1.67m. The estimated measured + indicated + inferred bauxite resources is 167Mt, which is 29.62% of the total resources in Boffa South.

2) Orebody #45

Generally, the orebody is south-north trend, with a length 4.12km, and has unstable dip, with an angle of 0°-15° generally. The orebody has irregular surface and stratified and quasi-stratified cross section. The highest elevation is 244.90m and the lowest elevation are 78.56m. The thickness of the orebody in a single borehole is 1.0m-11.7m, the average thickness is 5.47m, and the variation coefficient is 60.75%. The AAl_2O_3 content is 35.20～48.78% in a single borehole, the average AAl_2O_3 content is 40.40% and the variation coefficient is 7.78%, the $RSIO_2$ content is 0.15～3.12%, the average content is 1.32%, and the variation coefficient is 61.51%. The overburden thickness is 0m-9.0m and the average thickness is 1.81m. The estimated indicated + inferred bauxite resources are 35Mt, which is 6.14% of the total resources in Boffa South.

3) Orebody #46

Generally, the orebody is south-north trend, with a strike length 5.09km, and has unstable dip with an angle of 0-12° generally. The orebody has irregular surface and stratified and quasi-stratified cross section. The highest elevation is 195.39m and the lowest elevation are 67.68m. The thickness of the orebody in a single borehole is 1.0m-9.9m, the average thickness is 3.05m, and the variation coefficient is 66.69%. The content of AAl_2O_3 is 35.00-48.29% in a single borehole, the average AAl_2O_3 content is 39.28%, the variation coefficient is 7.97%, the $RSIO_2$ is 0.10-2.50%, the average content is 1.12%, and the variation coefficient is 59.81%. The overburden thickness is 0m-8.0m and the average thickness is 1.56m. The estimated indicated + inferred bauxite resources 332+333 are 35Mt, which is 3.83% of the total resources in Boffa South.

Table 6-1 List of Orebody Characteristic

Mine		Orebody No.	Area (km^2)	Average thickness (m)	Resources	Average grade (%)						Overburden thickness (m)
					(Mt)	AAl_2O_3	$RSiO_2$	Al_2O_3	SiO_2	Fe_2O_3	TiO_2	
Boffa North		10	30.04	4.81	291.92	38.54	1.12	42.33	1.84	30.15	2.25	1.78
		11	92.53	5.57	1040.71	39	0.95	42.84	1.99	29.80	2.24	1.69
		12	12.6	6.11	155.50	39.87	1.27	43.70	2.10	28.32	2.25	2.12
		26	48	3.28	317.93	38.91	0.88	42.31	1.89	30.89	2.10	1.61
		47	3.33	6.08	40.84	39.72	0.45	43.29	1.29	28.84	2.32	2.31
		Average /Total		**4.9**	**1846.90**	**39**	**0.98**	**42.75**	**1.94**	**29.89**	**2.22**	**1.9**
Boffa South	**Plateau #27**	27	32.87	4.09	271.70	39.19	1.64	43.91	3.11	26.07	2.05	1.81
		28	0.36	1.55	1.13	36.29	1.29	43.54	2.80	27.29	2.13	2.52
		35	3.34	2.78	18.71	40.49	2.01	43.72	3.47	26.67	1.86	1.59
		Average /Total		**3.95**	**291.54**	**39.26**	**1.66**	**43.90**	**3.36**	**28.02**	**2.04**	**1.98**
	Plateau #38	36	1.71	1.31	4.51	38.53	1.18	39.43	2.28	33.10	2.03	2.95
		37	3.82	2.65	20.42	38.83	1.29	42.30	1.88	30.60	1.98	2.66
		38	19.13	4.32	167.01	39.73	1.37	44.06	1.79	28.32	2.09	1.67
		39	0.43	4.51	3.96	37.15	1.23	40.02	2.40	34.23	2.20	2.55
		40	3.27	3.04	20.06	37.43	1.44	41.56	2.53	30.63	2.22	2.83
		45	3.14	5.47	34.65	40.4	1.32	42.35	1.41	31.16	2.18	1.81
		46	3.51	3.05	21.62	39.28	1.12	42.54	1.81	29.44	2.12	1.56
		Average /Total		**3.85**	**272.24**	**39.49**	**1.34**	**43.27**	**1.82**	**29.28**	**2.10**	**2.29**

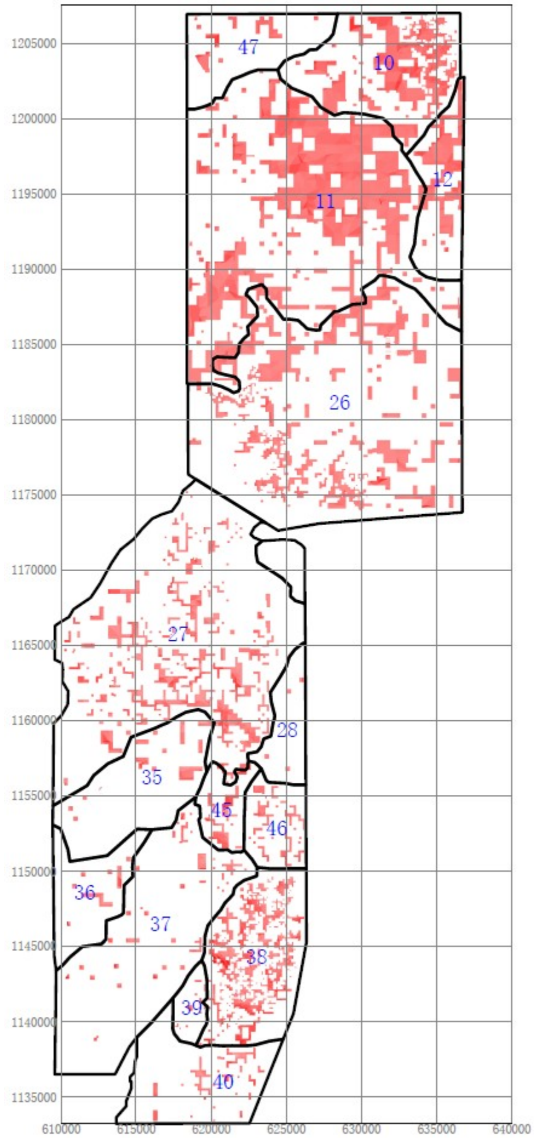


Fig. 6-3 Orebody Distribution of Boffa Mine

The main minerals are gibbsite (61%), goethite (17%) and hematite (15%), and a small amount of kaolinite (3.2%), quartz (1%), anatase (1.5%) and rutile (1%).

The main chemical composition is Al_2O_3, Fe_2O_3, SiO_2, TiO_2, and a small amount of S, CaO, MgO, Na_2O, K_2O and P_2O_5. The beneficial elements in the minerals are Ga (the average content of combination analysis is 0.0061%), the deleterious element is organic carbon (the average content of combined analysis was 0.13%).

The ore texture is mainly argillaceous, and the ore structure is mainly massive and earthy.

6.3 Deposit Type

The deposit consists of laterite bauxite.

Ore type: the mineral is mainly gibbsite with a content of 72%-96%, and a small amount of diasporite. The average AAl_2O_3 content is 39.11%, the average $RSIO_2$ content is 1.11%, which has low silicon content. The average Fe_2O_3 is 29.47%, which has super-high Fe content. The results of chemical analysis and spectral semi-quantitative analysis show that the sulfur content is very low. According to the above characteristic, the bauxite industry type in the area consists of gibbsite with high Fe content and low sulfur content.

7 Exploration

7.1 Survey Evaluation

During BHP Billiton's exploration from 2005 to 2011, no topographic survey of the mine was carried out. The coordinate system is Mercator projection, Clarke 1880 datum spheroid, six-degree zoning, the band sign is 28, the central longitude is west 15°, and scale factor of the central longitude is 0.9996.

According to the design coordinates, the technician use hand-held GPS to locate and measure boreholes. There are three kinds of borehole coordinate precision: the coordinates plane and elevation error surveyed by the high precision GPS is within 20cm, the coordinates plane and elevation error surveyed by the medium precision GPS is within 4.58m and 2.12m respectively, and the coordinates plane and elevation error surveyed by the low precision GPS is within 5m and 10m respectively.

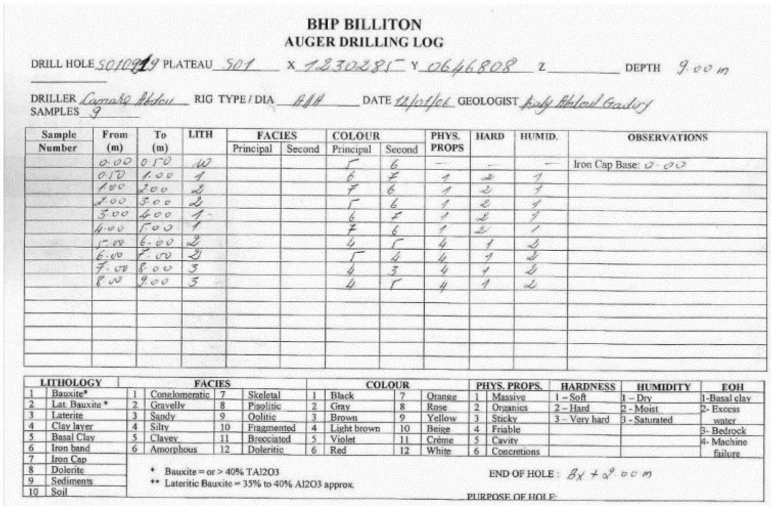
The precision of coordinate surveyed by medium precision and low precision GPS survey is low, which will affect the position and shape of orebody.

7.2 Geological Logging

In the orebody, each one-meter sample is logged in the field by a geologist based on codes set for litho-logy, color, physical properties, hardness and humidity (Figure 7-1), while in the base clay, each two-meter sample is logged. Borehole number, plateau, coordinates, date, driller, and depth of holes are recorded. Logs are field checked by the senior geologist.

The recorded log data is input into a spreadsheet at the laboratory at Sangaredi. The original sheets are also scanned and submitted to the geologist in charge of the digitized data. The data is validated by the senior geologist and then submitted to the database manager.

The senior geologist in Guinea checked the data.



BHP BILLITON
AUGER DRILLING LOG

DRILL HOLE S010919 PLATEAU S01 X 1230285 Y 0646808 Z ______ DEPTH 9.00 m

DRILLER Camara Abdou RIG TYPE / DIA AAA DATE 12/01/06 GEOLOGIST [illegible]
SAMPLES 9

Sample Number	From (m)	To (m)	LITH	FACIES Principal	FACIES Second	COLOUR Principal	COLOUR Second	PHYS. PROPS	HARD	HUMID.	OBSERVATIONS
	0.00	0.50	10			5	6	—	—	—	Iron Cap Base: 0.00
	0.50	1.00	1			6	7	1	2	1	
	1.00	2.00	2			7	6	1	2	1	
	2.00	3.00	2			5	6	1	2	1	
	3.00	4.00	1			6	7	1	2	1	
	4.00	5.00	1			7	6	1	2	1	
	5.00	6.00	2			4	5	4	1	2	
	6.00	7.00	2			5	4	4	1	2	
	7.00	8.00	3			4	3	4	1	2	
	8.00	9.00	3			4	5	4	1	2	

LITHOLOGY		FACIES				COLOUR				PHYS. PROPS.		HARDNESS	HUMIDITY	EOH
1	Bauxite*	1	Conglomeratic	7	Skeletal	1	Black	7	Orange	1	Massive	1 – Soft	1 – Dry	1-Basal clay
2	Lat. Bauxite *	2	Gravelly	8	Pisolitic	2	Gray	8	Rose	2	Organics	2 – Hard	2 - Moist	2- Excess water
3	Laterite	3	Sandy	9	Oolitic	3	Brown	9	Yellow	3	Sticky	3 – Very hard	3 - Saturated	3- Bedrock
4	Clay layer	4	Silty	10	Fragmented	4	Light brown	10	Beige	4	Friable			4- Machine failure
5	Basal Clay	5	Clayey	11	Brecciated	5	Violet	11	Crème	5	Cavity			
6	Iron band	6	Amorphous	12	Doleritic	6	Red	12	White	6	Concretions			
7	Iron Cap													
8	Dolerite													
9	Sediments													
10	Soil													

* Bauxite = or > 40% TAl2O3
** Lateritic Bauxite = 35% to 40% Al2O3 approx.

END OF HOLE : [illegible]

PURPOSE OF HOLE:

Fig. 7-1 BHP AUGER DRILLING LOG

7.3 Drilling

Between 2005 and 2011, BHP Billiton conducted 5 geological explorations in Boffa, Santou and Houda, with 13,596 boreholes (177,003.5m footage) drilled, most of them were drilled by Auger and a few of them were drilled by diamond drills. In 2008, the coring rate was checked by weighting samples of 1/20 boreholes drilled by auger drills, and the result shows that the coring rate is high.

The annual drilling is shown in Table 7-1.

Table 7-1 Number of different types of boreholes

Drilling Method	Number of boreholes	Footage (m)
Auger	13,492	175,805
Diamond	89	1,101.45
Other methods	12	97
Total	13,596	177,003.50

A total of 7,821 boreholes were carried out in the Boffa mine. Among them, the grid of zones # 38, #26 and #10 was 150m × 150m, and the grid of zone # 27 was 300m × 300m. In order to compare the exploration grids, the grid in 0.36km^2 area of zone #38 was 50m × 50 m and that in 0.09km^2 area was 25m × 25m. See Fig. 7-2 for details.

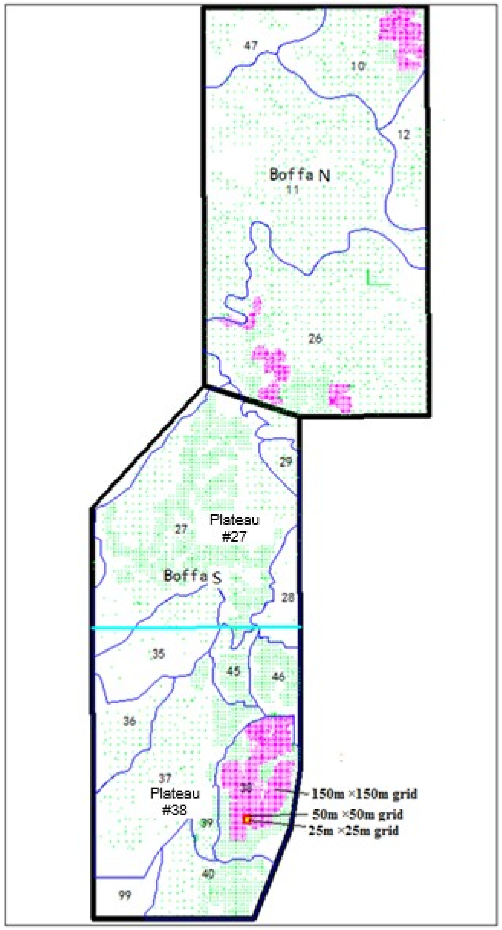


Fig. 7-2 Distribution of Boreholes in Boffa Mine

7.4 Sampling and QAQC

The auger borehole samples were collected through a wooden tray from the rock debris broken by Auger blade, with a length of 1m. The weight of each auger sample is about 25kg, and after reduction, the weight is about 2kg. Each sample was air dried at the site, and then was transferred to the sample warehouse.

Before 2007, the codes of the boreholes and samples were marked on site. Since 2007, the sample codes were prepared in advance.

1 in 20 duplicate samples were prepared.

Since the second stage of drilling, auger borehole samples and diamond borehole samples were compared 13 times. After comparison of each sample, there are obvious differences between the two drilling methods, but the overall deviation is not large. The quality of diamond boreholes is not high (non-triad pipe), the recovery rate is low, and the validity comparison results are not reliable.

The coring rate of auger drilling is high and the representativeness of samples is better.

In May 2017, diamond drilling was used to verify the sampling quality of auger drilling. The verification result showed that the orebody thickness delimited by auger borehole samples sampling is greater than that defined by diamond borehole samples, and this is because of contamination of the auger drilling.

7.5 Hydrogeological Evaluation

The mine is located in the highlands, north of the Rio Pongo River, which flows into the Atlantic Ocean in the Boffa. The Fatala River is the main river flowing through the mine, where it joins the Rio Pongo River 20km to the south at the Boffa bridge. There are many small streams which feed into the river.

The water level varies greatly during the rainy and dry seasons. During the rainy season, the lowlands and valleys are flooded. During the dry season, the small streams on the hills dry up and the flow of water from the big rivers drops sharply.

A great deal of rain drains through surface channels. Some precipitation could not reach rivers and streams, including those blocked by vegetations, evaporation, and seepage, water storage in puddles on the ground, and long-term water storage on the ground.

Erosion is very common in the area, including vast stretches of erosion, stream erosion, gully erosion, and torrent erosion. In April, on the east side of Bindan village in the lower reaches of Fatala river, the calculated average discharge at the 13 positions was about $2.95m^3/s$. Due to the influence of tide, the water level and discharge of the river vary greatly, the high tide head is far lower than the quaternary overburden in the mine. Therefore, it has no effect on the runoff and drainage of groundwater in the quaternary overburden.

According to the results of drilling and hydrogeological investigation, the strata in this area are mainly quaternary eluvial layer, Mesozoic intrusive rocks and Ordovician littoral sediments.

According to the seepage test results, the upper gossan layer of Quaternary residual layer has a large cellular pore structure, which is favorable for surface water infiltration. It has stronger permeability, and the permeability coefficient is between 1.70×10-3 and 2.94×10-3 (cm/s), and the permeability is medium. In combination with the results of water injection test and pumping test, it can be considered that the permeability of the bauxite layer is from top to bottom, from medium permeability to weak permeability. The kaolinized relative waterproof layer at the bottom of quaternary residual layer is slightly permeable.

Most of the minerals of Mesozoic diabase (βμ) are weathered and metamorphic, and the rock can be easily broken by hand. The structure is loose and the core is half rock and half soil.

Ordovician siltstone (O): Most of the minerals have weathered and metamorphosed, the blocks can be broken by hand, and the cores are half rock and half soil.

The aquifer in the area is shallow pore phreatic water, and the groundwater is mainly from atmospheric precipitation. The velocity of runoff in the field area is slow and the intensity is weak. All streams in the area are controlled by the topography which is high in the west and low in the east and flow to the Fatara River in the east. The deposit is the first type of directly water-filled porous aquifer deposit with simple hydrogeological conditions.

7.6 Geotechnical Assessment

Slope stability is the main geotechnical concern in an open pit mining. The eluvial diabase soil distributed in the area is easy to soften after being soaked, easy to disintegrate after loss of water, with a sharp decrease in strength and poor stability.

8 Preparation, Analysis and Quality of Samples

8.1 Preparation Process and Quality Assessment of Samples

1) Preparation

The sample was prepared in the sample preparation area, and the 2kg sample was broken up to 95% through 100-mesh screen. After the second reduction, 100g of the sample was taken for analysis, and 250g was taken as a duplicate sample.

8.2 QAQC of Sample Assay

8.2.1 Comparison of Analytical Methods and Results

The assay data provided by the Government of Guinea, 13,596 boreholes were drilled in Boffa South, Boffa North and Houda and 175,004 samples were analyzed. There were 113,069 FTR analytical data and 81,280 ABE analytical data

With FTR and ABE methods, 2,8087 samples were analyzed. After comparison of the results, it has been found that average AAl_2O_3% of FTR was 0.36% (absolute value) higher than that of ABE and average $RSiO_2$ of FTR was 0.41% (absolute value) lower than that of ABE. A total of 15856 samples with AAl_2O_3 content ≥35% were selected and analyzed by FTR and ABE methods. The results showed that the content of AAl_2O_3% was 0.73% higher (absolute value) and $RSiO_2$ was 0.33% lower (absolute value) than ABE's.

The results of AAl_2O_3 and $RSiO_2$ analyzed by FTR and ABE are compared in Fig. 8-1 and 8-2.

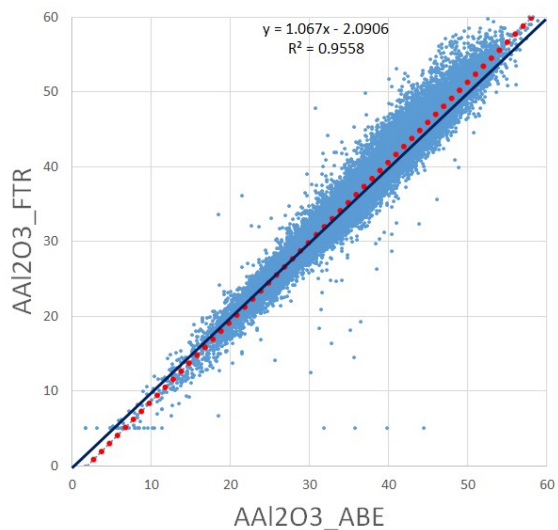


Fig. 8-1 Correlation Diagram of AAl_2O_3 Analysis by FTR and ABE

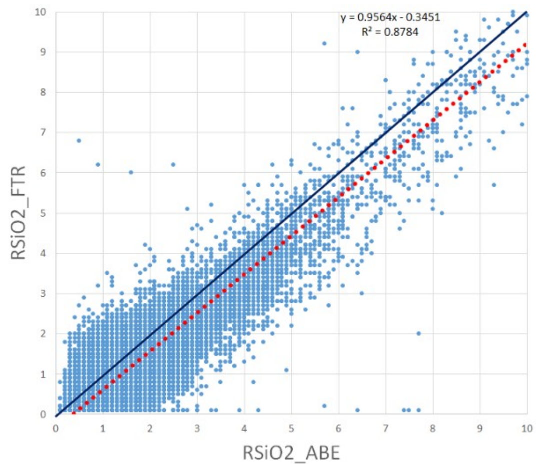


Fig. 8-2 Correlation Diagram of $RSiO_2$ Analysis by FTR and ABE

8.2.2 Analysis and QAQC

1) Standard sample analysis

The standard samples have been routinely inserted in the drill sample batches at the ratio of 1 in 50 samples. A total of 12 standard samples were added. These standard samples were obtained from a variety of internal sources and commercially available bauxite.

