
INDUSTRY OVERVIEW

The information and statistics set out in this section and other sections of this prospectus were extracted from the report prepared by China Insights Consultancy or CIC, which was commissioned by us, and from various official government publications and other publicly available publications. We engaged China Insights Consultancy or CIC to prepare the CIC Report, an independent industry report, in connection with the Global Offering. The information from official government sources has not been independently verified by us, the Joint Sponsors, the Overall Coordinators, the Joint Global Coordinators, the Joint Bookrunners, the Joint Lead Managers, any of the Underwriters, any of their respective directors and advisers, or any other persons or parties involved in the Global Offering, and no representation is given as to its accuracy.

SOURCES OF INDUSTRY INFORMATION

We commissioned CIC to conduct research, provide an analysis of, and to produce the CIC Report on Global and China nickel industry. CIC is an independent market research and consulting company that provides industry consulting services, commercial due diligence, and strategic consulting services to both institutional investors and corporations. We incurred a total of RMB500,000 in fees and expenses for the preparation of the CIC Report.

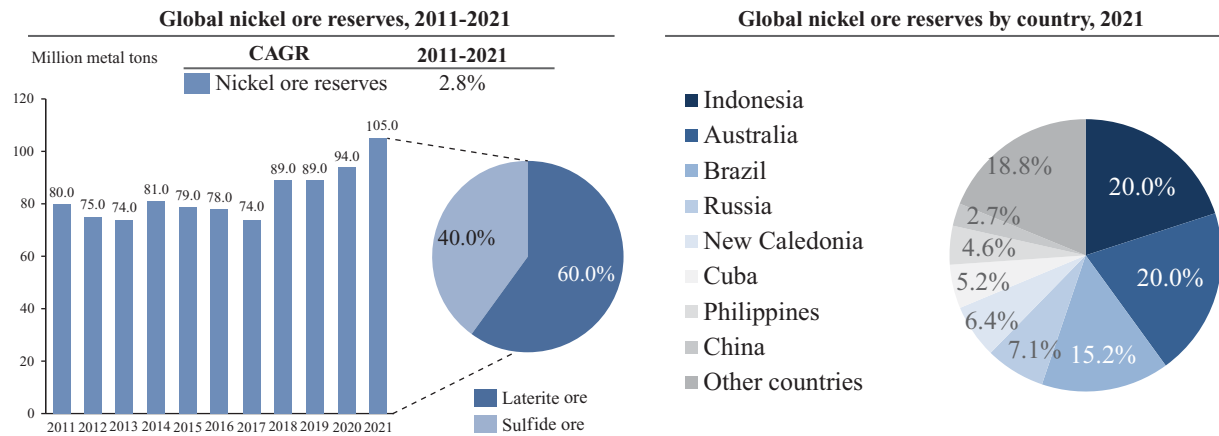
CIC conducted both primary and secondary research using a variety of resources. Primary research involved interviewing key industry experts and leading industry participants. Secondary research involved analyzing data from various publicly available data sources, such as the United States geological survey industry associations, National Bureau of Statistics of China, special steel enterprises association of China, International Monetary Fund, United Nation Comtrade database, etc.

CIC's projection on the size of each market takes into consideration various factors, including the following: (i) the overall global social, economic, and political environment is expected to maintain a stable trend during the forecast period; (ii) the key industry drivers are likely to continue to drive the growth in each market during the forecast period, and (iii) there is no extreme force majeure or unforeseen industry regulations in which the market may be affected either dramatically or fundamentally during the forecast period. Unless otherwise specified, all data and forecasts contained in this section are derived from the CIC Report. The Directors, upon acting with reasonable prudence, confirmed that there has been no occurrence of adverse change in the overall market information that would subject the data to significant restrictions, contradiction or negative effects since the date of the CIC Report.