In the fourth quarter of 2008, 3 standard samples (AMS Bauxite D, E and F) were produced in three items. All standard samples have been analyzed by XRF, only 6 standard samples contain AAl_2O_3 and $RSiO_2$ content.

The standard sample was analyzed 7,699 times by FTR and 2691 times by ABE. The results show that the deviation range of FTR is slightly larger, and the $RSiO_2$ results of ABE are concentrated. The AAl_2O_3 analytical results obtained by FTR and ABE have positive deviation, but the deviation value has not been calculated. Fig. 8-3 shows low AAl_2O_3 results from ABE, and Fig. 8-4 shows high AAl_2O_3 results from ABE.

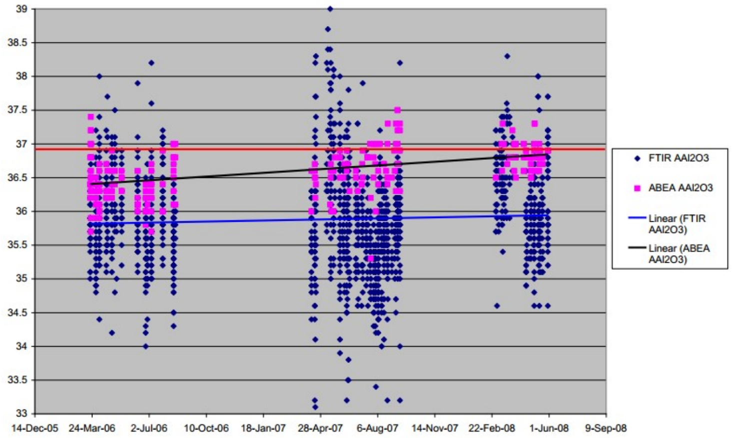


Fig. 8-3 Standard Sample AAl_2O_3 Results by ABE and FTR

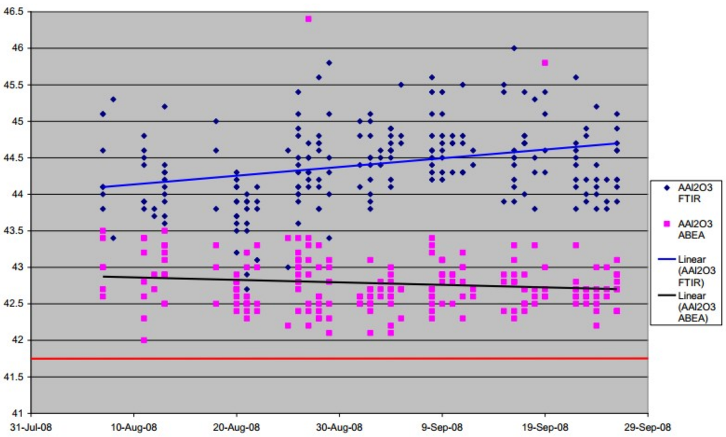


Fig. 8-4 Correlation Diagram of Standard AMS Bauxite E, AAl_2O_3 Results by FTIR and ABEA

2) External Check Analysis

1 in 50 external check analysis were sent to an external laboratory for analysis by ABE and FTR.

A total of 9,327 external check samples were analyzed, and the analysis results showed that the deviation of FTIR was slightly larger than that of ABE. The results of ABE are relatively consistent. ABE was used in the two laboratories. The AAl_2O_3 standard deviation was 0.34%, as shown in Table 8-1. The statistical ABE analysis of AAl_2O_3 and $RSIO_2$ showed that the sample assay results varied little within 95% confidence level. The results from two laboratories show that accuracy of ABE is within the confidence level.

Table 8-1 Results of External Check Analysis

Composition	Sample No.	Average of laboratory A %	Standard deviation of laboratory A	Average of Laboratory B %	Standard deviation of laboratory B	Total
AAl_2O_3	723	31.11	0.34	30.38	0.34	0.111378
$RSiO_2$	724	1.55	0.08	1.79	0.08	-0.1577

3) Field duplicate samples and pulp duplicate samples

Field duplicate samples and pulp duplicate samples are included at the rate of 1 in 20 samples and 1 in 50 samples respectively. 5,404 field duplicate samples and 2,773 pulp duplicate samples are recorded in the database. The analysis results showed that the variation values of the two types of duplicate samples were within the confidence level, but the variation of the field duplicate samples was slightly larger. This shows the sampling has good representativeness and the analysis results have good repeatability.

8.3 Data Management

The samples are sent to the office in Conakry from the preparation laboratory in batches and each batch has approximately 2,000 samples. The relevant sample details, logging and survey data are sent electronically to the database manager and stored in the database. The database is then validated by automated routines to check the hole number (against planned), the depth of hole and consistency of the logged data. Problems and queries are submitted to the senior geologist in Guinea for verification. The chemical analyses are input into the database by the database manager once he has received the results electronically from the laboratory. The QAQC data have been visually checked by the senior geologist on the automated graphing system in the database.

9 Data Verification

9.1 Verification Method

(1) Field validation of BHP coordinates, drilling quality, sample processing and assay quality.

① Field survey of borehole coordinates.

② Verification to verify the quality of drilling, sampling and processing, and assay. Sampling in the validation borehole to test the density and moisture content of the ore.

③ Duplicate samples from BHP's borehole to check the assay quality .

④ Random check of geological logs .

⑤ Geotechnical and hydrogeological investigation.

(2) On the basics of confirming the reliability of the data, the integrity of the previous exploration data has been checked. The data checked included:

1) Boffa Santou Houda Project Close Out Report (BHP, 2012);

2) BHP Billiton Block Model (text);

3) Borehole Coordinates (PDF);

4) Borehole Survey (excel);

5) Sample Assay Data Table (excel);

6) Drilling Logging Table.

(3) Using SURPAC software , a geological database are created with the above data. The cut-off grade and the geologic interpretation principle are determined. The engineering rarefaction test is carried out to determine the grid of different resource classification. The results of rarefaction test show that 300m × 300m grid could meet the geologic continuity requirements of indicated resource, and 150m × 150m grid could meet the requirements of measured resource. 600m × 600m grid is determined for inferred resource.

(4) Based on the database, the geological model is created and resources are estimated according to the principle of geologic interpretation and the grid of resource classification. The cut-off grade of AAl_2O_3 is ≥35%.

(5) Al_2O_3 solubility test was carried out by taking two test samples.

(6) The methods and processes of 3D model and resource estimate are reviewed.

9.2 Verification Results

1) The results for samples validation and duplicate samples analysis indicate that the exploration data provided by the Government of Guinea are reliable.

2) The verification results show that the orebody thickness defined by diamond drilling is smaller than that defined by auger drilling.

3) The recheck results of borehole coordinates showed that the results of high-precision instruments are reliable, and that of medium and low precision instruments are not reliable.

4) The results of solubility test show that the ore digestion rate is greater than 85%.

5) Through 3D modeling, the measured + indicated + inferred (cut-off grade of AAl_2O_3 ≥35%) of resources is 2,410Mt, with AAl_2O_3 content of 39.11% and $RSIO_2$ content of 1.11%.

6) Through the grid rarefaction verification, it has been determined that the grid of the measured resource is 150m × 150m, and that of the indicated resource is 300m × 300m.

9.3 Analysis of Duplicate Samples

9.3.1 Distribution of Boreholes of Duplicate Samples

At the Boffa mine, BHP Billiton drilled 7,821 boreholes, of which 4,304 have intersected orebody. A total of 404 duplicate samples from 45 boreholes (about 1% intersected orebody boreholes) (Fig. 9-1) were taken for duplicate samples. The samples were distributed widely and could represent the characteristic of all samples in the mine.

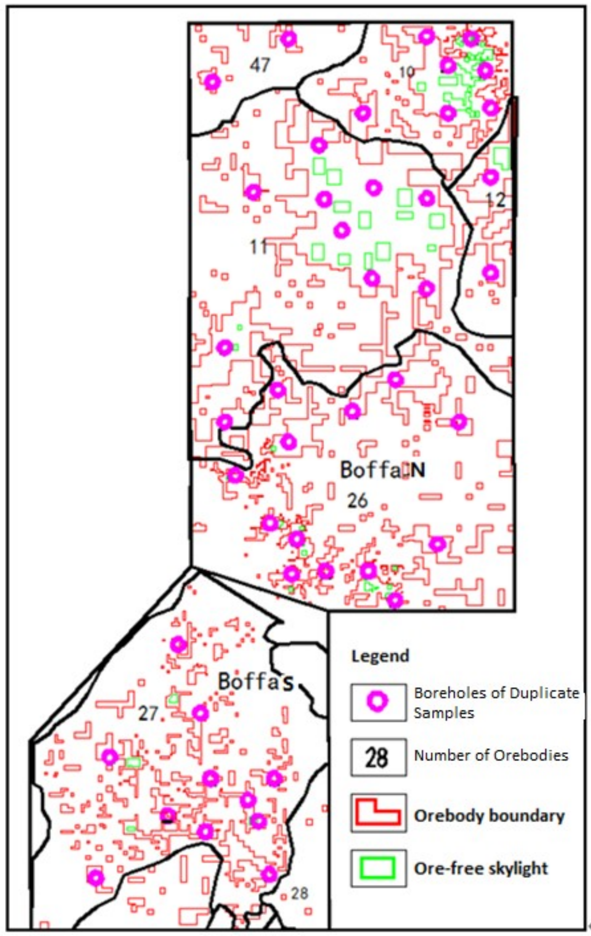


Fig. 9-1 Borehole Distribution Diagram for Duplicate Sample

9.3.2 Comparison of Duplicate Sample Analysis

The correlation of AAl_2O_3 and $RSIO_2$ contents between 404 duplicate samples and the original samples is shown in Figures 9-2 and 9-3. The results of the two analyses are close and the deviation is small. After comparison of both the duplicate samples and ABE results, the absolute value of average AAl_2O_3 deviation was 0.19% and that of average $RSIO_2$ deviation was -0.16%. After comparison of both the duplicate samples and FTR results, the absolute value of average AAl_2O_3 deviation was 0.19% and that of average $RSIO_2$ deviation was 0.32%. After comparison of both the duplicate samples and all original results, the absolute value of the average AAl_2O_3 deviation was 0.18% and the average $RSIO_2$ deviation was 0.0%.

The comparison of data show that the exploration data are reliable.

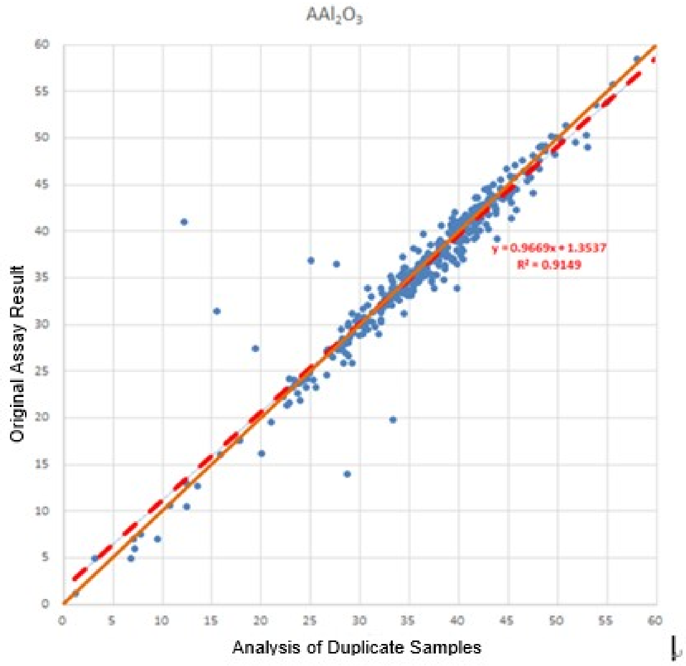


Fig. 9-2 Results of the AAl_2O_3 Duplicate Sample

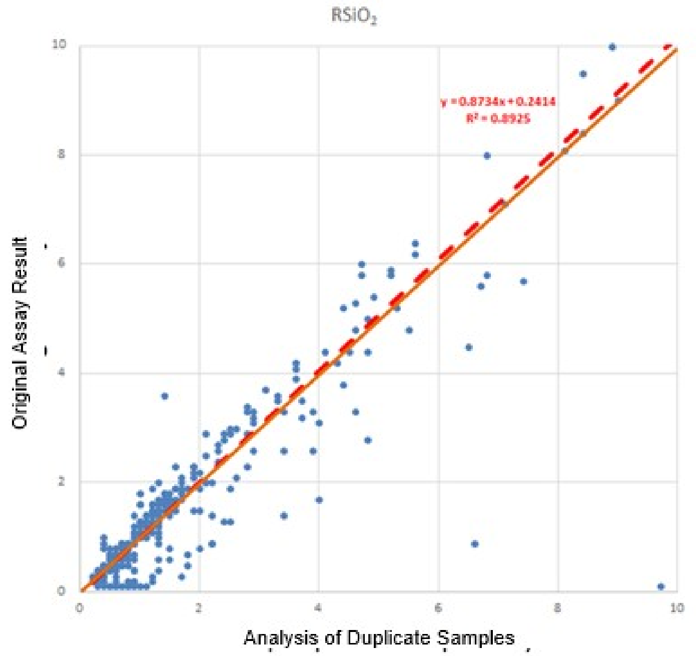


Fig. 9-3 Results of the RSIO$_2$ Duplicate Samples

9.4 Verification Conclusions

The results of verification show that:

① The results of verification samples and duplicate samples analysis show that the assay data provided by the Government of Guinea are reliable.

② The survey data are complete except that there is no topographic survey data.

③ The results of verification samples show that the orebody thickness has certain negative deviation.

④ The solubility test results show that the total aluminum digestion rate is more than 85% . The ore has better digestion property.

⑤ The coordinates survey showed that the results of high-precision instruments are reliable, that of medium and low-precision instruments are unreliable, which will affect the shape and position of ore body.

⑥ According to the review of the 3D orebody modeling, estimate method and process of resources, the resource in Boffa mine estimated by CINF in 2017 is reliable.

10 Beneficiation Performance Test

In April 2017, the Engineering Survey Branch Company of CINF collected two groups of samples (Each group of samples is 61.6kg) for the solubility test, which was conducted by Zhengzhou Non-Ferrous Metals Research Institute Co., Ltd. and Shandong Branch of Chalco. Low-temperature Bayer method was used for digestion test.

Each group of samples was collected from 44 samples (with a length of 1m) in deposit and roofs and floors in 6 verification boreholes in orebody # 38, each sample was collected with a weight of 1.4kg.

According to the sample results of Zhengzhou Non-Ferrous Metals Research Institute Co., Ltd., the AAl_2O_3 content is 38.70%, and the $RSIO_2$ content is 1.40%. The content of gibbsite and quartz in the ore is 61% and 1.0% respectively, as shown in Tables 10-1 and 10-2.

According to the sample results of Shandong Branch of Chalco, the AAl_2O_3 content is 39.91%, and the $RSIO_2$ content is 1.34%. The content of gibbsite and quartz is 61.5% and 1.0%, as shown in Tables 10-3 and 10-4.

Compared with the pre-feasibility study report (the average content of AAl_2O_3 and $RSIO_2$ are 40.33% and 1.41% respectively), the difference of AAl_2O_3 content is less than 4%, the error is within the allowable range, and the samples are representative.

Tables 10-1 Chemical Composition of Samples Tested by Zhengzhou Institute (%)

Al_2O_3	**SiO_2**	**Fe_2O_3**	**TiO_2**	**K_2O**	**Na_2O**	**CaO**
43.60	2.52	26.67	2.51	0.076	0.040	0.038
MgO	**MnO**	**P_2O_5**	**S**	**Ga**	**V**	**Zn**
0.11	0.013	0.13	0.033	0.0048	0.043	0.0034
C_{total}	**$C_{organic}$**	**LOI**	**AAl_2O_3**	**$RSiO_2$**		
0.24	0.18	24.59	38.7	1.40		

Tables 10-2 Mineral Composition of Samples Tested by Zhengzhou Institute (%)

Gibbsite	**Aluminum Goethite**	**Hematite**	**Kaolinite**	**Quartz**	**Anatase**	**Rutile**
61	17	15	3.2	1.0	1.5	1.0

Tables 10-3 Chemical Composition of Samples Tested by Shandong Branch. (%)

SiO_2	**Fe_2O_3**	**Al_2O_3**	**TiO_2**	**LOI**	**AAl_2O_3**	**$RSIO_2$**
2.65	25.61	44.3	2.38	24.62	39.91	1.34

Tables 10-4 Mineral Composition of Samples Tested by Shandong Branch (%)

Gibbsite	**Aluminum Goethite**	**Hematite**	**Kaolinite**	**Quartz**	**Boehmite**
61.5	17.5	11.0	2.89	1.0	2.1

10.1 Digestion Test Results

The test results show that the bauxite ore has good digestion properties, the digestion rate of Al_2O_3 is more than 85.0%, and the A/F of digested red mud is about 0.22.

10.1.1 Test Results of Zhengzhou Non-Ferrous Metals Research Institute

1) The bauxite mainly consists of gibbsite, where main iron-bearing minerals include aluminum goethite and hematite, the main silicon-bearing minerals include kaolinite and quartz, and the main

titanium-bearing minerals include anatase and rutile. The results show that the AAl_2O_3 is 38.70% and the $RSIO_2$ is 1.40%.

2) The Bond work index of the ball mill is 17.38 KW h/t when the particle size of bauxite is 50 microns.

3) The recommended pre-desiliation conditions of bauxite are as follows: the pre-desiliation temperature is 105℃; lime addition is 1% of the ore; pre-desiliation time is 8-10 hours; pre-desiliation slurry solid is about 800g/l; the concentration of caustic soda in circulating mother liquor is 160-180 g/l. Under the recommended pre-desilionization conditions, the pre-desilionization rate is about 51%.

4) The recommended digestion conditions of bauxite are: grinding size is 20 microns; digestion solution αk is 1.35; addition of lime 1.0% of the ore; concentration of caustic soda in circulating mother liquor 160-180g/l; digestion temperature 145℃; digestion time 30 min. Under the recommended digestion conditions, the digestion rate of aluminum oxide is greater than 85.0% and the A/F of red mud is about 0.22.

5) Under the recommended pre-desilionization and digestion conditions, the digested slurry was diluted to the concentration of caustic soda of 145g/l-160 g/l, and the silicon index of the solution can reach about 200 when the desilionization temperature is 105℃ and desilionization time is 2 hours.

6) Under the recommended conditions of pre-desilionization of bauxite, when there is 160g/L diluted Nk and 80g/L diluted solid, the settling velocity of flocculant Nalco85252 can reach 9.49-11.58m/h when 155-176g/ t-dry red mud is added; the compression liquid-solid ratio of the bottom flow is 4.56-4.66 and the suspended matter content of the supernatant is 0.04-0.05g/l after settling for 30min. If 192-250g/t dry red mud is added, the settling velocity of domestic ZX-650 reaches 4.67-4.93m/h, and the average settling velocity reaches 1.31-1.36m/h in the first 5 minutes, and the compression liquid-solid ratio of the bottom flow is 4.73-4.83 and the suspended matter content of the supernatant is 0.03g/L.

7) When the diluted Nk is 145g/l and diluted solid content is 100g/l, the settling velocity of flocculant Nalco85252 can reach 8.03-12.34m/h when 81-132g/t of dry red mu is added; the compression liquid-solid ratio of the bottom flow is 3.44-3.66 and the suspended matter content of the supernatant is 0.04-0.05g/L after settling for 30min. If 132-198g/t-dry red mud is added, the setting velocity of the domestic flocculants ZX-650 can reach 4.72-5.14m/h, and the average settling velocity is 1.36-1.43m/h in the first 5 minutes, the compression liquid-solid ratio of the bottom flow is 3.76-3.88 and the suspended matter content of the supernatant is 0.04 -0.05g/l.

8) As compared with domestic flocculants, foreign flocculants are more suitable for Guinean Bauxite. When foreign flocculants are used for Guinean bauxite, in terms of settling velocity and dosage of flocculants, 145g/l is more suitable than 160g/l.

10.1.2 Test Results of Shandong Branch of Chalco

1) Al_2O_3 content is 44.3% and AAl_2O_3 content is 39.91% ,61.5% gibbsite and 2.1% boehmite.

2) When αk is 1.36, the initial digestion rate is 87.6% and the relative digestion rate is 97.2%. The digestion of the ore is better.

3) In order to meet the demand of the subsequent separation, the digestion of αk shall be controlled at 1.36-1.42.

4) The red mud has good settlement and compression properties. It is suggested that ISEN 232 flocculants and 185g/t dry red mud shall be used in the process of separating and settling dilution slurry. The control temperature of the separation washing system is ±95℃.

5) In order to ensure the silicon index and recovery rate of aluminum oxide, it is suggested that the ore shall be mixed with good desiliation property ore in practical production.

6) The main economic and technical indexes of ore: the mineral consumption is 2.634 t/t-AO, chemical loss is 36.7Kg-Na_2O_3/t-AO, and the red mud yield is 42%.

11 Estimation of Mineral Resource

11.1 Estimation Method and Parameter Selection

11.1.1 Data and Databases

The data are based on BHP Billiton exploration data. There are 7,821 boreholes and 94,030 samples in Boffa mine.

The AAl_2O_3 and $RSiO_2$ are analyzed in two ways: ABE (low-temperature Bayer method) and FTR (Fourier Transform Infrared Spectroscopy). 54，953 samples were analyzed by ABE and 57154 samples were analyzed by FTR, among which 18,077 samples were analyzed by two methods. The data selection principle in resource estimate is that ABE data should be used firstly, and FTR data should be used for samples without ABE assay.

Based on the data, the geological database is created by SURPAC software, and the following data tables are created: collar, survey and assay. All the data tables are saved as .CSV format. Three-dimensional terrain model of the mine is based on the data of the borehole coordinates.

11.1.2 Parameter Selection for Resource Estimation

(1) Industrial indices

① Cut-off grade: $AAl_2O_3 \geq 35\%$.

② Minimum minable thickness ≥1m.

③ Interlayer thickness ≥1m.

(2) Volumetric weight: 2.02t/m³.

(3) Grid for resource classification

① 150m×150m grid for Measured Resources.

② 300m×300m grid for Indicated Resources.

③ 600m×600m grid for Inferred Resources.

(4) Principle of delineation of orebody

① Delineation of single drill orebody

From the top to bottom, the first and last samples to reach the cut-off grade ($AAl_2O_3 \geq 35\%$) is used as the boundary of the orebody (Fig. 11-1).

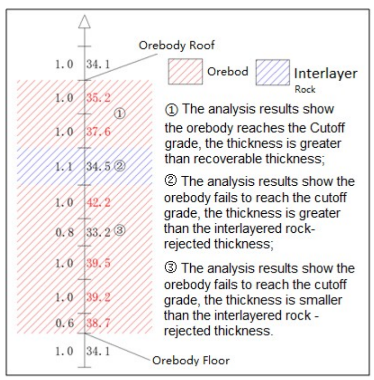


Fig. 11-1 Sketch Map of Orebody Delineation in Single Borehole

② Delineation of plane boundary of orebody

A. Finite extrapolation

The finite extrapolation of the orebody depends on the spacing between the borehole intersected by orebody and the borehole not intersected by orebody. When the spacing is less than the grid of the corresponding resource classification, the extended distance is 1/4 the spacing between two drills. When the spacing is great than the grid of the corresponding resource classification, the extended distance is 1/4 grid of the corresponding resource classification.

B. Infinite extrapolation

When there is no external drill control, the extended distance is 1/4 grid of the corresponding resource classification. (Fig. 11-2)

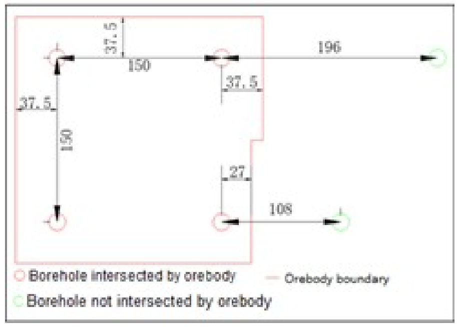


Fig. 11-2 Diagram of Delineation and Extrapolation

C. Interlayer

In the block model estimate, the interlayer in center of orebody is delineated by extrapolating 1/2 the distance between the block, or the interlayer in the side of orebody is delineated by extrapolating to the boundary of the orebody (Fig. 11-3)

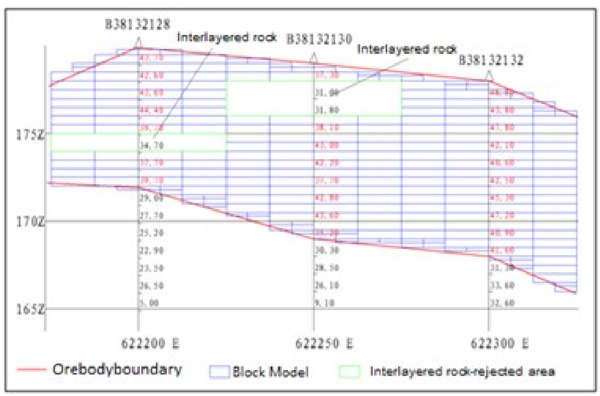


Fig. 11-3 Interlayer Definition

11.1.3 Resource Estimation Method

11.1.3.1 Orebody Classification

The estimated resource scope includes 15 ore-bodies in Boffa mine. Among them, Boffa North include ore-bodies #10, #11, #12, #26 and #47, Boffa South includes ore-bodies #27, #28, #35, #36, #37, #38, #39, #40, #45 and #46 (Fig. 11-4,11-5).

11.1.3.2 Solid Model

1) Digital terrain model

The digital terrain model is created by using borehole coordinates.

2) Orebody model

① Through the constraint conditions (AAl_2O_3≥35%, thickness ≥1m) in the database, the boreholes intersected by the orebody and not interested by the orebody are screened out.

② According to the delineation principle of the plane boundary of the orebody, the plane boundary of the orebody is established in AUTOCAD software, and then input into SURPAC to establish the solid model of the plane boundary.

③ The top and bottom points of intersected orebody in drilling are fitted by SURPAC software to establish the roof and floor models (.dtm)

④ The final orebody model is established through the entity intersection (Figure 11-6).

⑤ Rejection zone

The area using the parameters of BHP's report is rejected, namely:

1) 400m off the village area; 2) 100m off the river; 3) 100m off the lake;

In the block model, the attribute of the 'rejection zone' is created, the value of the overlaid orebody area is 1, and the value of the exclude orebody area is 2. The rejection zone is shown in Figure 11-7.

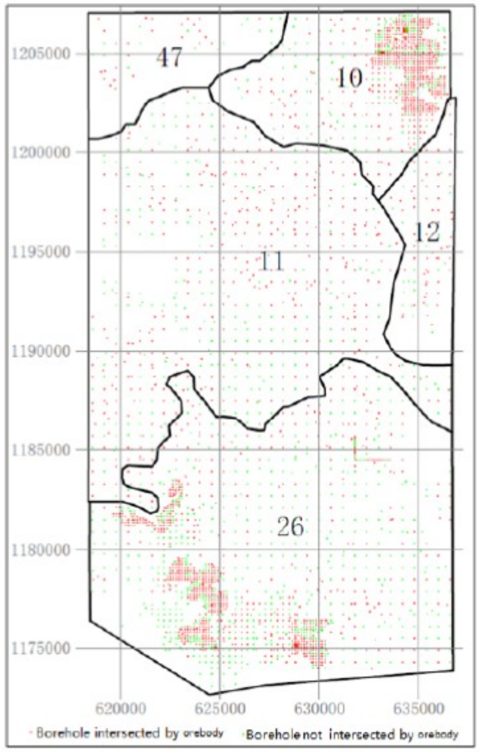


Fig. 11-4 Orebody Distribution of Boffa North

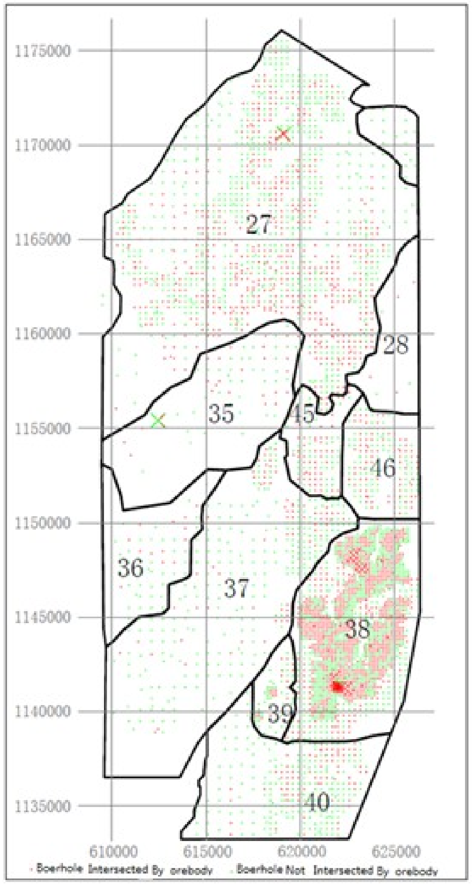


Fig. 11-5 Orebody Distribution of Boffa South

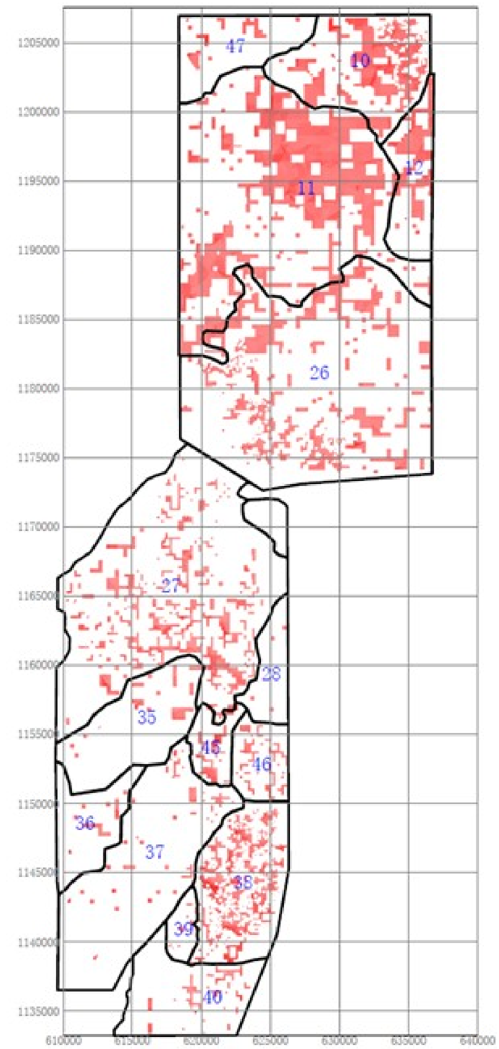


Fig. 11-6 Plan of Orebody Model in Boffa Mine

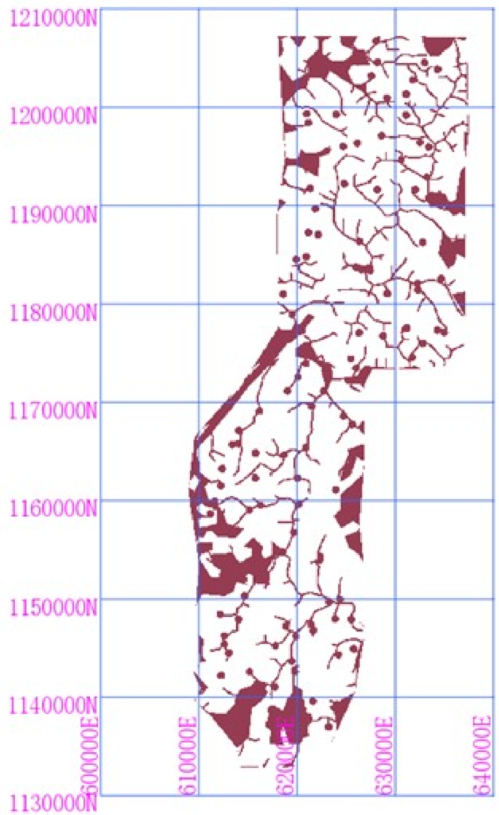


Fig. 11-7 Plan of Rejection Zone

11.1.3.3 Grade Estimation Method and Block Modeling

The distance power inverse ratio method is used to estimate grade.

Due to the large volume of data involved in the assessment area, the resources estimate divides the ore-bodies in the area into five estimated blocks, Boffa North ore-bodies #10, #12 and #47 **(Boffa North-orebody #10)**, Boffa North-orebody #11, Boffa North-block #26, Boffa South -block #27, and Boffa South-block #38. The basic block size is 12.5m (x) × 12.5m (Y) × 0.5m (Z), and the minimum block size is 6.25m (x) × 6.25m (Y) × 0.25m (Z). The block model is not rotated. Each block model is established according to the scope of the orebody distribution. The minimum and maximum coordinates are shown in Table 11-1.

Table 11-1 Block Model Coordinate Range

Model	Coordinate	X	Y	Z
Boffa North-orebody #10 orebody #12 and orebody #47 block model (Boffa North-10)	Minimum value	618200	1190000	0
	Maximum value	636900	1207000	500
Boffa North-orebody #11 block model	Minimum value	618000	1182000	0
	Maximum value	637000	1203500	500
Boffa North-orebody #26 block model	Minimum value	618400	1173800	0
	Maximum value	636900	1189800	500
Boffa South Plateau #27 block model	Minimum value	609700	1153000	0
	Maximum value	626400	1176000	500
Boffa South- Plateau #38 block model	Minimum value	610200	1133400	0
	Maximum value	626300	1155900	500

11.2 Estimation of Resources

11.2.1 Resources

According to the block model estimation, in May 2017, the Measured + Indicated + Inferred bauxite resources of Boffa mine were 2410Mt, with the average content of AAl_2O_3 and $RSiO_2$ being 39.09% and 1.10% respectively. The bauxite resources overlaid (protected) by villages and rivers that need to be excluded were 303Mt, the average content of AAl_2O_3 was 38.91%, and the average content of $RSiO_2$ was 1.05%. Apart from the bauxite resources overlaid (protected) by villages and rivers, the Measured + Indicated + Inferred bauxite resources of Boffa mine were 2108Mt, with the average content of AAl_2O_3 and $RSiO_2$ being 39.11% and 1.11% respectively. The estimated bauxite resources of Boffa mine are shown in Table 11-2.

Table 11-2 Estimation of Resources (May 2017)

Mine	Classification	Resources(Mt)	AAl_2O_3(%)	$RSiO_2$(%)
Boffa North	Measured	74.14	39.2	0.96
	Indicated	51.08	39.22	1.1
	Inferred	1475.96	39	0.98
	Measured+ Indicated	125.22	39.21	1.02
	Measured+ Indicated + Inferred	1601.18	39.02	0.99
Boffa South - Plateau #27	Measured	0	0	0
	Indicated	51.65	39.71	1.74
	Inferred	214.82	39.2	1.67
	Measured+ Indicated	51.65	39.71	1.74
	Measured+ Indicated + Inferred	266.47	39.3	1.68
Boffa South - Plateau #38	Measured	75.09	40.49	1.28
	Indicated	49.22	39.39	1.27
	Inferred	116.01	38.99	1.38
	Measured+ Indicated	124.31	40.05	1.28
	Measured+ Indicated + Inferred	240.32	39.54	1.33
Boffa South	Measured	75.09	40.49	1.28

Mine	Classification	Resources(Mt)	AAl_2O_3(%)	$RSiO_2$(%)
	Indicated	100.88	39.55	1.51
	Inferred	330.83	39.12	1.56
	Measured+ Indicated	175.97	39.95	1.41
	Measured+ Indicated + Inferred	506.8	39.41	1.51
Boffa in total	Measured	149.23	39.85	1.12
	Indicated	151.96	39.44	1.37
	Inferred	1806.79	39.02	1.09
	Measured+ Indicated	301.19	39.64	1.25
	Measured+ Indicated + Inferred	2107.98	39.11	1.11

On December 31, 2021, apart from reserves, the Measured + Indicated + Inferred bauxite resources were 1954.90Mt with the average content of AAl_2O_3 and $RSiO_2$ being 38.92% and 1.10% respectively. The resources in Boffa mine (December 31, 2021) are shown in Table 11-3.

The assumption conditions of resources are product price and cut-off grade. The loading price of bauxite is 22.02USD/WT, and the corresponding CIF price of ore arriving in China is 53.16 USD/DT The price is determined by the feasibility study and is close to the average price of bauxite imported from Guinea by China from 2017 to 2021. The price is still used on December 31, 2021 (See 16.2 product price forecast). The cut-off grade of resources estimation is $AAl_2O_3 \geq 35\%$, and the minimum minable thickness is 1m. The reference point for resources estimation is the point where bauxite is delivered to wharf yard and available for use by alumina refineries. The metallurgical recovery is 85%.

Table 11-3 Resources Apart from Reserves (December 31, 2021)

Mine	Classification	Resources(Mt)	AAl_2O_3(%)	$RSiO_2$(%)
Boffa North	Measured	40.92	37.54	0.75
	Indicated	28.66	37.25	0.81
	Inferred	1475.96	39.00	0.98
	Mea. + Ind.	69.58	37.42	0.77
	Mea. + Ind. + Inf.	1545.54	38.93	0.97
Boffa South - Plateaus # 27	Measured			
	Inferred	23.60	39.00	1.76
	Inferred	214.82	39.20	1.67
	Mea. + Ind.	23.60	39.00	1.76
	Mea. + Ind. + Inf.	238.42	39.18	1.68
Boffa South - Plateaus # 38	Measured	28.46	37.46	2.06
	Inferred	26.47	37.43	1.08
	Inferred	116.01	38.99	1.38
	Mea. + Ind.	54.93	37.45	1.59
	Mea. + Ind. + Inf.	170.94	38.50	1.45
Boffa South	Measured	28.46	37.46	2.06
	Inferred	50.07	38.17	1.40
	Inferred	330.83	39.12	1.56
	Mea. + Ind.	78.53	39.89	1.43
	Mea. + Ind. + Inf.	409.36	39.27	1.53

Mine	Classification	Resources(Mt)	AAl_2O_3(%)	$RSiO_2$(%)
Boffa in total	Measured	69.38	37.51	1.29
	Inferred	78.73	37.84	1.19
	Inferred	1806.79	39.02	1.09
	Mea. + Ind.	148.11	37.69	1.24
	Mea. + Ind. + Inf.	1954.9	38.92	1.10

11.2.2 Grade and Resources

Curve of Grade and Resources (Fig 11-8), the curve shows that in the range of 35-42%, with the increase of the cut-off grade, the resources of the deposit decrease obviously, which reflects that most of the ore block grade is in this range, and the slight adjustment of the cut-off grade is related to great change of the resources.

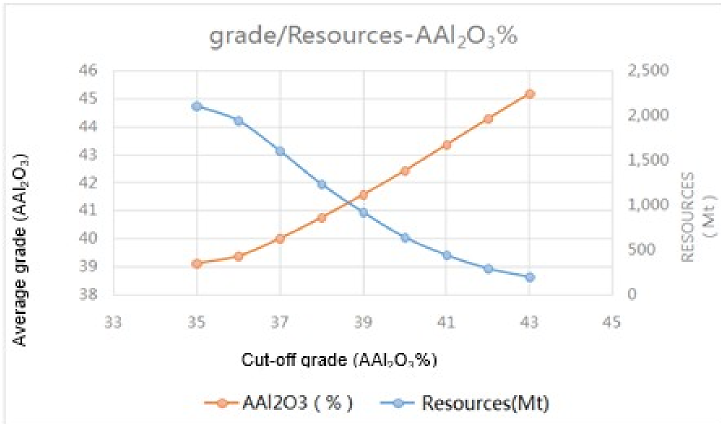


Fig. 11-8 Curves of Grade and Resources

11.3 Analysis of Reliability of Resources and Influence factors

The resources were estimated with SURPAC software in the Distance Power Inverse Ratio method. In order to determine the reliability of estimated resources, the infilled 25m× 25m grid area (0.09km²) of orebody #38 was selected, and the resources were re-estimated in the horizontal projection geological block method, which were compared with the resources calculated in the method of arithmetic weighting average (Table 11-4), the relative error was less than 2% , which showed that the estimation method was reasonable and the estimation result was reliable.

Table11-4 Comparison of Recourses Calculated in the Two Estimation Methods

Method	Resources (t)	Average grade(%)	
		AAl_2O_3	$RSiO_2$
Arithmetic average	2069249	44.26	1.82
SURPAC(IDW)	2113484	44.3	1.84
Relative error(%)	-2%	0%	-1%

12 Mineral Reserves

12.1 Selection of Parameters and Method for Reserves Estimation

According to the Detailed Design Phase I (Preliminary Design) Specification of Guinea Boffa Bauxite Mine Project, open pit mining was adopted with a capacity of 12Mt/a exported finished ROM ore ($AAl_2O_3 \geq 39\%$) (dry ore output 11.04Mt/a), and the low grade ore ($35\% \leq AAl_2O_3 \leq 39\%$) would be temporarily stockpiled and supplied for the alumina production when it is commenced.