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OVERVIEW OF THE GLOBAL NICKEL INDUSTRY

Global Reserves of Nickel



Source: United States Geological Survey, CIC Report

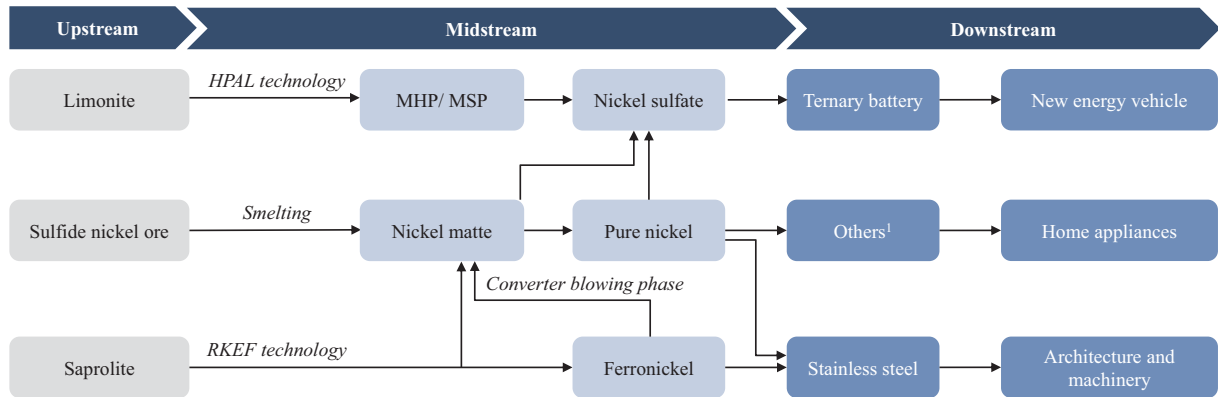
Nickel ore can be classified by ore composition into sulfide nickel ore and laterite nickel ore. In terms of Ni content, laterite nickel ore can be further categorized into limonite (1.1% < Ni content < 1.5%) and saprolite (1.5% < Ni content < 2.1%).

The global reserves of nickel ores are mainly concentrated in Indonesia, Australia and Brazil, accounting for 55.2% of the global nickel ore reserves as of 2021. The reserves of laterite nickel ore and sulfide nickel ore account for 60% and 40% respectively. Laterite nickel ore is mainly distributed in Indonesia, Brazil, New Caledonia, Cuba and the Philippines. Sulfide nickel ore is mainly distributed in Russia and China. Australia has both laterite nickel ore reserves and sulfide nickel ore reserves. Although China has a large demand for nickel resources, it has very limited nickel ore reserves, accounting for 2.7% of global reserves. Indonesia, one of the countries with the largest nickel ore reserves, implemented a comprehensive ban on the export of nickel ore since January 1, 2020 in order to develop its domestic nickel industry chain. The export of nickel ore is expected to shift to other countries as a result. Import-and-export traders and Chinese nickel industrial companies in Indonesia are expected to turn to invest in local smelting projects in Indonesia and export other nickel products, such as ferronickel, MHP and MSP.

Characterized by a high nickel content and a mature production process, sulfide nickel ore was historically the primary source of nickel, accounting for approximately 56.0% of the total nickel production in 2000. However, after a long period of exploitation, large deposits of sulfide ore became steadily fewer in number. In 2007, the application of a new process that could produce stainless steel from ferronickel instead of electrolytic nickel facilitated the mass adoption of laterite nickel ore. Laterite nickel ore is a more attractive alternative because it has higher reserves and is found at shallower depths than sulfide nickel ore, which simplifies and speeds up extraction operations. In recent years, over 70.0% of nickel ore production has been laterite nickel ore. It is expected that laterite nickel ore will continue to occupy an increasing share of the global nickel ore mining in the future.

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Value Chain Analysis of the Nickel Industry



Source: CIC Report

Note: 1. Others include alloy steels, non-ferrous alloys, plating, etc.

The upstream of the nickel industry mainly consists of the mining of nickel ores. The specific production technology used varies depending on the type of nickel ore and its intended downstream usage.

The midstream of the nickel industry mainly consists of refining products including mix sulfide precipitate (MSP), mix hydroxide precipitate (MHP), and nickel matte, as well as further processed products including nickel sulfate, pure nickel, and ferronickel.

The downstream of the nickel industry has a wide range of applications including ternary battery used in new energy vehicle and stainless steel mainly used in architecture and machinery.