The design covers all scope from mining to the loading of ore at port wharfs, including all of production, auxiliary production and office and living facilities, such as mining, yard for exported finished products of mines, ROM ore road transportation, ROM ore belt transportation, wharf yard, power station, low-voltage power distribution room, etc.

12.1.1 Analysis of Relevant Factors in Economic and Technological Study

Relevant factors in economic and technological study are summarized in the following table.

Table 12-1 Relevant Factors in Economic and Technological Study

Factor	Feasibility Study Scheme and Implementation
Mine infrastructure	The mine road and truck- belt conveying system is adopted, which has been built at present. 68 numbers of 60t dump trucks are needed in the initial stage, and more large transport vehicles are needed after capacity expansion in the later stage. At present, equipment has been put into operation. The local ground water quality is conforming and may be used as the water source for mine production and domestic use. Power is supplied by self-built heavy oil power station.
Mine design and planning	The mining method for Boffa bauxite is open pit mining. The exported finished ROM ore ($AAl_2O_3 \geq 39\%$) is shipped to China and the low grade ore ($35\% \leq AAl_2O_3 < 39\%$) is temporarily stockpiled. Mining is commenced. The detailed layout of the mine has been designed and is under construction.
Laboratory test	The laboratory test of bauxite solubility has been completed. The test results show that the bauxite has good solubility and the ROM ore has good quality. No aluminum oxide plant will be constructed in the first phase.
Environmental compliance and permits	The waste, noise, pollution and ecology that affect the environment have been analyzed and an environmental protection programme has been prepared in accordance with the requirements of the report Environment and Social Impact assessment of the Boffa Bauxite Project in Guinea (PPT) (ERM). The cost of the environmental protection counts for 1.77% of the construction investment. The way of land reclamation is greening while mining. The environmental permits have been obtained.
Other relevant factors	(1) Government: A development cooperation agreement has been signed with the Government of Guinea, a company has been registered in Guinea as required by law, mining permits and environmental permits have been obtained, and detailed due diligence on the relevant Guinean laws has been conducted; the Project has survived the coup in Guinea in September, 2021. (2) Community: Conflicts between mine project and the community, and the favorable factors of the mine project to the community have been carefully analyzed with countermeasures prepared. In addition, it is required to restrain and slow down the unfavorable factors, and magnify the favorable factors, so as to increase community employment, develop community economy and establish a mining enterprise that are popular among the local people. (3) Land use: Land for infrastructure has been acquired. (4) Labor: It is required to train and hire local staff as far as possible. (5) Operating Environment: The risk is low based on the analysis.

Factor	Feasibility Study Scheme and Implementation
	(6) Financing: Equity funds count for 30% of the total investment and bank financing counts for 70%. The capital is mainly financed from Chinese banks.
Investment	Project capex: 435292.22KUSD, of which: direct cost: 306007.55KUSD, accounting for 70.30% of total investment; indirect cost: 97953.09KUSD, accounting for 22.50% of the capex; entry cost of construction period: 5000KUSD, accounting for 1.15% of the capex; contingency: 26331.58KUSD, accounting for 6.05% of the capex. The total investment of the Project is 474014.92KUSD, of which the construction investment is 435292.22KUSD, the interest during the construction period is 14382.05KUSD and the working capital is 24340.64KUSD. Tolerance: ± 15%, probability: ≤10%.
Operating costs	The average total cost of the project with the production goal satisfied is estimated to be 240528KUSD/a. Where: 74568KUSD/a for mining, 55318KUSD/a for belt conveying, 7785KUSD/a for wharf yard, 22980KUSD/a for administration, 5285KUSD/a for business operating, 2708KUSD/a for finance, 22242KUSD/a for value added tax, 17570KUSD/a for export duty, 17570KUSD/a for mineral tax, 10318KUSD/a for income tax and 4184KUSD/a for stock dividend.
Economic analysis	ROI is 8.63%, and ROE is16.48%. The financial internal return rate before income tax is 11.85%, the payback period of investment is 8.44 years (including the construction period), the financial internal return rate after income tax is 8.72%, the payback period is 10.10 years (including the construction period) The financial internal return rate on capital of the Project is 10.16%. The repayment period of the loan is 7.92 years (including the construction period) according to the maximum repayment ability of the Project, which indicates that the Project has good repayment ability.

12.1.2 Parameters and Method for Reserves Estimation

12.1.2.1 Preferred Stope

According to comprehensive analysis and comparison, the Boffa South Orebody #38 is determined as the preferred stope for mining.

12.1.2.2 Parameters and Method for Reserves Estimation

Demarcation of ore-bodies and estimation of reserves may be completed using SURPAC software based on constraints. The process is as follows:

(1) Reserves estimation parameters

① Bauxite selling price: loading price 22.02USD/WT.

② Mining dilution rate: 1.95% for high grade ore and 3.64% for low grade ore. The mining loss rate is 8.85%.

③ Recovery: initial dissolution rate is 87.6%, and relative dissolution rate is 97.2%.

④ The average annual mining unit cost for years with the production goal satisfied is 6.21USD/t.

⑤ The average annual unit cost for belt conveying is 4.61USD/T.

⑥ The average annual unit cost for wharf yard is 0.65 USD/T.

⑦ Period cost: 22980KUSD/a for company administration, 2708KUSD/a for financial cost, 5285KUSD/a for business operating.

⑧ Taxes: mineral tax is 17570KUSD/a, value added tax is 22242KUSD/a, export duty is 17570KUSD/a, and income tax is 10318KUSD/a.

⑨ Stock dividend cost: 4184KUSD/a.

(2) The method of demarcating open pit shell by computer

The orebody model and economic model of the deposit are created and the open pit shell is demarcated by computer in the LG method supplemented by the floating cone method.

① Orebody Model

Based on the drilling data provided by Mining one close report database, the 3D model of orebody is created on SURPAC platform.

Orebody Model: The size of orebody unit is 12.5m × 12.5m × 0.5m, and the size of secondary block is 6.25m × 6.25m × 0.25m(length × width × height).

Ore Density: $\gamma = 2.02\ t/m^3$.

② Economic Model

An economic model is created by inputting of economic parameters. The main economic parameters are: anticipated bauxite selling price (excluding tax price), mining dilution rate, loss rate, recovery rate, administration fee and financial cost, mining cost, stripping cost, period cost and mineral tax, etc.

③ The main constraint condition

The surface constraint condition of the designed mining boundary is the Measured and Indicated resource ore-bodies area.

12.1.2.3 Principles and Conditions for Converting Resources to Reserves

① Only the Measured and Indicated resources may be converted into reserves.

② After the resources are analyzed by modifying factors, only the conforming resources may be converted into reserves.

③ The reserves shall be classified into Proven and probable reserves.

On the basics of the above principles, the Measured and Indicated resources in BOFFA mine may be converted into reserves.

12.1.2.4 Calculation Equation for Converting Resources to Reserves

The section of the orebody in Boffa mine is shown in Fig. 12-1. The average total thickness of the orebody is 6.28 m. The average thickness of the low grade ore in the top is 0.93m, accounting for 14% of the whole orebody, the average thickness of the High grade ore is 4.53m, accounting for 67% of the whole orebody, and the average thickness of the low grade ore in the bottom is 0.82m, accounting for 13% of the whole orebody. The average mining recovery is 91.15%.

Currently, the reserves are the resources portion (Measured + Indicated) that may be converted into High grade ore ($AAl_2O_3 \geq 39\%$). According to the mining design, the reserves of ore-bodies are counted respectively.

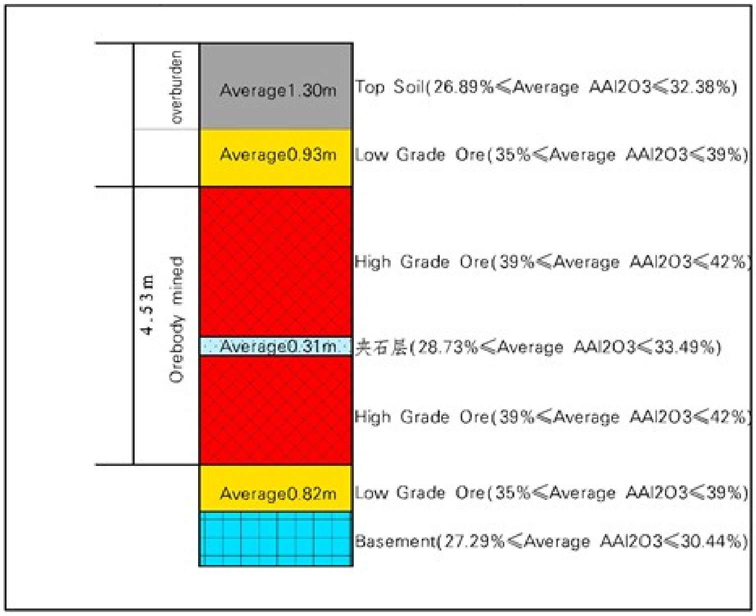


Fig. 12-1 Diagram of the Orebody

12.2 Reserves Estimation Result

Reserves estimation result in May, 2017 as shown in table 12-2.

From December 31, 2019 to December 31, 2021, the mine had produced 21.67Mt High grade ore in total. By December 31, 2021, Boffa mine had 131.41Mt Proven + probable reserves, the average content of AAl_2O_3 was 41.82% and the average content of $RSiO_2$ was 1.23%. Where, the Proven reserves were 58.19Mt, the average content of AAl_2O_3 was 41.71% and the average content of $RSiO_2$ was 1.07%; the probable reserves were 73.22Mt, the average content of AAl_2O_3 was 41.74% and the average content of $RSiO_2$ was 1.35%.

The assumption conditions of reserves estimation are product price and cut-off grade. The loading price of bauxite is 22.02USD/WT, and the corresponding CIF price of ore arriving in China is 53.16 USD/DT. The price is determined by the feasibility study and is close to the average price of bauxite imported from Guinea by China from 2017 to 2021. The price is still used on December 31, 2021 (See 16.2 product price forecast). The cut-off grade of reserves estimation is $AAl_2O_3 \geq 39\%$, and the minimum minable thickness is 1m.

The reference point for reserves estimation is the point where bauxite is delivered to wharf yard and available for use by alumina refineries. The metallurgical recovery is 85%.

Table12-2 Reserve Estimation Result (May 2017)

Mine	Orebody No.	AAl_2O_3(%)	Classification	Reserves(Mt)	AAl_2O_3(%)	$RSiO_2$(%)
Boffa North	10	≥39%	Proven	16.62	41.14	1.03
			Probable	11.59	41.46	1.18
	26	≥39%	Proven	16.61	41.35	0.81
			Probable	10.83	42.04	0.88
	Boffa N Total	≥39%	Proven	33.22	41.24	0.92
			Probable	22.42	41.74	1.04
			Proven + Probable	55.64	41.44	0.97
Boffa South	27	≥39%	Probable	28.05	41.62	1.70
	37	≥39%	Probable	0.94	42.01	1.16
	38	≥39%	Proven	46.59	42.34	1.26
			Probable	15.95	42.01	1.26
			Proven + Probable	62.53	42.26	1.26
	39	≥39%	Proven	0.04	39.97	0.92
			Probable	0.09	40.05	1.29
			Proven + Probable	0.13	40.02	1.17
	45	≥39%	Probable	4.31	41.64	1.11
	46	≥39%	Probable	1.46	41.44	0.99
	Boffa South in Total	≥39%	Proven	46.63	42.34	1.26
			Probable	50.8	41.74	1.48
			Proven + Probable	97.43	42.03	1.37
Boffa	Total	≥39%	Proven	79.85	41.88	1.12
			Probable	73.22	41.74	1.34
			Proven + Probable	153.08	41.82	1.23

12.3 Related Notes

At present, mining has been commenced in BOFF south mine, mining stope and mine roads, low grade ore stacking yard and surface soil stacking yard have been built according to design requirements, the truck- belt conveying system has been completed and operated, and inland river wharf has been completed, the High grade ore has been shipped to China. According to the current design capacity, reserves in BOFF mine may meet mine production for 12 years, where, reserves in BOFF south mine may meet mine production for 8 years; since the repayment period of the loan is 8 years (including the construction period), the reserves in BOFF south mine may meet the mine production in investment repayment period of the loan.

13 Mining Methods

According to the mining technical conditions of the deposit, open-pit mining is applicable.

13.1 Geotechnical Investigation

According to the geotechnical data, the bauxite is covered under the iron-cap layer, and the massive bauxite is mainly produced in the weathering residual slope sediment layer of quaternary, the hardness is medium and the compressive strength of 7.1-27.9MPa.

13.2 Hydrogeological Condition Study

Water in the aquifer in the mine is shallow pore phreatic water, and the recharge source of underground water is mainly atmospheric precipitation. The velocity of runoff in the field is slow; therefore the impact force of the aquifer is weak. The water is discharged to the surface in the form of gravity spring and collects into a stream at the bottom of the gully. All streams in the area flow to the eastern part of Fatala due to the topography and landform that the western part is higher than that of the eastern part. The deposit is the water direct filling porous aquifer of Class I with simple hydrogeological conditions.

13.3 Mining Methods

Open pit mining. The 2500SM opencast mining machine technology (Fig. 13-1) is adopted based on the economic comparison of mining technologies.

13.4 Mining Index

The mining recovery is 91.15%, and the ore dilution rate is 1.95%. The unit area of mining is 600m × 100m.

Fig. 13-1 Operation of the 2500SM Opencast Mining Machine

13.5 Production Capacity and Service Life

Production capacity: the annual production of High grade ore is12MT.

The annual working time is 270 (days) with three shifts a day, and each shift lasts for 8 hours.

The present reserves may meet the mine production 12 years, and the anticipated service life of the mine is 60 years.

The production schedule is shown in Table 13-1.

Table13-1 Production Schedule of Boffa Bauxite for the First 20 Years

Item		Unit	Construction Schedule	Production Schedule										
			Year 1	Year 1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9	Year10	Year11
Stripping quantity for construction		m3	1183770											
		t	2391215											
Total of mining and stripping (dry)		t	2391215	14973000	17112000	17112000	17112000	17112000	17112000	17147982	17112000	17082000	16984183	17455911
Topsoil stripped	Dry	t	1861357	4144000	4636000	4636000	4636000	4636000	4636000	3424504	4100000	4404720	3650591	3773711
	Original	t	2023214	4504348	5039130	5039130	5039130	5039130	5039130	3722287	4456522	4787739	3968034	4101860
Intercalated rock eliminated	Dry		0	386400	441600	441600	441600	441600	441600	295218	331200	331200	459017	428889
	Original	t	0	420000	480000	480000	480000	480000	480000	320889	360000	359999	498931	466184
low grade ore	Dry	t	529858	1169000	1436000	1436000	1436000	1436000	1436000	2683479	1972000	1637280	2293592	2642200
	Original	t	575933	1270652	1560870	1560870	1560870	1560870	1560870	2916825	2143478	1779652	2493035	2871957
High grade ore	Dry	t		9660000	11040000	11040000	11040000	11040000	11040000	11040000	11040000	11040000	11040000	11040000
	Original	t		10500000	12000000	12000000	12000000	12000000	12000000	12000000	12000000	12000000	12000000	12000000
Grade of low grade ore	AAl_2O_3	%		36.12	36.12	36.12	36.12	36.12	36.12	35.67	35.39	35.40	35.44	35.44
	$RSiO_2$	%		1.63	1.63	1.63	1.63	1.63	1.63	1.45	1.74	1.89	1.83	1.83
	Al/Si			22.19	22.19	22.19	22.19	22.19	22.19	24.64	20.29	18.72	19.34	19.34
Grade Of High grade ore	AAl_2O_3	%		41.04	41.04	41.04	41.04	41.04	41.04	41.05	41.26	40.82	40.73	40.40
	$RSiO_2$	%		1.44	1.44	1.44	1.44	1.44	1.44	1.45	1.59	1.41	1.81	1.77
	Al/Si			28.48	28.48	28.48	28.48	28.48	28.48	28.33	26.03	29.00	22.45	22.78
Stripping-mining ratio		t/t		0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.58	0.58	0.62
Area of land leased annually		m2	537952	1401450	1567839	1567839	1567839	1567839	1567839	1564514	1744577	1877457	1362502	1408454
Roads built per year		km	7.5	6.2	5.5	6.8	5.9	5.5	8.7	7.5	6.2	5.6	4.5	5.0
Belt going northward		km		5					5					5

Table13-1 (Cont'd) Production Schedule of Boffa Bauxite for the First 20 Years

Item		**Unit**		**Production Schedule**									
				Year 12	**Year13**	**Year14**	**Year15**	**Year16**	**Year17**	**Year18**	**Year19**	**Year20**	**Year21 End of term**
Stripping quantity for construction		m3											
		t											
Total of mining and stripping (dry)		t		17455911	17455911	17455911	17455911	17455911	17455911	17455911	17014243	17112000	840436230
Topsoil stripped	Dry	t		3773711	3773711	3773711	3773711	3773711	3773711	3773711	5709293	3407520	173908263
	Original	t		4101860	4101860	4101860	4101860	4101860	4101860	4101860	6205754	3703826	189030721
Intercalated rock eliminated	Dry			428889	428889	428889	428889	428889	428889	428889	428957	331200	25521455
	Original	t		466184	466184	466184	466184	466184	466184	466184	466257	360000	27740712
Low grade ore	Dry	t		2642200	2642200	2642200	2642200	2642200	2642200	2642200	264950	2664480	110910154
	Original	t		2871957	2871957	2871957	2871957	2871957	2871957	2871957	287989	2896174	120554515
High grade ore	Dry	t		11040000	11040000	11040000	11040000	11040000	11040000	11040000	11040000	11040000	555617813
	Original	t		12000000	12000000	12000000	12000000	12000000	12000000	12000000	12000000	12000000	603932406
Grade of low grade ore	AAl_2O_3	%		35.44	35.44	35.44	35.44	35.44	35.44	35.44	35.44	35.46	35.45
	$RSiO_2$	%		1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.07	1.21
	Al/Si			19.34	19.34	19.34	19.34	19.34	19.34	19.34	19.34	19.34	29.32
Grade Of High grade ore	AAl_2O_3	%		40.40	40.40	40.40	40.40	40.40	40.40	40.40	40.34	40.16	40.18
	$RSiO_2$	%		1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.57	0.93	1.00
	Al/Si			22.78	22.78	22.78	22.78	22.78	22.78	22.78	25.76	43.05	40.33
Stripping-mining ratio		t/t		0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.58	0.58	0.56
Area of land leased annually		m2		1408454	1408454	1408454	1408454	1408454	1408454	1408454	2210408	1841715	66898916
Roads built per year		km		5.0	5.0	5.0	5.0	5.0	8.5	5.5	5.0	5.4	
Belt going northward		km		5				5					

13.6 Equipment and Staffing

13.6.1 Main Mining and Stripping Equipment and Quantity

According to the designed mining and stripping process, for continuous ore-bodies with wide distribution, the mining and stripping equipment shall be opencast mining machine, and for independent small orebody demarcated by single-hole controlled or double-hole controlled orebodies, the mining and stripping equipment shall be hydraulic excavator.

According to the technical conditions of mining, production scale and reasonable allocation of automobiles, 2500SM opencast mining machine and 2.8m^3 hydraulic excavator are recommended. By calculation, a total of six 2500SM opencast mining machines and two 40t hydraulic excavators are required.

Bulldozer: based on years of mining experience, D10t high-power bulldozer of CATERPILLAR and SD220 bulldozer auxiliary hydraulic excavator are selected.

Excavator: based on the actual situation of similar mine, 2 sets of 40t class hydraulic excavators are selected for auxiliary operation.

Loader: as auxiliary equipment required for limited workload, ZL-50 loader is selected.

13.6.2 Bauxite Transport Automobiles

68 sets of 60t 12-wheel heavy dump trucks with double front axles (4 wheels) and double rear axles (8 wheels) are required annually based on the production calculation.

13.6.3 Main Reclamation Equipment

The main equipment for reclamation includes bulldozer, loader and dump truck. Imported or domestic mature bulldozers with larger power and good performance, such as high-power bulldozers of Caterpillar D series or SD220 bulldozers shall be selected. Zl-50 loader, which is widely used in Chine with strong climbing ability and a capacity of 3M^3 shall be selected. Dump truck of the same type with mining shall be selected.

Based on the characteristics of production technology of the Project, 664 people including 586 operators, 78 administration (including technical personnel) and service personnel shall be arranged.

13.6.4 Organization and Staffing

A summary of the organization and the staffing is shown in Table 13-2.

Table 13-2 Organization and Staffing

No.	Name of Structure	Staffing				Remarks
		Total	Production workers	Administration personnel	Service personnel	
1	Mining Workshop	464	434	30		Work area
2	Repair Shop	71	68	3		Work area
3	Integrated Workshop	59	57	2		Work area
4	Mine Departments	49	8	41		Administration
5	Belt conveyor	12	11	1		Work area
6	Wharf Yard	9	8	1		Work area
	Total	664	586	78		

14 Beneficiation and Recovery Method

The product of the mine project is bauxite. Processing plant will not be built in the local area.

15 Infrastructure

15.1 Plot Plan and Transportation

The objective of the design is a mining project with the capacity of 12Mt/a (Phase I). The exported product is bauxite, which is transported from the open stope to the wharf yard of Fatala River by belt conveyors, and then transported to the marine berth platform by transfer barges.

The plot plan includes mining stope, raw ore yard, low-grade ore yard, water source, belt conveyor, maintenance road, wharf yard and living area, heavy oil power station, temporary waste dump, etc.

The ore is transported by automobiles in the open stope, and then transported to the wharf yard of Fatala River by belt conveyors (Fig. 15-1, 15-2).

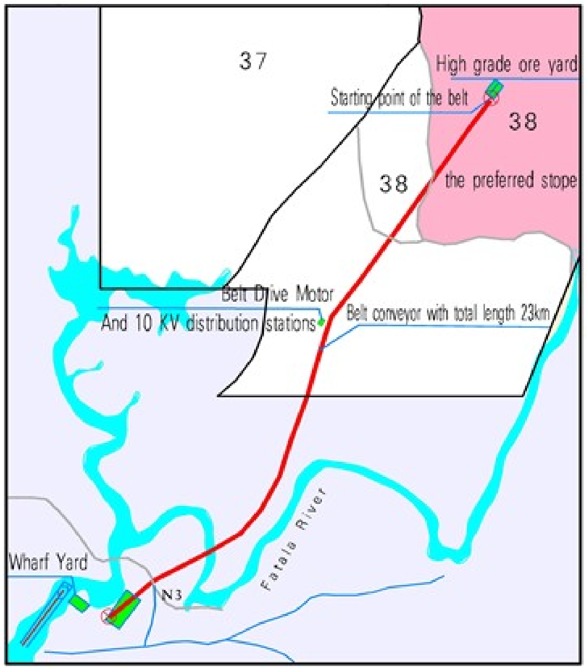


Fig. 15-1 Plot Plan and Logistics in Boffa Mine

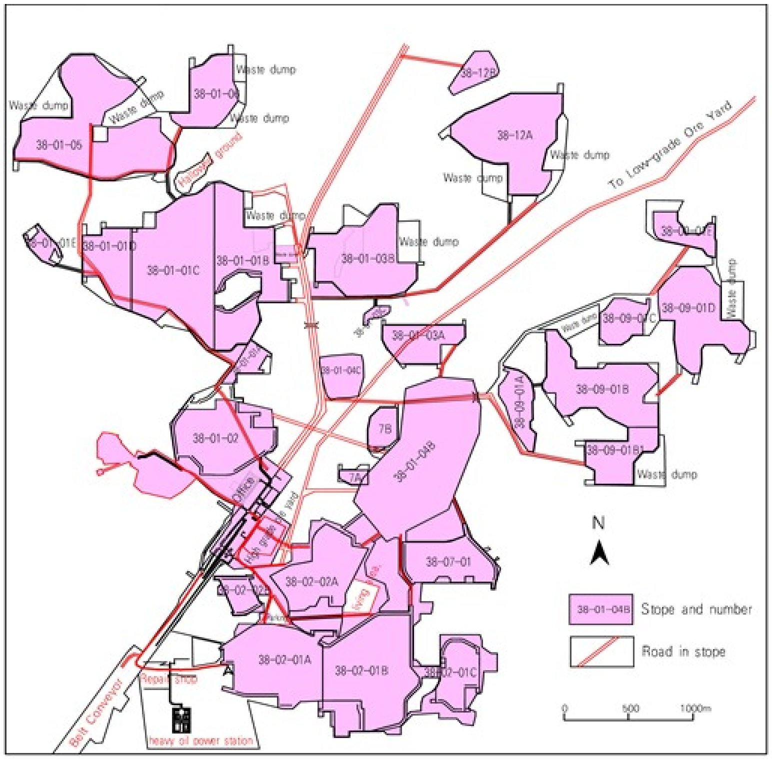


Fig. 15-2 plan of the Preferred Stope in Boffa Mine

15.2 Site Selection

The principle of site selection

(1) The production area and the office area are independent and arranged separately, and the office area is located in upstream direction of the dominant wind, so as to avoid the production pollution to environment and living quarters;

(2) Under the premise of satisfying the production process, conditions shall be created for the mechanization and automation of production;

(3) It is required to select effective means of transport and arrange reasonable transport routes to ensure work safety;

(4) To minimize the energy loss of power facilities during transport, all kinds of power supply equipment should be arranged close to the load center or the main load center as far as possible.

(5) The layout of buildings and structures should be compact and reasonable with reasonable channel width and spacing, so as to meet the requirements of various specifications, and save land.

(6) Good ventilation and daylighting conditions among the buildings shall be maintained, and the interferences of harmful factors such as waste gas and waste water shall be prevented.

15.3 General Arrangement

15.3.1 Stope and High grade ore Yard

According to the requirement of mine transportation, a 1Mt storage yard (Fig. 15-2, 15-3) is arranged on the west side of the site. The size of the yard is 450m × 148m and the area is 6.66 hm^2 with roof provided, which may prevent rainwater from entering the ore yard and reduce the water content of the ore. The ore shall be unloaded through the transfer fleet from the north and south sides into the yard, stockpiled through the stacker-reclaimer stockpiling, and transferred to the main conveyor belt through two horizontal and one vertical belts after being taken out by the reclaimer, belt conveyor stations are arranged at the belt transfer points.

The mine machinery parking lot (Fig. 15-2) is located on the east side of the storage yard with sufficient area for the parking demand of the vehicles. The method for site curing is the same as that for roads.

The living area of the stope is arranged on the east side of the machinery parking lot is set up as (Fig. 15-2), the site area is about 1.5 hm^2. The living area is equipped with 7 dormitories, an office building, a dining hall, two basketball courts; the dormitory area covers 5650m^2, which may satisfy the living demand of 500 people based on their shifts in the stope. The lower part of the northwest side of the site is provided with an initial rainwater tank and a domestic sewage treatment facility.

In order to reduce the influence of dust and noise on the living area, a large arbor shelter belt is arranged between the living area and the storage yard.

Fig. 15-3 Picture of the Preferred Stope Site in Boffa

The repair shop of automobile engineering machinery, the spare parts warehouse of mining equipment, the heavy oil power station, reserve oil depot, gas station and other facilities are arranged in turn on the south side of the living area (Fig. 15-2), which may provide power source for mining. The heavy oil power station includes heavy oil generator shop and low-voltage distribution room; the reserve oil depot includes oil pump room and underground oil storage tank; and the gas station is equipped with refueling island to facilitate the refueling of mining machinery. A protective forest is also provided between the site and the living area against noise and dust.

In addition to the High grade ore yard, other sites are equipped with solid walls and accesses, to ensure the safety of materials and personnel.

15.3.2 Low Grade Ore Yard

The low-grade ore storage yard (Fig. 15-3) is located at 500m to the northeast of the mine compound. The yard has a design volume of 12Mt, a design bottom elevation of 89– 145m, a storage slope ratio of 1:2, and an area of 70.41 hm^2. Intercepting ditches are arranged around the yard. The yard is arranged by steps, with a step width of 60m, a step height of 30m, and an overall slope ratio of 1:2. At the slope toe of the yard, a rock-retaining dam is set up to prevent people and animals from being injured by falling ore. The dam body is 6m wide and 10m high, with a slope ratio of 1:1.5.

15.3.3 Water Source

A reservoir was designed as the water source, while now water is taking from wells.

15.3.4 Belt Conveyor and its Maintenance Road

The belt conveyor is about 23km long (Fig. 15-4), most part of which is laid overhead. The designed line covers an area of 21.17 hm^2, 5m wide on both sides of the central line. The whole line runs downhill in general, part of which runs uphill. The line is divided into two sections. The belt conveyor is driven by the head end. The belt drive motor and the substation are arranged on the belt head.

The belt maintenance road starts from the mine compound and extends along the west side of the belt to the wharf yard. The pavement is 6.0m wide, and the roadbed is 7.0m wide. The pavement consists of a 3cm thick wearing course and a 15cm thick macadam. For some sections with soft foundation, soft materials are removed and replaced with boulders (forming a 3m thick foundation) to increase the bearing capacity of the foundation. The road route is arranged basically parallel to the belt, but there are local curves and detours due to the undulation of the terrain. The road has a total length of 23, an area of 22.88 hm^2, and a maximum longitudinal slope of 8%. Double-slope pavement is designed, and drainage ditches are arranged on both sides of the road to prevent ponding on the pavement.

Fig. 15-4 Belt Conveyor and its Maintenance Road

15.3.5 Ferries Wharf

The Ferries Wharf was designed for vehicles crossing the Fatala River. Now a cable-stayed bridge (Fig. 15-5) has been built to substitute the Ferries Wharf.

Fig. 15-5 The Cable-Stayed Bridge Crossing the Fatala River

15.3.6 Wharf Yard and Living Area

The wharf yard (Fig. 15-6) has a capacity of 0.5Mt, an area if 12 hm^2, and a ground elevation of 11m. Materials will be unloaded with the belt, then fed to the ship belt with the stacker-reclaimer, and finally lifted with the ship belt to the corner point at 26m.

The living area is located on the north side of the Wharf Yard, with an elevation of 13.50m and an area of 4.18 hm^2. There are dormitories, canteens, laundry rooms, recreation center and office buildings. To the west side of the living area is a machine repair site with the same elevation as the living area. There are office rooms, substations, machine repair workshops and warehouses. To the west side of the machine repair site is the ship repair slipway and berth for inspection and repair of ships.

Fig. 15-6 Wharf and Wharf Yard in Boffa Mine Area

15.3.7 Heavy Oil Power Station

A centralized heavy oil power station (Fig. 15-7) is designed in the Project. The station is arranged to the northeast of the living area.

The heavy oil power station has an oil tank area, main and auxiliary equipment rooms, comprehensive water treatment facilities, radiators, electric rooms, step-up transformers, and starter diesel generator set. There is 2.2m high solid brick wall around the power station to ensure the safety of materials and personnel.

Fig. 15-7 Heavy Oil Power Station

15.3.8 Temporary Waste Dump

A temporary waste dump is arranged near the two stope areas in the north and the south, respectively, which is used for surface soil storage. The dumps will be reclaimed with topsoil after the stope-out and landscaping of the site. The design capacity of the temporary waste dump is 1Mt, and the waste will be stored from bottom to top.

15.3.9 Others

This mine is an open stope. In order to reduce the influence of the muddy water caused by the rain scouring the bare ground on the river, three low dams are set up in the lower reaches of this mine to collect, store, clarify muddy water in the rainy season.

15.3.10 Internal and External Transportation

From the stope to the high-grade ore storage yard, the ore is transferred by the 60t dump truck. Stripped topsoil and the low-grade ore are also transported by dump trucks to the temporary waste dumps and the low grade ore yard respectively via mine road.

The external transportation uses the belt conveyor.

Transportation workload is shown in Table 15-1。

Table1 15-1 Transportation Workload

No.	Material	Unit	Annual Consumption	Remarks
1	Diesel oil	t/a	14884	Oil for mining, transported by tankers
2	Engine oil	t/a	2	
3	Washing oil	t/a	82	
4	Turbine oil	t/a	138	
5	Butter oil	t/a	352	
6	Wiping material	t/a	8	
7	Auxiliary oil	t/a	1444	

No.	Material	Unit	Annual Consumption	Remarks
	Total	t/a	16910	
1	high grade ore	Mt/a	12	Belt conveyor, 23km
2	Low grade ore	Mt/a	3	Mean haul: 2.3km
3	Stripped topsoil	Mt/a	4.08	Mean haul: 200m
	Total	Mt/a	19.08	

15.3.11 Power System

A power station is set up for the Project. It consists of 4 × 4,340kW/ 10kV generators, 3 in use and 1 standby. According to the load calculation results and load distribution requirements, a 35kV step-up substation with 1 × 8,000kVA,35/10kV step-up transformer is installed near the wharf power station. The wharf loads are directly powered by the 10kV grade line at the generator outlet.

From the 35kV wharf substation introduces a 35kV circuit to the middle of the belt and the stope. A 35kV step-down substation is set up near the head of the C08 belt. The step-down substation is equipped with 1 × 5,000kVA, 35/10kV step-down transformer and supplies power at 10kV to C08 belt head motor, C07 belt tail drive motor and the auxiliary transformer.

A 35kV step-down substation with 1 × 4,000kVA, 35/10kV step-down transformer is set up near the tail of C08 belt in the stope, which supplies power to the C08 tail drive motor, the distribution transformer in the stope and the distribution transformer in the water source site.

The lighting along the belt is powered by solar energy facilities, and the installation and maintenance of the belt are powered by small mobile generators.

15.3.12 Water Supply and Drainage

(1) Production water supply system

The production water demand in the stope is 700m^3/d, and the water will be supplied by the 1000M^3 elevated tank (with a bottom elevation of 210, φ22m × 3.5m) set up in stope through D219 × 8 welded steel pipes. A water intake is arranged near the road of the stope to connect the water truck.

(2) Domestic water supply system

In order to meet the domestic water requirement, the water should be further purified. The domestic water demand is 100m^3/d. The water comes from the elevated tank in the stope and is treated by the JYSBI-10 integrated domestic water processor (with a capacity of 10m^3/h). The water is first disinfected by the dioxidochlorine, then flows into the clean water tank, and then flows through the DN65 composite steel and plastic water supply pipe to each water point.

(3) Drainage

The drainage demand in the Project is 26m^3/d, and the wastewater is discharged after treatment in the grease trap.

The sewage discharge demand is 85m^3/d, and the sewage is treated by septic tank and sent to outdoor sewage pipe network and SEJ-100 integrated buried sewage treatment equipment (with a capacity of 100m^3/d). The effluent is discharged after it meets the first grade standard given in the Integrated Wastewater Discharge Standard (GB8978－1996).

Domestic sewage quality: BOD - 150mg/l, SS - 220mg/l, ammonia nitrogen - 45mg/l.

After treatment, the quality of domestic sewage is as follows: BOD - 20mg/l, SS - 70mg/l, ammonia nitrogen - 15mg/l.

16 Market Studies

16.1 Forecast of Product Supply and Demand

Since the beginning of the 21st century, domestic consumption of bauxite has counted for 44.77% of the world. China has been the world's largest importer of bauxite since 2007, overtaking United States.

From 2008 to 2016, the annual growth rate of domestic bauxite imports was as high as 17%. From 2010 to 2016, the proportion of imported bauxite in total bauxite was 49.66%. The data show that the annual import of bauxite is increasing, and the bauxite imported counts for a large proportion of the total bauxite. The bauxite resources are highly dependent on other countries. Bauxite has become one of the scarcest minerals in China and has been listed in the strategic mineral catalogue.

According to Antech data, from 2012 to 2015, global aluminum production grew at a rate of 7.2%, bauxite production 7.9%, and aluminum consumption 7.5%. These figures show that global demand for aluminum is still growing strongly.

According to Antech data, from 2010 to 2015, domestic aluminum output grew at a rate of 14.1%, bauxite output 20.0%, and aluminum consumption 21.8%, all of which are higher than the world averages.

With the development of industrialization, urbanization and informationization in China, the demand of aluminum is still strong, and it will still grow strongly in the future.

According to the July 2017 data of the Ministry of Commerce, from January to May 2017, China's total bauxite import from Guinea ranked first, and Guinea has surpassed Australia to become China's largest bauxite exporter.

16.2 Product Price Forecast

The relevant data of bauxite price comes from the Asian metal net, USGS and Chalco Shandong Co., Ltd. Combined with the specific situation of Boffa Project, after considering the 8% moisture content of bauxite, the data collected for the five years before July 2017 were converted to the bauxite CIF price trend (8% moisture content) by country. The FOB price of Capesize ship is 32.5USD/WT, and after the cost of wharf and inland waterway and platform transship is deducted, the loading price of bauxite is 22.02USD/t. The forecast period is 20 years.

From 2017 to 2021, the five-year average price of bauxite (AAl_2O_3 40%, $RsiO_2$ 3%) imported from Guinea by China is 55.8 USD/DT (CIF). See Table 16-1 for details.

Price of Bauxite Imported from Guinea by China Table 16-1

Year	2017	2018	2019	2020	2021	Five-year average price
USD/DT	55	55	58	55	56	55.8

The loading price of Boffa mine in the feasibility study is 22.02 USD/WT, and that of ROM ores (AAl_2O_3 39%, $RsiO_2$ 1%) is 53.16 USD/DT (48.91 USD/WT, moisture content: 8%).The current market price is slightly higher than that determined in the feasibility study, and fluctuates within a reasonable range. Therefore, as of December 31, 2021, we still use the bauxite loading price of 22.02 USD/WT.

16.3 Signed or Potential Contracts

The Boffa Bauxite Project in Guinea has rich resources, better mining conditions, excellent economic indicators and better development prospects. Against the background of the contradiction between the development of domestic economy and the shortage of resources, the development of Boffa Bauxite Project in Guinea and the establishment of an overseas bauxite supply base will provide a stable and reliable bauxite resource guarantee for the development of domestic economy.

The high-grade bauxite will be sold to Chalco's aluminum oxide plant, so the off-take is secured.

17 Environmental Studies, Permits and Social Impacts

17.1 Results of Environmental Studies

The mine sites include open stope, ore storage yard, mine compound, belt conveyor and wharf storage yard. The impacts on the environment mainly include impacts on the terrestrial ecosystems (terrestrial animals, terrestrial plants, amphibians and reptiles), freshwater ecosystems, mangroves and living areas of dwarf gorillas. The main pollutants are discharged waste fuel oil, equipment operation noise and waste water.

Effective control measures for all kinds of pollutants will be been taken, which can greatly reduce the discharge of pollutants. At the same time, prevention and mitigation measures are proposed for possible impacts on or damages to surface water, terrestrial ecosystems and freshwater ecosystems during the construction and operation of the project. Therefore, after the Project is put into production, its regional environmental impact is not large. The specific extent and scope of the environmental impact shall be determined by the environmental impact assessment of the Project.

17.2 Disposal of Three Types of Wastes

17.2.1 Waste Gas Treatment

The waste gas in the Project mainly comes from the dust of mining, loading and unloading, fuel gas (tail gas) of mining machinery equipment and the waste gas of heavy oil power station.

The dust produced during the loading and unloading of ore will be treated with bag dust collectors. The waste gas generated by the heavy oil power station will be discharged into the atmosphere through a 30m high exhaust cylinder after it is cooled in the waste heat boiler and denitrified with the SCR method.

17.2.2 Wastewater Treatment

The project wastewater is mainly wastewater from the repair workshop, cooling system sewage from the heavy oil power station and domestic sewage.

The wastewater from the repair workshop will be discharged after being treated by the grease trap; the mine living area and the wharf living area will be equipped with a sewage treatment system, respectively, and the domestic sewage will be first pre-treated by septic tanks, then discharged into the underground integrated sewage treatment plant to treat to the Guinea's sewage discharge standards. The effluent from the cooling system of the heavy oil power station is clean and can be discharged directly.

In order to prevent pollution caused by the muddy water resulted from washing of the bare ground by rainfall in the rainy season, three rock dams will be set up near the lower reaches of the mine to clear the muddy water. A dam will be 100m long. The muddy water will be collected, stored and set before discharge.

17.2.3 Solid Waste Treatment

Two temporary dumps will be set up during the construction period, with the capacity of 1.76 million m^3 and 0.46 million m^3, respectively, for storing the stripped materials. The temporary dump is equipped with a roller compacted rock fill dam, and a trapezoidal trench with a bottom width of 1m and a depth of 1m, and a trapezoidal rubble drainage trench with a bottom width of 0.6m and a depth of 0.6m will be arranged around the dump to direct the drainage of rainwater during the rainy season.

The stripped topsoil is the main reclamation soil source, which will be used for reclamation and backfilling of goaf. When mining, the stripped topsoil will be piled near the stope and then backfilled to the goaf during reclamation.

Because the public infrastructure of the project site is not perfect and there is no disposal site for domestic waste, a set of buried garbage station with a capacity of $6m^3$ will be set up in the mine living area. Two garbage collection transfer vehicles will be arranged. The domestic waste will be collected by the garbage station and transferred to a special environment-friendly closed incinerator for incineration. Domestic waste slag will be collected in special containers and disposed of properly to meet the corresponding environmental protection requirements in Guinea.

During the operation of the heavy oil power station, the heavy oil residue will be produced, which is a hazardous waste and will be disposed of by a closed incinerator set in the power station.

17.2.4 Environmental Investment and Staffing

The environmental protection investment in the Project is 2147.86KUSD, accounting for 0.485% (exchange rate: 6.37) of the project capex. See Table 17-1 for details of the environmental investment estimates.

Table 17-1 Environmental Investment Estimates

Item	Investment(KUSD)	Description	Remarks
Waste gas treatment	420.00	Pulse cleaning bag filter and automatic dust removal device for belt transfer	
Sewage treatment	430.86	Grease trap, underground integrated sewage treatment plant, etc.	
Noise control	85.71	Muffler, base damping, etc.	
Solid waste treatment	224.29	Underground garbage station, environment-friendly garbage bin, garbage transport vehicle, special closed incinerator, etc.	
Landscaping	644.14	Landscaping area: 47,928m^2	
Final acceptance	342.86		
Total	2147.86		

When starting mining, an environmental protection department shall be set up to take charge of the daily environmental management work. Two full-time environmental management personnel will be arranged, and a part-time environmental protection officer will be appointed in each workshop/shift to work with the environmental protection department.