Analysis of primary nickel ore production technology

Technology		Features
Pyrometallurgy	Blast Furnace	<ul style="list-style-type: none"> • Mature technology • Widely industrial application • High requirement for the grade of nickel ore • Major downstream applications include stainless steel and alloy • RKEF may also be utilized for ternary battery industry with latest technology but having relatively high economic cost in comparison to hydrometallurgy
	Reduction Smelting Nickel Matte	
	Rotary Kiln Electric Furnaces	
Hydrometallurgy	Acid Leaching	<ul style="list-style-type: none"> • Complicated smelting technology • Lower energy consumption • High investment in smelting technology • Major downstream applications include ternary battery and electroplating • Relatively low economic cost of applying hydrometallurgy to ternary battery
	Reduction Roasting Acid Leaching	
	High Pressure Acid Leaching	

 refer to the most competitive technologies

Source: CIC Report

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Technically, production technologies are classified into pyrometallurgy technology and hydrometallurgy technology. Production technologies applied to sulfide nickel ore mainly refers to reduction smelting nickel matte process. Both pyrometallurgy and hydrometallurgy technology are available to process laterite nickel ore and the methods chosen are dependent on the nickel content of the ore source. MHP and MSP from limonite are processed through hydrometallurgy technology, which takes cost advantage compared with pyrometallurgy technology. In addition, the production of nickel matte from laterite ore adopts RKEF technology, while it is further divided into two technical routes. The direct production of nickel matte from saprolite is achieved by adding sulfur to the furnace together with nickel ore for production. The other route refers to a two-step process where the ore is first processed through RKEF technology to get ferronickel. Ferronickel needs to be refined with sulfur-containing materials through converter blowing to produce nickel matte. After then, the conversion from nickel matte to nickel sulfate involves the process of purification, leaching, and crystallization. This route is chosen while using sulfide nickel ore as raw ore. Considering the economic benefit brought by HPAL technology's higher recovery rate of nickel and cobalt, compared with traditional hydrometallurgy technology, the technical route from MHP/MSP to nickel sulfate is expected to gain enormous popularity in the industry.

Historical Development of Nickel Product's Production Technology

In the past, pyrometallurgy technology was initially adopted for nickel product production. Driven by its comparative low difficulty of processing and high technical maturity, it achieved wide industrial application.

First generation of HPAL technology	The 1950s	The first attempt of hydrometallurgy technology referred to the Cuba's MOA nickel project started in 1957. The technology was still at the exploratory stage with simple process design and serious scaling problem.
Second generation of HPAL technology	The 1990s	After a few decades, the Murrin Murrin nickel project located in Australia started in 1997 representing the second generation of HPAL technology. While due to the flawed original design, it lacked a backup system and surge well preventing it from reaching the design capacity.
Third generation of HPAL technology	Early 21 st century	In the early 21 st century, HPAL technology evolved into the third generation and gradually stepped into a mature stage. The representative projects include the Ramu nickel project located in Papua New Guinea and the Coral Bay nickel project located in the Philippines. The Ramu nickel project was the first successful HPAL project which achieved high capacity utilization with relatively low operation cost. The third generation of HAPL technology is featured with low emission and low energy consumption. The Obi project is the most successful HPAL project after the Ramu nickel project by far, achieving the shortest construction period of greenfield project, and the lowest capital expenditure per nickel metal ton and the shortest duration of reaching production compared with other HPAL projects.

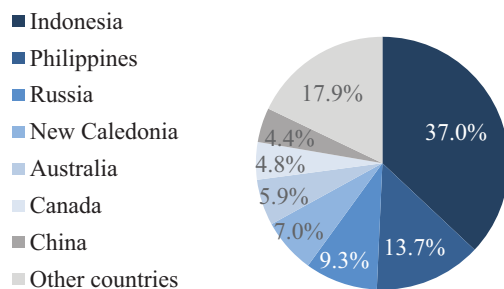
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Global Nickel Ore and Ferronickel Trade

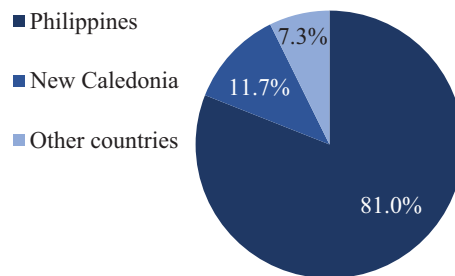
The global nickel ore mining recorded steady growth from 2.1 million metal tons to 2.6 million metal tons between 2016 and 2019. It then decreased by approximately 4% in 2020, owing primarily to the reduced demand caused by the COVID-19 pandemic. The decreased demand and production are offset by a rapid recovery in China’s production of nickel-bearing stainless grade steel, booming new energy vehicle market in China and the continued ramp up of nickel pig iron projects in Indonesia. The global nickel ore mining reached 2.7 million metal tons in 2021.