17.3 Environmental Permit for the Project

The design follows the requirements of the laws and regulations of the Republic of Guinea and complies with local environmental quality standards and pollutant emission standards.

Environmental protection codes are governed by the laws and regulations of the Republic of Guinea, international conventions and relevant international assessment standards.

In September 2017, the Government of Guinea adopted the Environmental Social Assessment Report and held a public consultation meeting with the local community and a public hearing with the technical committee on environmental assessment. Then, the Government of Guinea granted an EIA permit to Chalco Hong Kong Limited, which is valid for one year. The term may be extended if the implementation of the Social Environmental Management Plan is satisfactory.

17.4 Planning, Consultation, or Agreement with Local Individuals or Groups

The implementation of the project involves environmental permits, water, land, employment, and living services, all of which have to be dealt with the local communities, and many of them are complex and sensitive. In order to resolve these issues, local residents will be arranged to involve in the Project as much as possible, so that the residents of the community can realize that the Project can be conducive to the sustainable economic and social development of the community, and that the community can support the development of the Project to reduce potential risks.

17.5 Mine Closure Plan

Project reclamation is the focus in the design. According to the technical conditions of land reclamation, the overburden layer is 1.30m thick on average, which can be stripped and used for land reclamation, thus complying with the requirement for an overburden soil thickness of more than 0.5m.

According to the design, reclamation starts from the second year of mine production, and then the mining and reclamation will be carried out simultaneously year by year, so that the goaf can be reclaimed in time the vegetation restored as soon as possible, and the ecological environment protected.

17.6 Related Notes

The Qualified Person considers that

① The project has been designed to meet the environmental requirements of the laws and regulations of the Republic of Guinea, the international conventions and the relevant international assessment standards.

② Based on the analysis of the factors that may affect the environment, the waste gas, waste water, solid waste and noise treatment plans, the ecological protection schemes and the reclamation scheme have been put forward.

③ Agreements have been reached with the local communities on the effects and possible conflicts brought by the environmental issues, with coping methods provided.

④ The project has obtained an environmental permit from the Government of Guinea.

⑤ The project has arranged personnel and expense to deal with environmental issues.

The environmental protection design complies with the standard and the working plan is detailed and effective.

18 Capital and Operating Costs

18.1 Investment estimation

18.1.1 Basis of compilation

(1) Quantities and pricing parameters basis

Quantities and pricing parameters are based on the design quantities and the design technical parameters.

(2) Quota indicator basis

① Building works

As for the steel structures used for the project, in consideration of the material costs in China, the domestic production costs, the intermediate freight costs, the bank charges, the site installation costs, etc. , the construction materials including the cement, sand, stone, brick and timber will be purchased in Guinea.

② Installation works

The installation cost will be adjusted according to the principle of charging installation works in China and the price of labor and main materials in Guinea.

(3) Other notes

① Exchange rate

1USD=6.70￥；

1€=7.85￥。

② Currency

The investment estimate is made in KUSD.

18.1.2 Project investment estimation

The project cost mainly includes the infrastructure survey and stripping, the mining equipment, the mine roads, the surface cleaning, the mine buildings and structures, the ore products yard, the communication system, the belt conveyor, the power station and substation, plot plan and transportation, the water source and watercourse structures, the suspension bridge, the head tank, the oil tank foundation and walls, the ventilation and dust removal, the vehicle maintenance workshop, the welfare and the service facilities.

The construction investment is 435,292.22KUSD, including the direct cost: 306,007.55KUSD, accounting for 70.30% of the construction investment; indirect cost: 97,953.09KUSD, accounting for 22.50% of the construction investment; entry cost during the infrastructure construction period: 5,000KUSD, accounting for 1.15% of construction investment; reserve fund: 26,331.58KUSD, accounting for 6.05% of the construction investment. The investment estimation is shown in Table 18-1.

Table 18-1 Investment Estimation

No.	Works and Cost Description	Estimated cost(KUSD)						Proportion of the total cost%
		Construction	Equipment	Installation	Tools	Others	Total	
1	Major production works	91548.57	129965.58	22415.21			243929.36	56.04
1.1	Infrastructure survey	13428.21	397.45	67.21			13892.87	
1.2	Open pit	38332.62	65670.81	3115.23			107118.66	
1.2.1	Infrastructure stripping	17226.50					17226.50	
1.2.2	Mining equipment		54431.49				54431.49	
1.2.3	Roads	3402.99					3402.99	
1.2.4	Drainage works	470.15					470.15	

No.	Works and Cost Description	Estimated cost(KUSD)						Proportion of the total cost%
		Construction	Equipment	Installation	Tools	Others	Total	
1.2.5	Surface cleaning	3613.11					3613.11	
1.2.6	Mining structures	5420.90					5420.90	
1.2.7	ROM yard	8154.95	7934.22	2143.15			18232.32	
1.2.8	Communication system	44.03	3305.09	972.09			4321.20	
1.3	ROM conveying system and storage yard	39787.74	63897.32	19232.77			122917.83	
1.3.1	Belt #1 and #2	3927.40	2165.78	636.99			6730.17	
1.3.2	Belt #7# and #8	25484.62	41998.94	12369.23			79852.79	
1.3.3	Belt #6	5662.76	1137.29	338.43			7138.48	
1.3.4	Belt #5		216.58	63.70			280.28	
1.3.5	Feeder and stacker-reclaimer		6589.89	1938.20			8528.09	
1.3.6	250m suspension bridge	3056.72					3056.72	
1.3.7	C08 belt conveyor head substation	263.22	955.60	297.86			1516.69	
1.3.8	Stope substation	261.12	714.60	244.46			1220.17	
1.3.9	Wharf power station	886.05	9029.30	2878.19			12793.54	
1.3.10	Wharf substation	245.86	1089.34	465.70			1800.90	
2	Auxiliary production and utility works	41655.65	4281.82	3890.75			49828.22	11.45
2.1	Plot Plan and transportation	36831.72	2185.83				39017.55	
2.1.1	Transportation equipment		2185.83				2185.83	
2.1.2	Plot Plan	36831.72					36831.72	
2.2	Water supply and drainage	2979.18	89.54	417.34			3486.07	
2.2.1	Water source		51.66	372.91			424.57	
2.2.2	Watercourse structures	2524.00					2524.00	
2.2.3	Domestic water treatment room		35.65	30.46			66.11	
2.2.4	Sewage treatment room		2.24	5.57			7.81	
2.2.5	Head tank	343.28		8.40			351.69	
2.2.6	Settling tank	111.90					111.90	
2.3	Integrated pipe network (power supply, water supply and heat supply)		11.58	2571.16			2582.75	
2.4	Maintenance and storage	1419.94	352.57	239.88			2012.38	
2.4.1	Vehicle maintenance workshop	668.11	169.92	51.32			889.35	

No.	Works and Cost Description	Estimated cost(KUSD)						Proportion of the total cost%
		Construction	Equipment	Installation	Tools	Others	Total	
2.4.2	Spare parts warehouse	144.27	38.34	21.80			204.41	
2.4.3	Gas stations and auxiliary oil depot	607.55	144.31	166.76			918.62	
2.5	Automation instrumentation		847.06	246.72			1093.78	
2.6	Ventilation and dust removal		666.37	244.93			911.30	
2.7	Laboratory	424.81	128.86	170.72			724.40	
3	Welfare and Service	7706.20	1861.71	891.02			10458.93	2.40
3.1	Office building	1376.57		30.25			1406.81	
3.2	Canteen	799.60	1077.05	301.85			2178.50	
3.3	Dormitory	5530.03	784.66	558.92			6873.61	
4	Smart factory	597.01	1194.03				1791.04	0.41
	Subtotal(1+2+3+4)	141507.44	137303.14	27196.98			306007.55	
5	Other construction expenses				2736.72	95216.37	97953.09	22.50
5.1	Land requisition					13800.00	13800.00	
5.2	Management by the Employer					19227.77	19227.77	
5.3	Construction supervision					3184.69	3184.69	
5.4	Feasibility study					776.12	776.12	
5.5	Environmental impact assessment					1671.64	1671.64	
5.6	Environmental protection					358.21	358.21	
5.7	consulting for soil and water conservation					298.51	298.51	
5.8	Temporary facilities					1767.03	1767.03	
5.9	Assessment of labor safety and health					293.34	293.34	
5.10	Tests and studies					298.51	298.51	
5.11	Engineering investigation					4038.93	4038.93	
5.12	Design					11110.25	11110.25	
5.13	Preparation of the construction drawings					1111.03	1111.03	
5.14	Preparation of the as-built drawings					888.82	888.82	
5.15	Joint commissioning					1712.24	1712.24	
5.16	Training					1910.45	1910.45	
5.17	Office and living furniture				678.38		678.38	
5.18	Tools and furniture				2058.34		2058.34	
5.19	Bidding agency					184.11	184.11	

No.	Works and Cost Description	Estimated cost(KUSD)						Proportion of the total cost%
		Construction	Equipment	Installation	Tools	Others	Total	
5.20	Investment insurance and engineering insurance					4705.61	4705.61	
5.21	Due diligence in early stage (resources, laws, taxes, risks, lawyers)					1013.43	1013.43	
5.22	Headquarters building					26865.67	26865.67	
6	Entry fee					5000.00	5000.00	1.15
7	Reserve fund					26331.58	26331.58	6.05
8	Construction investment(1~7)	141507.43	137303.14	27196.98	2736.72	126547.95	435292.22	100.00
		32.51	31.54	6.25	0.63	29.07	100.00	

18.2 Operating costs

18.2.1 Notes for cost planning

(1) The cost of this project includes the manufacturing cost, the administration cost, the business expenses and the financial cost. The administration cost refers to the expenses incurred when the administrative department of an enterprise manages and organizes the business activities.

(2) The bauxite produced in the project needs to be shipped to China for sale. It is estimated that the bauxite yield is 9Mt in the first year and 12Mt/a from the second year.

(3) The consumption quota of the materials in the manufacturing cost estimation is specified based on the conditions provided by the relevant specialties with reference to the actual consumption quota of similar projects; the unit price of the auxiliary materials and power is forecasted to the end of the infrastructure construction period according to the CIF price or the local market price.

(4) The quantity of material consumed in the process is provided by each discipline.

(5) The material quota is calculated in accordance with the international price.

(6) The depreciation of the project is calculated by the straight-line method, and the composite depreciation rate is 6%.

(7) The calculation period of the project is 21.5 years, including the construction period lasting for 1.5 years and the operation period lasting for 20 years.

(8) The cost of land and vegetation restoration will be 1,000KUSD/a and the cost for road construction and surface cleaning will be 2,400KUSD /a.

(9) The diesel price is 1,200USD/T (tax excluding) .

(10) The heavy oil rice is 550USD/T (tax excluding).

(11) The repair cost is estimated at 2% for construction and 6% for equipment.

(12) The operating cost is estimated at 2% of the operating income.

(13) The Guinean Mining Code provides for a three-year exemption from the wage package tax and a single property tax during the mining phase.

(14) Equity fund: Based on "Resources for loan", the entry fee is 30,000KUSD. The down payment is 5,000KUSD after the mineral properties are granted, and the rest is paid via the form of equity fund at 0.208USD/t, which is paid according to the actual export bauxite in the first 9 years and then according to the amount of the equity balance in the 10th year.

18.2.2 Operating cost estimation

The total operating cost of the project is shown in Table 18-2.

The annual average operating cost of the project is estimated to be 240,528KUSD/a, which includes: 74,568KUSD /a for mining, 55,318KUSD/a for belt conveying, 7,785KUSD/a for wharf yards, 22,980KUSD /a for management, 5,285KUSD /a for business, 2,708KUSD /a for finance and 22,242KUSD /a for value added tax, 17,570KUSD /a for export tax, 17,570KUSD /a for mineral tax, 10,318KUSD /a for income tax and 4184KUSD /a for stock dividends.

Table 18-2 Annual Average Total Cost Estimate for the Project

No.	Item	Unit	Cost	Unit cost USD/t	Remarks
	Total cost	KUSD	240528	20.04	Annual average of reaching the design capacity
1	Direct cost	KUSD	168643	14.05	Annual average of reaching the design capacity
1.1	Mining and manufacturing	KUSD	74568	6.21	Annual average of reaching the design capacity
1.2	Belt conveying	KUSD	55318	4.61	Annual average of reaching the design capacity
1.3	Yard	KUSD	7785	0.65	Annual average of reaching the design capacity
1.4	Management	KUSD	22980	1.92	Annual average of reaching the design capacity
	Tax	KUSD	7424	0.62	Annual average of reaching the design capacity
	Insurance	KUSD	1892	0.16	Annual average of reaching the design capacity
	Equity fund	KUSD	1217	0.10	Annual average of reaching the design capacity
1.5	Operating cost	KUSD	5285	0.44	Annual average of reaching the design capacity
1.6	Finance cost	KUSD	2708	0.23	Annual average of reaching the design capacity
2	Value-added tax	KUSD	22242	1.85	Annual average of reaching the design capacity
3	Export tax	KUSD	17570	1.46	Annual average of reaching the design capacity
4	Mineral tax	KUSD	17570	1.46	Annual average of reaching the design capacity
5	Income tax	KUSD	10318	0.86	Annual average of reaching the design capacity
6	Stock dividends	KUSD	4184	0.35	Annual average of reaching the design capacity

18.2.3 Notes for capital and operating cost

Each of sub-item investment of the project has been estimated. The price of the equipment is quoted by the vendor, and the freight is estimated at a certain proportion. Detailed studies were carried out on the materials supplying places and prices, and on Guinea’s tax laws and charging rules. According to the agreement with the Government of Guinea, the relevant expenses have been charged, which are calculated in a detailed and reasonable manner.

The consumption quota of the materials in the manufacturing cost estimation is specified based on the conditions provided by the relevant specialties with reference to the actual consumption quota of similar projects; the unit price of the auxiliary materials and power is forecasted to the end of the infrastructure construction period according to the CIF price or the local market price. A historical analysis and reasonable estimation of the price of the various materials and commodities during the operation have been carried out. Dividends and other costs have been withdrawn in accordance with Guinea's tax laws and charging rules. The calculations are detailed and reasonable.

In the view of the Qualified Person, the estimation method for the project capital and operating cost is feasible. The estimation of the commodity price parameters is reasonable, and the estimation precision meets the requirements of the feasibility study, i. e. the error is within ± 15% and the accidental error is less than or equal to 10%.

19 Financial Analysis

19.1 Basis and principles of financial analysis

(1)The financial evaluation of the feasibility study is based on the third edition of Economic Evaluation Methods and Parameters of Construction Projects issued jointly by the National Development and Reform Commission and the Ministry of Housing and Urban-Rural Development.

(2)The basic data of calculating cost is provided by each discipline.

(3)Reference is made to the Mining Code of Guinea for the taxes.

(4)This economic calculation only considers the benefits of the mines in Guinea. The bauxite FOB price (Capesize-class ships) is 32.5USD/WT. After deducting the transportation costs such as port cost, inland water transport and other transfer costs, the loading price is 22.02USD/t. The period calculated is 20 years.

(5)The stock dividends are calculated at 15%.

(6)The Mining Code of Guinea provides for a three-year exemption from wage package tax and a single property tax during the mining phase.

19.2 Profit and profit distribution

19.2.1 Product sales and revenue

The main product of the project is bauxite. The bauxite yield of the first year during the production period is 9,000kt and 12,000kt since the second year.

The bauxite loading price is 22.02USD/t, based on which the annual revenue is estimated to be 264,240KUSD/a. The annual operating revenue of the project is shown in Table 19-1.

19.2.2 Value-added tax

According to the Guinean tax laws, the value-added tax rate on the import of raw materials for the project is 18%. The value-added tax of the project cannot be offset since it only considers incomes, and the VAT will be listed separately. It is estimated that the annual value-added tax paid is 22,242KUSD/a.

19.2.3 Ore export tax and Mineral tax

According to the calculation, the annual average export tax is 17,570KUSD /a and the annual mineral tax is 17,570KUSD /a after reaching the design capacity.

19.2.4 Profit and distribution

According to the calculation, the annual average profit of the project is 38,214KUSD/a, the annual average income tax is 10,318KUSD/a, the annual average net profit is 27,896KUSD/a, the annual average stock dividends are 4,184KUSD/a and the net profit after deducting the stock dividends is 23,712KUSD/a.

The annual profit analysis is shown in table 19-1.

Table19-1 Annual Profit Analysis

No.	Item	Unit	Value (KUSD)	Unit value USD/t	Remarks
I	Operating revenue	KUSD	264240	22.02	Annual average value after reaching the design output
II	Total cost	KUSD	240528	20.04	
1	Direct cost	KUSD	168643	14.05	
1.1	Mining and manufacturing	KUSD	74568	6.21	
1.2	Belt conveying	KUSD	55318	4.61	
1.3	Yard	KUSD	7785	0.65	
1.4	Management	KUSD	22980	1.92	
	Taxes	KUSD	7424	0.62	

No.	Item	Unit	Value (KUSD)	Unit value USD/t	Remarks
	Insurance	KUSD	1892	0.16	
	Equity fund	KUSD	1217	0.10	
1.5	Operating cost	KUSD	5285	0.44	
1.6	Financial cost	KUSD	2708	0.23	
2	Value added tax	KUSD	22242	1.85	
3	Export tax	KUSD	17570	1.46	
4	Mineral tax	KUSD	17570	1.46	
5	Income tax	KUSD	10318	0.86	
6	Stock dividends	KUSD	4184	0.35	
III	Profits to Chalco	KUSD	23712	1.98	
IV	Financial internal rate of return	%	8.72	8.72	After income tax

19.3 Analysis of project profitability

Refer to Table 19-2 for the annual profit and profit distribution of the project.

The ROI is 8.63%, and the ROE is 16.48%.

19.4 Cash flow calculation

The calculation of the total investment cash flow of the project is shown in Table 19-3 and the calculation of the capital cash flow is shown in Table 19-4.

19.5 Solvency analysis and project benefits

The assets and liabilities of the project during the calculation period are shown in Table 19-5 and the estimated debt service is shown in Table 19-6.

The repayment period of the loan is 7.92 years (including the construction period) according to the maximum repayment ability of the project, which indicates that the project is of good repayment ability.

The cash flow of the project financial plan is shown in Table 19-7.

Preferential tax policy: After the mine is put into commercial operation, ① the income tax will be exempted for 8 years; ② the single property tax will be exempted for 8 years; ③ the registration tax (registration fee) will be exempted for 8 years; ④ the value -added tax will be exempted.

The after-tax financial index of the project considering the tax preference is as follows: The financial internal rate of return of the project is 12.86%, and the payback period of the investment is 8.45 years (including the construction period)

Table19-2 Annual Profit and Profit Distribution of the Project

No.	Item	Unit	Average	Operating period									
				3	4	5	6	7	8	9	10	11	12
1	Operating revenue	KUSD/a	264240	198180.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
2	Value-added tax	KUSD/a	22242	16850.18	21335.43	21335.43	21335.43	21335.43	21855.11	21783.63	21775.58	21748.60	21780.94
3	Total cost	KUSD/a	168643	153824.53	168275.26	165020.05	164141.99	160733.63	168912.61	165808.37	165359.53	165722.07	166614.84
4	Ore export tax	KUSD/a	17570	13285.67	17714.23	17714.23	17714.23	17714.23	17714.23	17719.18	17800.77	17628.69	17594.25
5	Mineral tax	KUSD/a	17570	13285.67	17714.23	17714.23	17714.23	17714.23	17714.23	17719.18	17800.77	17628.69	17594.25
6	Gross profit	KUSD/a	38214	933.95	39200.85	42456.06	43334.12	46742.47	38043.81	41209.64	41503.35	41511.94	40655.72
7	Reserve fund	KUSD/a	3821	93.39	3920.08	4245.61	4333.41	4674.25	3804.38	4120.96	4150.34	4151.19	4065.57
8	Taxable income	KUSD/a	34392	840.55	35280.76	38210.45	39000.71	42068.23	34239.43	37088.67	37353.02	37360.75	36590.15
9	Income tax	KUSD/a	10318	252.17	10584.23	11463.14	11700.21	12620.47	10271.83	11126.60	11205.91	11208.23	10977.04
10	NET profit	KUSD/a	27896	681.78	28616.62	30992.92	31633.91	34122.01	27771.98	30083.03	30297.45	30303.72	29678.68
11	Stock dividends	KUSD/a	4184	102.27	4292.49	4648.94	4745.09	5118.30	4165.80	4512.46	4544.62	4545.56	4451.80
12	Net profit after deducting the stock dividends	KUSD/a	23712	579.51	24324.13	26343.98	26888.82	29003.70	23606.19	25570.58	25752.83	25758.16	25226.87
13	Undistributed profit	KUSD/a	23712	579.51	24324.13	26343.98	26888.82	29003.70	23606.19	25570.58	25752.83	25758.16	25226.87
14	Total undistributed profit	KUSD/a	246125	579.51	24903.64	51247.62	78136.44	107140.15	130746.33	156316.91	182069.74	207827.90	233054.78
15	Earnings before interest and tax	KUSD/a	40921	18911.52	55563.44	55802.73	53545.71	53786.84	41796.17	41939.92	41503.35	41511.94	40655.72
16	Earnings before interest, tax, depreciation and amortization	KUSD/a	64434	45704.54	82356.46	82595.75	80338.73	80579.86	69411.62	69555.36	69118.80	69127.39	68271.17

Table19-2 (Cont'd) Annual Profit and Profit Distribution of the Project

No.	Item	Unit	Average	Operating period									
				13	14	15	16	17	18	19	20	21	22
1	Operating Revenue	KUSD/a	264240	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
2	Value-added tax	KUSD/a	22242	22642.84	22642.84	22642.84	22642.84	22642.84	23162.52	23162.52	23162.52	22795.76	22823.20
3	Total cost	KUSD/a	168643	172622.69	172937.12	173267.25	173613.87	173977.79	168922.02	169323.19	169744.40	169395.71	169831.51
4	Ore export tax	KUSD/a	17570	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17440.31	17367.73
5	Mineral tax	KUSD/a	17570	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17440.31	17367.73
6	Gross profit	KUSD/a	38214	34046.23	33731.80	33401.67	33055.06	32691.13	37227.22	36826.05	36404.84	37167.91	36849.84
7	Reserve fund	KUSD/a	3821	3404.62	3373.18	3340.17	3305.51	3269.11	3722.72	3682.60	3640.48	3716.79	3684.98
8	Taxable income	KUSD/a	34392	30641.61	30358.62	30061.50	29749.55	29422.02	33504.50	33143.44	32764.35	33451.11	33164.86
9	Income tax	KUSD/a	10318	9192.48	9107.59	9018.45	8924.86	8826.61	10051.35	9943.03	9829.31	10035.33	9949.46
10	NET profit	KUSD/a	27896	24853.75	24624.21	24383.22	24130.19	23864.53	27175.87	26883.01	26575.53	27132.57	26900.39
11	Stock dividends	KUSD/a	4184	3728.06	3693.63	3657.48	3619.53	3579.68	4076.38	4032.45	3986.33	4069.89	4035.06
12	Net profit after deducting the stock dividends	KUSD/a	23712	21125.69	20930.58	20725.74	20510.66	20284.85	23099.49	22850.56	22589.20	23062.69	22865.33
13	Undistributed profit	KUSD/a	23712	21125.69	20930.58	20725.74	20510.66	20284.85	23099.49	22850.56	22589.20	23062.69	22865.33
14	Cumulative undistributed profit	KUSD/a	246125	254180.46	275111.05	295836.78	316347.44	336632.29	359731.78	382582.35	405171.55	428234.23	451099.56
15	Earnings before interest and tax	KUSD/a	40921	34046.23	33731.80	33401.67	33055.06	32691.13	37227.22	36826.05	36404.84	37167.91	36849.84
16	Earnings before interest, tax, depreciation and amortization	KUSD/a	64434	60909.59	60595.16	60265.03	59918.42	59554.50	50663.25	50262.07	49840.86	50603.93	50285.87

Table19-3 Financial Cash Flow of the Total Project Investment (Unit: KUSD)

No.	Item	Construction period		Operating period								
		1	2	3	4	5	6	7	8	9	10	11
1	Cash inflow			198180.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
1.1	Operating revenue			198180.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
1.2	Residual value of recovered fixed assets											
1.3	Recovery of working capital											
2	Cash outflow	174116.89	261175.33	174528.96	188565.45	186293.18	188646.35	208636.41	198994.18	199197.09	199665.82	199658.17
2.1	Construction investment	174116.89	261175.33									
2.2	Working capital			21951.23	2389.42							
2.3	Operating costs			109053.94	125119.65	124880.35	127137.37	126896.24	137544.81	137462.64	137744.09	138106.63
2.4	Value-added tax			16850.18	21335.43	21335.43	21335.43	21335.43	21855.11	21783.63	21775.58	21748.60
2.5	Maintenance investment							19857.97				
2.6	Stock dividends			102.27	4292.49	4648.94	4745.09	5118.30	4165.80	4512.46	4544.62	4545.56
2.7	Ore export tax			13285.67	17714.23	17714.23	17714.23	17714.23	17714.23	17719.18	17800.77	17628.69
2.8	Mineral tax			13285.67	17714.23	17714.23	17714.23	17714.23	17714.23	17719.18	17800.77	17628.69
3	Net cash flow before income tax	-174116.89	-261175.33	23651.04	75674.55	77946.82	75593.65	55603.59	65245.82	65042.91	64574.18	64581.83
4	Total net cash flow before income tax	-174116.89	-435292.22	-411641.18	-335966.6	-258019.8	-182426.2	-126822.6	-61576.8	3466.1	68040.3	132622.2
5	Adjusted income tax			5645.44	15493.01	15467.14	14763.69	14733.78	11397.54	11345.69	11205.91	11208.23
6	Net cash flow after income tax	-174116.89	-261175.33	18005.61	60181.54	62479.68	60829.96	40869.81	53848.28	53697.22	53368.28	53373.61
7	Total net cash flow after income tax	-174116.89	-435292.22	-417286.61	-357105.07	-294625.39	-233795.44	-192925.63	-139077.35	-85380.12	-32011.85	21361.76
8	Indicator calculated before income tax		IRR:	11.85%					Pt:	8.44a		
9	Indicator calculated after income tax		IRR:	8.72%					Pt:	10.10a		

Table19-3 (Cont'd) Financial Cash Flow of the Total Project Investment (Unit: KUSD)

No.	Item	Operating period										
		12	13	14	15	16	17	18	19	20	21	22
1	Cash inflow	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	324289.57
1.1	Operating revenue	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
1.2	Residual value of recovered fixed assets											35708.92
1.3	Recovery of working capital											24340.64
2	Cash outflow	220278.61	207058.47	207338.47	207632.45	207941.11	228123.15	217653.13	218010.38	218385.47	217705.95	217989.19
2.1	Construction investment											
2.2	Working capital											
2.3	Operating costs	138999.40	145759.33	146073.76	146403.89	146750.50	147114.43	155485.99	155887.17	156308.38	155959.68	156395.48
2.4	Value-added tax	21780.94	22642.84	22642.84	22642.84	22642.84	22642.84	23162.52	23162.52	23162.52	22795.76	22823.20
2.5	Maintenance investment	19857.97					19857.97					
2.6	Stock dividends	4451.80	3728.06	3693.63	3657.48	3619.53	3579.68	4076.38	4032.45	3986.33	4069.89	4035.06
2.7	Ore export tax	17594.25	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17440.31	17367.73
2.8	Mineral tax	17594.25	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17440.31	17367.73
3	Net cash flow before income tax	43961.39	57181.53	56901.53	56607.55	56298.89	36116.85	46586.87	46229.62	45854.53	46534.04	106300.38
4	Total net cash flow before income tax	176583.6	233765.1	290666.6	347274.2	403573.1	439689.9	486276.8	532506.4	578360.9	624895.0	731195.3
5	Adjusted income tax	10977.04	9192.48	9107.59	9018.45	8924.86	8826.61	10051.35	9943.03	9829.31	10035.33	9949.46
6	Net cash flow after income tax	32984.35	47989.05	47793.94	47589.10	47374.02	27290.24	36535.52	36286.59	36025.23	36498.71	96350.92
7	Total net cash flow after income tax	54346.11	102335.16	150129.10	197718.20	245092.23	272382.46	308917.98	345204.57	381229.80	417728.51	514079.42
8	Indicator calculated before income tax	IRR:	11.85%					Pt：	8.44	a		
9	Indicator calculated after income tax	IRR:	8.72%					Pt：	10.10	a		

Table19-4 Project Capital Cash Flow (Unit: KUSD)

No.	Item	Construction period		Operating period								
		1	2	3	4	5	6	7	8	9	10	11
1	Cash inflow			198180.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
1.1	Operating revenue			198180.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
1.2	Residual value of recovered fixed assets											
1.3	Recovery of working capital											
2	Cash outflow	54032.82	90936.90	220131.23	266629.42	264240.00	264240.00	284097.97	264240.00	223431.65	210871.72	210866.39
2.1	Project capital	54032.82	90936.90	21951.23	2389.42							
2.2	Repayment of principal on loan			27372.53	51117.15	53137.00	53681.84	55796.72	51221.63	12377.68		
2.3	Interest payments on loans			17977.57	16362.59	13346.68	10211.59	7044.37	3752.36	730.28		
2.4	Operating costs			109053.94	125119.65	124880.35	127137.37	126896.24	137544.81	137462.64	137744.09	138106.63
2.5	Value-added tax			16850.18	21335.43	21335.43	21335.43	21335.43	21855.11	21783.63	21775.58	21748.60
2.6	Income tax			252.17	10584.23	11463.14	11700.21	12620.47	10271.83	11126.60	11205.91	11208.23
2.7	Maintenance investment							19857.97				
2.8	Stock dividends			102.27	4292.49	4648.94	4745.09	5118.30	4165.80	4512.46	4544.62	4545.56
2.9	Ore export tax			13285.67	17714.23	17714.23	17714.23	17714.23	17714.23	17719.18	17800.77	17628.69
2.10	Mineral tax			13285.67	17714.23	17714.23	17714.23	17714.23	17714.23	17719.18	17800.77	17628.69
3	Net cash flow before income tax	-54032.82	-90936.90	-21699.06	8194.81	11463.14	11700.21	-7237.50	10271.83	51934.95	64574.18	64581.83
4	Total net cash flow before income tax	-54032.82	-144969.72	-166668.78	-158473.97	-147010.83	-135310.62	-142548.12	-132276.30	-80341.35	-15767.16	48814.67
5	Net cash flow after income tax	-54032.82	-90936.90	-21951.23	-2389.42			-19857.97		40808.35	53368.28	53373.61
6	Total net cash flow after income tax	-54032.82	-144969.72	-166920.95	-169310.36	-169310.36	-169310.36	-189168.33	-189168.33	-148359.99	-94991.71	-41618.10
Financial internal rate of return:					10.16%							

Table19-4 (Cont'd) Project Capital Cash Flow (Unit: KUSD)

No.	Item	Operating period										
		12	13	14	15	16	17	18	19	20	21	22
1	Cash inflow	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	324289.57
1.1	Operating revenue	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
1.2	Residual value of recovered fixed assets											35708.92
1.3	Recovery of working capital											24340.64
2	Cash outflow	231255.65	216250.95	216446.06	216650.90	216865.98	236949.76	227704.48	227953.41	228214.77	227741.29	227938.65
2.1	Project capital											
2.2	Repayment of principal on loan											
2.3	Interest payments on loans											
2.4	Operating costs	138999.40	145759.33	146073.76	146403.89	146750.50	147114.43	155485.99	155887.17	156308.38	155959.68	156395.48
2.5	Value-added tax	21780.94	22642.84	22642.84	22642.84	22642.84	22642.84	23162.52	23162.52	23162.52	22795.76	22823.20
2.6	Income tax	10977.04	9192.48	9107.59	9018.45	8924.86	8826.61	10051.35	9943.03	9829.31	10035.33	9949.46
2.7	Maintenance investment	19857.97					19857.97					
2.8	Stock dividends	4451.80	3728.06	3693.63	3657.48	3619.53	3579.68	4076.38	4032.45	3986.33	4069.89	4035.06
2.9	Ore export tax	17594.25	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17440.31	17367.73
2.10	Mineral tax	17594.25	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17440.31	17367.73
3	Net cash flow before income tax	43961.39	57181.53	56901.53	56607.55	56298.89	36116.85	46586.87	46229.62	45854.53	46534.04	106300.38
4	Total net cash flow before income tax	92776.06	149957.59	206859.12	263466.67	319765.56	355882.41	402469.28	448698.90	494553.43	541087.47	647387.85
5	Net cash flow after income tax	32984.35	47989.05	47793.94	47589.10	47374.02	27290.24	36535.52	36286.59	36025.23	36498.71	96350.92
6	Total net cash flow after income tax	-8633.75	39355.30	87149.24	134738.34	182112.36	209402.60	245938.12	282224.71	318249.93	354748.64	451099.56
Financial internal rate of return:								10.16%				

Table19-5 Balance Sheet (Unit: KUSD)

No.	Item	Construction period		Operating period								
		1	2	3	4	5	6	7	8	9	10	11
1	Assets	175914.65	449674.28	447939.88	424574.53	397781.51	370988.49	364053.44	336438.00	349630.90	375383.73	401141.89
1.1	Gross working capital			25058.63	28486.30	28486.30	28486.30	28486.30	28486.30	69294.64	122662.92	176036.53
1.1.1	Account Receivable			9087.83	10426.64	10426.64	10426.64	10426.64	10426.64	10426.64	10426.64	10426.64
1.1.2	Inventory			10904.14	12692.44	12692.44	12692.44	12692.44	12692.44	12692.44	12692.44	12692.44
1.1.3	Cash			5066.66	5367.21	5367.21	5367.21	5367.21	5367.21	5367.21	5367.21	5367.21
1.1.4	Accumulated surplus fund							0.00	0.00	40808.35	94176.62	147550.23
1.2	Works in progress	175914.65	449674.28									
1.3	Net value of fixed assets			403767.30	379309.31	354851.32	330393.33	325793.30	300132.63	274471.95	248811.27	223150.60
1.4	Net value of intangible assets and other assets			19113.95	16778.93	14443.90	12108.87	9773.84	7819.07	5864.31	3909.54	1954.77
2	Liabilities and owners 'equity	175914.65	449674.28	447939.88	424574.53	397781.51	370988.49	364053.44	336438.00	349630.90	375383.73	401141.89
2.1	Total current liabilities			3107.40	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65
2.1.1	Accounts payable			3107.40	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65
2.1.2	Working capital borrowings											
2.2	Construction investment loan	121881.82	304704.55	277332.02	226214.87	173077.87	119396.03	63599.31	12377.68			
	Subtotal of liabilities	121881.82	304704.55	280439.42	230360.53	177223.53	123541.69	67744.96	16523.33	4145.65	4145.65	4145.65
2.3	Owner's equity	54032.82	144969.72	167500.46	194214.00	220557.99	247446.81	296308.48	319914.67	345485.25	371238.08	396996.24
2.3.1	Capital fund	54032.82	144969.72	166920.95	169310.36	169310.36	169310.36	189168.33	189168.33	189168.33	189168.33	189168.33
2.3.3	Cumulative undistributed profit			579.51	24903.64	51247.62	78136.44	107140.15	130746.33	156316.91	182069.74	207827.90
Indicator: Asset-liability ratio (%)				69.28	67.76	62.61	54.26	44.55	33.30	18.61	4.91	1.19
	Current ratio (%)			806.42	687.14	687.14	687.14	687.14	687.14	1671.50	2958.83	4246.29
	Quick ratio (%)			455.51	380.97	380.97	380.97	380.97	380.97	1365.34	2652.67	3940.13

Table19-5 (Cont'd) Balance Sheet (Unit: KUSD)

No.	Item	Operating period										
		12	13	14	15	16	17	18	19	20	21	22
1	Assets	446226.74	467352.42	488283.01	509008.74	529519.40	569662.22	592761.72	615612.28	638201.48	661264.17	684129.49
1.1	Gross working capital	228878.85	276867.90	324661.84	372250.94	419624.96	466773.18	503308.69	539595.28	575620.51	612119.22	648420.57
1.1.1	Account receivable	10426.64	10426.64	10426.64	10426.64	10426.64	10426.64	10426.64	10426.64	10426.64	10426.64	10426.64
1.1.2	Inventory	12692.44	12692.44	12692.44	12692.44	12692.44	12692.44	12692.44	12692.44	12692.44	12692.44	12692.44
1.1.3	Cash	5367.21	5367.21	5367.21	5367.21	5367.21	5367.21	5367.21	5367.21	5367.21	5367.21	5367.21
1.1.4	Accumulated surplus fund	200392.55	248381.60	296175.55	343764.64	391138.67	438286.88	474822.40	511108.98	547134.21	583632.92	619934.27
1.2	Works in progress											
1.3	Net value of fixed assets	217347.89	190484.53	163621.16	136757.80	109894.44	102889.05	89453.02	76017.00	62580.97	49144.95	35708.92
1.4	Net value of intangible assets and other assets											
2	Liabilities and owners' equity	446226.74	467352.42	488283.01	509008.74	529519.40	569662.22	592761.72	615612.28	638201.48	661264.17	684129.49
2.1	Total current liabilities	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65
2.1.1	Account payable	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65
2.1.2	Working capital borrowings											
2.2	Construction investment loan											
	Subtotal of liabilities	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65	4145.65
2.3	Owner's equity	442081.08	463206.77	484137.35	504863.09	525373.75	565516.57	588616.06	611466.62	634055.83	657118.51	679983.84
2.3.1	Capital fund	209026.31	209026.31	209026.31	209026.31	209026.31	228884.28	228884.28	228884.28	228884.28	228884.28	228884.28
2.3.3	Cumulative undistributed profit	233054.78	254180.46	275111.05	295836.78	316347.44	336632.29	359731.78	382582.35	405171.55	428234.23	451099.56
Indicator: Asset-liability ratio (%)				0.93	0.89	0.85	0.81	0.78	0.73	0.70	0.67	0.65
	Current ratio (%)	5520.93	6678.51	7831.38	8979.31	10122.04	11259.34	12140.63	13015.93	13884.91	14765.32	15640.97
	Quick ratio (%)	5214.77	6372.35	7525.22	8673.14	9815.88	10953.17	11834.47	12709.76	13578.75	14459.16	15334.81

Table19-6 Calculation of Debt Service (Unit: KUSD)

No.	Item	Total	Calculation period							
			1	2	3	4	5	6	7	8
1	Opening balance			121881.82	304704.55	277332.02	226214.87	173077.87	119396.03	63599.31
2	Current year borrowing		121881.82	182822.73						
3	Current year accrued interest		1797.76	12584.30	17977.57	16362.59	13346.68	10211.59	7044.37	3752.36
	Interest incurred during construction	14382.05	1797.76	12584.30						
4	Current debt service	320430.10	1797.76	12584.30	45350.10	67479.73	66483.68	63893.43	62841.09	54973.99
	Repayment of principal	185308.52			27372.53	51117.15	53137.00	53681.84	55796.72	51221.63
	Payment of interest	72280.48	1797.76	12584.30	17977.57	16362.59	13346.68	10211.59	7044.37	3752.36
5	Ending balance	930133.27	121881.82	304704.55	277332.02	226214.87	173077.87	119396.03	63599.31	12377.68
6	Source of repayment fund	78489.68			27372.53	51117.15	53137.00	53681.84	55796.72	51221.63
6.1	Depreciation expense	48915.98			24457.99	24457.99	24457.99	24457.99	24457.99	25660.68
6.2	Amortization charge	4670.06			2335.03	2335.03	2335.03	2335.03	2335.03	1954.77
6.3	Undistributed profit	24903.64			579.51	24324.13	26343.98	26888.82	29003.70	23606.19
7	Surplus fund					(226214.87)	(173077.87)	(119396.03)	(63599.31)	(12377.68)
	Calculation index: Loan repayment period:	7.73 a								

Table19-7 Financial Plan Cash Flow (Unit: KUSD)

No.	Item	Construction period		Operating period								
		1	2	3	4	5	6	7	8	9	10	11
I	Net cash flow from operating activities			45350.10	67479.73	66483.68	63893.43	62841.09	54973.99	53916.31	53368.28	53373.61
1	Cash inflow			198180.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
1.1	Operating revenue			198180.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
2	Cash outflow			152829.90	196760.27	197756.32	200346.57	201398.91	209266.01	210323.69	210871.72	210866.39
2.1	Operating costs			109053.94	125119.65	124880.35	127137.37	126896.24	137544.81	137462.64	137744.09	138106.63
2.2	VAT			16850.18	21335.43	21335.43	21335.43	21335.43	21855.11	21783.63	21775.58	21748.60
2.3	Income tax			252.17	10584.23	11463.14	11700.21	12620.47	10271.83	11126.60	11205.91	11208.23
2.4	Stock dividends			102.27	4292.49	4648.94	4745.09	5118.30	4165.80	4512.46	4544.62	4545.56
2.5	Ore export tax			13285.67	17714.23	17714.23	17714.23	17714.23	17714.23	17719.18	17800.77	17628.69
2.6	Mineral tax			13285.67	17714.23	17714.23	17714.23	17714.23	17714.23	17719.18	17800.77	17628.69
II	Net cash flow from investment activities	-174116.89	-261175.33	-21951.23	-2389.42			-19857.97				
1	Cash outflow	174116.89	261175.33	21951.23	2389.42			19857.97				
1.1	Construction investment	174116.89	261175.33									
1.2	Maintenance investment							19857.97				
1.3	Working capital			21951.23	2389.42							
III	Net cash flow from financing activities	174116.89	261175.33	-23398.88	-65090.32	-66483.68	-63893.43	-42983.12	-54973.99	-13107.96		
1	Cash inflow	175914.65	273759.63	21951.23	2389.42			19857.97				
1.1	Project capital investment	54032.82	90936.90	21951.23	2389.42			19857.97				
1.2	Construction investment loan	121881.82	182822.73									
1.3	Working capital borrowings											
2	Cash outflow	1797.76	12584.30	45350.10	67479.73	66483.68	63893.43	62841.09	54973.99	13107.96		
2.1	Interest expense	1797.76	12584.30	17977.57	16362.59	13346.68	10211.59	7044.37	3752.36	730.28		
2.2	Principal repayment			27372.53	51117.15	53137.00	53681.84	55796.72	51221.63	12377.68		
	Net cash flow(I＋II＋III)							0.00		40808.35	53368.28	53373.61
	Accumulated surplus fund							0.00	0.00	40808.35	94176.62	147550.23

Table19-7 (Cont'd) Financial Plan Cash Flow (Unit: KUSD)

No.	Item	Operating period										
		12	13	14	15	16	17	18	19	20	21	22
I	Net cash flow from operating activities	52842.32	47989.05	47793.94	47589.10	47374.02	47148.21	36535.52	36286.59	36025.23	36498.71	36301.35
1	Cash inflow	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
1.1	Operating revenue	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00	264240.00
2	Cash outflow	211397.68	216250.95	216446.06	216650.90	216865.98	217091.79	227704.48	227953.41	228214.77	227741.29	227938.65
2.1	Operating costs	138999.40	145759.33	146073.76	146403.89	146750.50	147114.43	155485.99	155887.17	156308.38	155959.68	156395.48
2.2	VAT	21780.94	22642.84	22642.84	22642.84	22642.84	22642.84	23162.52	23162.52	23162.52	22795.76	22823.20
2.3	Income tax	10977.04	9192.48	9107.59	9018.45	8924.86	8826.61	10051.35	9943.03	9829.31	10035.33	9949.46
2.4	Stock dividends	4451.80	3728.06	3693.63	3657.48	3619.53	3579.68	4076.38	4032.45	3986.33	4069.89	4035.06
2.5	Ore export tax	17594.25	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17440.31	17367.73
2.6	Mineral tax	17594.25	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17464.12	17440.31	17367.73
II	Net cash flow from investment activities	-19857.97					-19857.97					
1	Cash outflow	19857.97					19857.97					
1.1	Construction investment											
1.2	Maintenance investment	19857.97					19857.97					
1.3	Working capital											
III	Net cash flow from financing activities	19857.97					19857.97					
1	Cash inflow	19857.97					19857.97					
1.1	Project capital investment	19857.97					19857.97					
1.2	Construction investment loan											
1.3	Working capital borrowings											
2	Cash outflow											
2.1	Interest payment											
2.2	Principal repayment											
	Net cash flow(I＋II＋III)	52842.32	47989.05	47793.94	47589.10	47374.02	47148.21	36535.52	36286.59	36025.23	36498.71	36301.35
	Accumulated surplus fund	200392.55	248381.60	296175.55	343764.64	391138.67	438286.88	474822.40	511108.98	547134.21	583632.92	619934.27

19.6 Economic efficiency analysis

The financial internal rate of return before income tax is 11.85%, and the payback period is 8.44 years (including the construction period). The financial internal rate of return after income tax is 8.72%, and the payback period is 10.10 years (including the construction period).

The capital financial internal rate of return of the project is 10.16%.

19.7 Risk analysis

With the world's largest bauxite reserves, Guinea has great prospects for development in the bauxite industry. China and Guinea have maintained a stable development relationship. Currently, the Government of Guinea is working to improve the investment environment and attract foreign investment, hoping to promote the national economic development through the development in mining industry. According to the BOFFA Project Risk Assessment Report (Sinorating), the risk is high, mainly political risk. Close attention should be paid to the risks of government stability and the indirect default and political violence risks arising from the domestic political pressure. After the coup in September 2021, the political risks are under control.

Economic and financial risks mainly include macroeconomic risks, fiscal deficits, government debt risks and inflation risks. According to the Risk Assessment Report, Guinea's economy has little impact on the project. On the one hand, Guinea's economy is likely to show a slow recovery and the inflation has been effectively curbed, and the fiscal deficit is improving gradually. The only concern is that Guinea's debt levels, particularly the external debt, are expected to rise rapidly. On the other hand, the products of the project will mainly be shipped to China and will not be sold locally, which will not be affected by the local economy, but by the changes of government policies and the dissatisfaction of local residents.

Foreign exchange risk. Since the products of this project are mainly exported to China rather than being sold in Guinea, USD will be used as the settlement currency in accordance with international practice. Therefore, the depreciation of Guinean Franc has no effect on the revenue from this project. However, holding a certain amount of local currency is required for the construction and operation of the project, which may increase the construction and operating costs of the project.

Market risk. The project products are mainly supplies the Corporation, which will not face any market sale barriers. However, the world's aluminum industry will still suffer hard times in the short term, and the liberalization of bauxite export controls in Indonesia may reduce the market competitiveness of the bauxite from Guinea, which reduces the number of projects that Chalco supplies. Besides, Chinese enterprises' entering the traditionally western-dominated Guinean market is bound to provoke resistance. According to the comprehensive assessment, the project is facing a market risk of the medium level.

Policy risks on the infrastructure. According to the Mining Code, the infrastructure (including but not limited to the railway, highway, bridges, ports, airports, cities and auxiliary facilities, canals and power transmission network) built for mining activities in any way financing shall be handed over to the Government of Guinea 5 years free of charge after the investor has gained fair return on investment. After that, the mining company enjoys a preferential access to such infrastructure. According to the agreement with the Government of Guinea, the mining company can continue to operate the infrastructure built for the mining projects or the Government of Guinea can specify independent operator to operate the infrastructure shared by the mining company and other companies through bidding. Therefore, the right of managing the public infrastructure is at the risk of losing control if no agreement is reached with the Government of Guinea in advance.

The bauxite price is largely based on average price of the five years before 2017, a period when the industry was at a low ebb. Now the bauxite price is on the rise. Currently, the loading price of bauxite is higher than that in the 2017 feasibility study report.

The infrastructure has been completed as planned and has reached the design capacity 3 years ahead of schedule. The funds are in place and the construction cost is controlled within the budgeted cost.

The operating cost is within the budget according to the current production.

The results of the economic analysis are of a high precision and the economic risks are under control.

20 Adjacent Properties

The mining rights near the Boffa Mine are shown in Table 20-1 and Figure 20-1.

① Henan International Mine, with an area of 486.4405km^2 and a validity of 25 years from October 25, 2010 to October 24, 2035.

② SPIC Mine, with an area of 124.8749km^2+757.7357km^2 and a validity from August 10, 2018 to August 9, 2043.

③ Alcoa Guinea Mine, with an area of 578.55km^2 and a validity from June 23, 1964 to June 22, 2039.

④ EGA Mine (SOCIETE GLOBAL ALUMINA), with an area of 690.2km^2 and a validity from November 21, 2005 to November 21, 2030.

⑤ AXIS MINERALS RESOURCES SA, with an area of 425.3605km^2 and a validity from November 2, 2018 to November 1, 2033.

⑥ SOCIETE GUINEAN BRAIN TOUCH SARL, with an area of 175.5074km^2 and a validity from November 2, 2018 to November 1, 2033

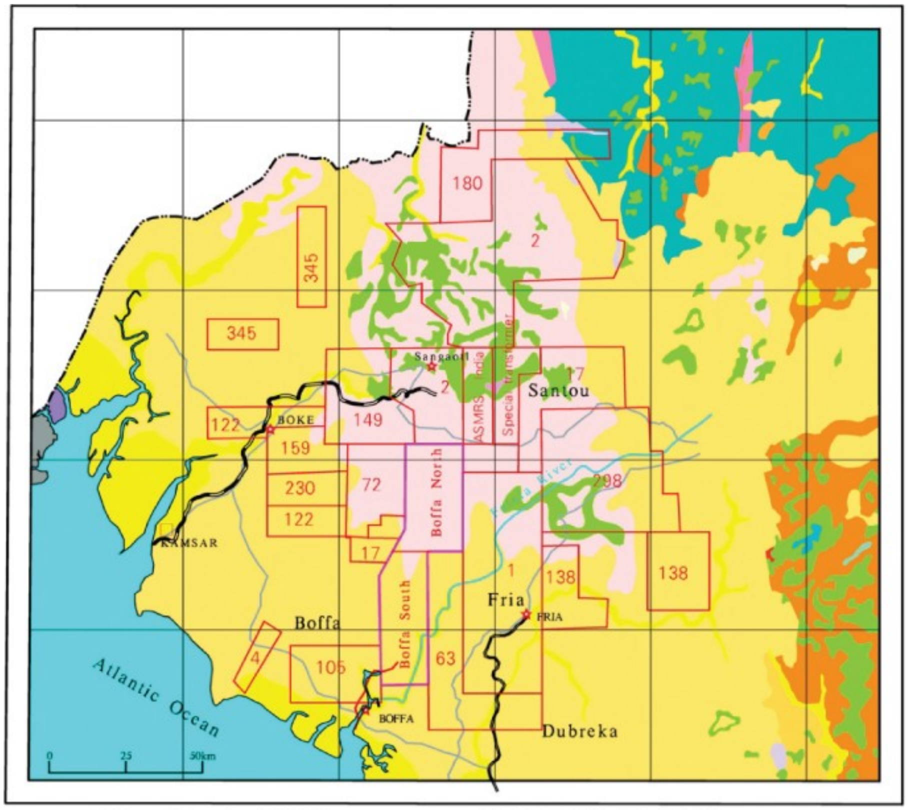
⑦ Aluminum Company of Guinea (Rusal), with an area of 1,776.25km^2 and a validity from August 13, 1964 to February 28, 2025.

⑧ A Shapura Minex Resources Sau (India), with an area of 100.0002km^2 and a validity from November 11, 2019 to November 10, 2034.

⑨ Societe Minierede Boke (SMB)-SA (SMB-Winning Consortium), with an area of 261.1311km^2 and a validity from June 8, 2021 to June 7, 2046.

Table 20-1 Mining Rights Near the Boffa Mine

No.	Mining rights owners	Area(km^2)	Validity (year)	Starting and ending time
1	Henan International	486.4405	25	25 Oct 2010 to 24 Oct 2035
2	SPIC	882.6106	25	10 Aug 2018 to 9 Aug 2043
3	Alcoa CBG (Aluminum Company of Guinea)	578.55	75	23 Jun 1964 to 22 Jun 2039
4	Emirates Global Aluminum (SOIETE Global Alumina)	690.2	25	22 Nov 2005 to 21 Nov 2030
5	Axis Minerals Resources SA, India	425.3605	15	2 Nov 2018 to 1 Nov 2033
6	SOIETE GUINEAN BRAIN TOUH SARL	175.5074	15	2 Nov 2018 to 1 Nov 2033
7	Aluminum company of Guinea, Rusal	1776.25	60.5	13 Aug 1964 to 28 Feb 2025
8	A Shapura, India	100.0002	15	11 Nov 2019 to 10 Nov 2034
9	(SMB)Santou-Houda Mine	261.1311	25	8 June 2021 to 7 June 2046



1 Henan International (No.72)
2 SPIC (No.17)
3 CBG, Alcoa (No.2)
4 SGA, EGA (No.149)
5 AXIS, India (No.63)
6 TBEA
7 Rusal (No.1)
8 ASMRS, India
9 SMB–SA(No.122, No.345)
10 Kimbo (No.138) ERG (No.298)
11 Shengrong Mining (No.105)
12 Alufer, Britain (No.4)
13 Dynamic (No.230)
14 AMCG, Australia (No.159)
15 AMR, France (No.180)

Fig. 20-1 Mining Rights Near the Boffa Mine

21 Other Relevant Data and Information

Other Relevant Data and Information include: five-year bauxite price (from 2017 to 2021) imported from Guinea by China offered by CINF, which are cited in 16.2.

22 Interpretation and Conclusions

Boffa Mine is composed of Boffa North and Boffa South with a total area of 1,248.16km^2. The exploitation license and environmental certificate have been obtained. The exploitation license is valid for 15 years (July 9, 2018 to July 8, 2033,) and may be renewed upon expiry. It is mined for bauxite.

Chalco Guinea has 85% shares and the Government of Guinea has 15% shares.

Boffa Mine is a productive mine with an annual yield of 12Mt ($AAl_2O_3 \geq 39\%$), which is shipped to China.

According to the survey, the drilling coordinates measured by the intermediate and low precision GPS are of poor accuracy.

It is Proven that the quality of the drilling is acceptable, the quality of sampling, processing and assaying is reliable, and the assay results are credible.

According to the review of the BHP Boffa Santou Houda Project Close Out Repot and the databases provided by Guinea, all data were complete except for the absence of topographic survey. 7,821 drilling works were carried out and 94,030 samples were taken in Boffa Mine. According to the verification and inspection, the Billiton survey data is credible.

CINF has created the digital terrain model based on the drilling coordinates and re-created the resource model and ore block model and estimate the resources with the Distance Power Inverse Ratio method based on the Billiton survey data.

According to the Technical Report for Boffa Bauxite Project in Guinea submitted by CINF in May 2017, the indicated and measured resources in Boffa Mine were 301.19Mt and the inferred resources were 1,806.79Mt, with an average AAl_2O_3 content of 39.02% and $RSiO_2$ content of 1.09%. The total amount of the resources was 2,107.98Mt, and the average AAl_2O_3 content was 39.11% and the average $RSIO_2$ content was 1.11%. The method of estimation is appropriate and the results are credible.

As of December 31, 2021, the (indicated + measured + inferred) bauxite resources at the Boffa Mine were reported 1,954.90Mt, with an average AAl_2O_3 content of 38.92% and an average $RSIO_2$ content of 1.10%, excluding the reserves.

In August 2017, CINF submitted the Feasibility Study Report on Chalco Hong Kong Guinea Boffa Bauxite Mine Project.

In May 2018, CINF submitted the Phase I (Preliminary Design) Specification of Chalco Hong Kong Guinea Boffa Bauxite Mine Project.

The mining method designed is open-pit mining. ROM with the AAl_2O_3 no less than 39% is mined and shipped to China.

The related transforming factors were studied and analyzed in the estimation of reserves. The indicated and measured resources ($AAl_2O_3 \geq 39\%$) are converted into reserves. The Proven reserves in Boffa Mine are 79.85Mt, with an average AAl_2O_3 content of 41.88% and average $RSiO_2$ content of 1.12%; the probable reserves in Boffa Mine are 73.22Mt, with an average AAl_2O_3 content of 41.74% and an average $RSiO_2$ content of 1.34%; the Proven + Probable reserves in Boffa Mine are 153.08Mt, with an average AAl_2O_3 content of 41.82% and an average $RSiO_2$ content of 1.23%. The results of reserves estimation are credible.

From 2019 to the end of 2021, 21.67Mt bauxite were mined from Boffa South-orebody #38. By the end of December 31, 2021, Boffa Mine had (Proven + probable) reserves of 131.41Mt, with an average AAl_2O_3 content of 41.82% and an average $RSIO_2$ content of 1.23%.

The investment analysis and financial analysis methods are suitable, and the parameters used in the analysis are sufficient and reasonable.

The total investment of the project is 474,014.92KUSD, including 435,292.22KUSD for the investment in the construction period, 13,831.95KUSD for the interest incurred during the construction period and 24,340.64KUSD for the working capital.

The ROI is 8.63%, and the ROE is 16.48%.

The financial internal rate of return before income tax is 11.85%, and the payback period is 8.44 years (including 1.5a construction period). The financial internal rate of return after income tax is 8.72%, and the payback period is 10.10 years (including 1.5a construction period).

The financial internal rate of return on capital of the project is 10.16%.

The repayment period of the loan calculated based on the maximum repayment ability is 7.73 years (including 1.5a construction period), which indicates that the project has good repayment ability.

The reserves of Boffa South could produce in full scale for 8 years. The total Boffa reserves could produce in full scale for 12 years.

The above conclusions are of high reliability and meet the precision of the feasibility study.

The high political risks may be the main concern of the project. However after the coup in Guinea in September 2021, political factors have little influence on the project and the risks are basically under control.

The economic and other risks are moderate and controllable.

23 Recommendations

① The surveying of the borehole coordinates is of poor accuracy, which affects the shape and position of the orebody. It is suggested that high-accuracy surveying of the borehole coordinates should be carried out.

② High-accuracy topographic survey shall be carried out in the mine, and the wellhead coordinates of the borehole shall be corrected with the topographic model.

③ The terrain model and orebody model shall be re-created based on the high-accuracy survey data for the mining design and production control to reduce the mining dilution rate and loss rate.

24 References

The main references are as follows：

① In May 2017, CINF submitted the <Technical and Resources Report on Bauxite Development Project in Boffa, Guinea>and its database (hereinafter referred to as the "CINF Technical Resources Report";

② In August 2017, CINF submitted the Guinea Boffa Bauxite Mine Project Feasibility Study Report of Chalco Hong Kong (hereinafter referred to as the “CINF Feasibility Study Report”);

③ In May 2018, CINF submitted the Guinea Boffa Bauxite Mine Project Detailed Design Phase I Specification of Chalco Hong Kong (hereinafter referred to as the “CINF Project Detailed Design Phase I”;

The specific sections are as follows:

Table 24-1 Specific Sections for References

Table of contents	References	Pages
1 Executive Summary		
1.1 Introduction to Mining Properties	CINF feasibility study report	P19-P20
1.2 Property Geology	CINF Project Detailed Design Phase I	P196-P203
1.3 Exploration	CINF Resources Technical Report	P3-P8
1.4 Development and Operations		
1.5 Mineral Resources	CINF Resources Technical Report	P86-P88
1.6 Mineral Reserve	CINF Project Detailed Design Phase I	P228-P242
1.7Capital and Operating Costs	CINF feasibility study report	P287-P303
1.8 Permitting		
1.9 Conclusions and Recommendations		
2 Introduction		
2.1 About the Registrant	CINF Project Detailed Design Phase I	P1-P2
2.2 Scope of Technical Report Summary		
2.3 Sources of Information	CINF feasibility study report	P18-19
2.4 Qualifications and Declaration		
3 Property Description	CINF Project Detailed Design Phase I	P195
4 Accessibility, Infrastructures and Physiography		
4.1 Topography, Elevation and Vegetation		
4.2 Accessibility	CINF feasibility study report	P20-P21
4.3Climate		
4.4 Infrastructure		
5 The Project History		
5.1 Prior and Current Ownership		
5.2 Exploration and Development	CINF feasibility study report	P94-P101
5.2.1 BHP Exploration		
5.2.2 Mining One Due Diligence		
5.2.3 CINF Technical and Resource Report		
5.2.4 CINF Feasibility Study and Design		
5.2.4 Chalco Guinean company Mine Construction and Production		

25 Dependence on Data Provided by Registrant

The technical summary report was prepared based on the following information.

(1) Guinea's database on the projects provided by Chalco

① Boffa Santou Houda Project Close Out Report(BHP, 2012)

② BHP Billiton Block model file (CSV format)

③ Borehole Coordinates (PDF file)

④ Borehole Survey Table (excel format)

⑤ Sample Assay Table (excel format)

(2) Technical Due Diligence and Resources Assessment Report on Bauxite Development Project in Boffa, Guinea of Mining One.

① Boffa bauxite block model made by Mining one

② From February to May 2017, CINF carried out on-site verification work for data (1) and (2), and under the condition that the data is reliable and complete, CINF re-modeled and estimated the resources, and submitted the Resources Technical Report on Boffa Bauxite Development Project in Guinea.

(3) Technical Due Diligence for Boffa Bauxite Project - Review Comments on Resources Assessment Report" (Chalco, 2017)

(4) The framework agreement signed between Chalco and the Guinean government.

(5) Risk Assessment Report of Chalco Hong Kong Guinea Boffa Project (Sino Rating)

(6) "Environmental and Social Impact Assessment (PPT) of Guinea Boffa Bauxite Project" (ERM)

From March 2017 to May 2019, CINF undertook the feasibility study, preliminary design and construction drawing design of the Boffa project. In the feasibility study work and design, some achievements in the (2), (5), (6) reports were used. In the feasibility study work and design, some achievements in the (2), (5), (6) reports were used. In May 2018, CINF submitted the Detailed Design Phase 1 (Preliminary Design) of the Boffa Bauxite Project in Guinea of Chalco Hong Kong.

The above information is the investigation and research information submitted by a third-party professional company commissioned by the Registrant, which is objective, reasonable and fair.

The mineral resources part is mainly based on the Resources Technical Report of the Boffa Bauxite Development Project in Guinea" submitted by CINF.

The part of mineral reserves and economic analysis is mainly based on the Feasibility Study Report of the Boffa Bauxite Project in Guinea of Chalco Hong Kong submitted by CINF and the Detailed Design Phase 1 (Preliminary Design) of the Boffa Bauxite Project in Guinea of Chalco Hong Kong.

In addition, the Registrant submitted the information and drawings of the adjacent mining properties, and the preparation work of adjacent mining assets was mainly based on the information and drawings submitted by the Registrant.