The major nickel mining countries include Indonesia, the Philippines, Russia and New Caledonia. Indonesia and the Philippines are the leading nickel ores mining countries in the world, accounting for more than 50% of global production in 2021. After the ban of exporting nickel ore in Indonesia in 2020, the global nickel ore export is concentrated in the Philippines.

Global nickel ore mining by countries in terms of mine production volume, 2021



Global nickel ore trade volume by export countries, 2021



Source: United States Geological Survey, United Nation Comtrade database, CIC Report

With the increasing consumption for nickel, the global nickel ore trade grew steadily between 2016 and 2019. In terms of trade volume, global nickel ore trade volume increased from 41.7 million tons in 2016 to 66.0 million tons in 2019, representing a CAGR of 16.5%. Although Indonesia reinstated the ban on the export of nickel ore on January 1, 2020, which caused a huge decrease in global nickel ore trading volume in 2020, nickel ore trading companies will procure nickel ore from other key nickel ore exporting countries such as the Philippines and New Caledonia to fulfil the supply gap caused by Indonesia’s nickel ore export ban. In addition, the rapid development of downstream industries such as stainless steel, new energy vehicles will drive the growth of global nickel ore trading volume. Given the fact that the global nickel ore trading volume reached 53.5 million tons in 2021, representing a year-on-year growth rate of 12.6%, it is expected that the expected growth of global nickel ore trading volume at a CAGR of 5.3% from 2021 to 2026.

The global ferronickel trade volume increased from 1.8 million tons in 2016 to 4.9 million tons in 2021, representing a CAGR of 22.1%. The major application of ferronickel is in the manufacture of stainless steel. As many countries are expected to increase their spending on infrastructure in the future, the ferronickel trade will be driven by the growth of stainless steel industry. It is expected that the global ferronickel trade volume will reach 8.1 million tons in 2026.

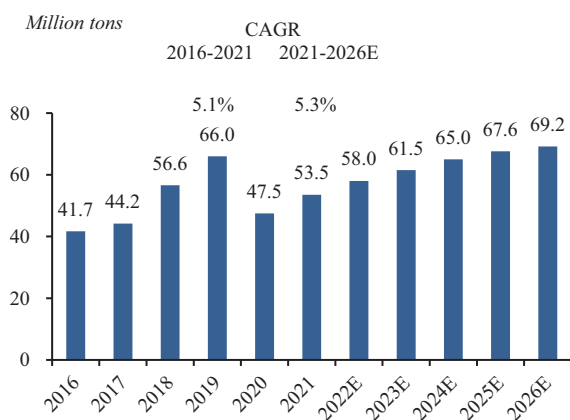
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Russia, mainly producing sulfide nickel ore, nickel matte and other nickel products, ranked third globally in terms of nickel ore mine production volume and ranked fourth globally in terms of nickel ore reserves. Regarding the Russia-Ukraine conflict, although Russia's nickel ore reserves and nickel ore mining rank among the top in the world, nickel ore and ferronickel exporting volume from Russia and Ukraine only account for less than 1% of global nickel ore and ferronickel trading volume. As a result, the Russia-Ukraine conflict will not have a great impact on global nickel ore and ferronickel trading.

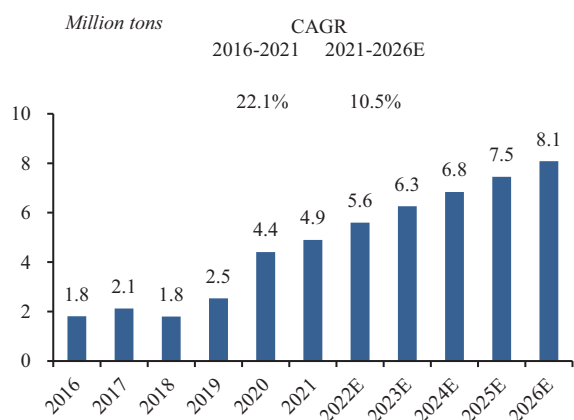
Due to the commodity characteristics of nickel, the global nickel market such as global nickel ore and ferronickel trading has a significant impact on the nickel industry. China is the biggest consumer of nickel ore. In 2021, 43.5 million tons of nickel ore were traded to China globally, accounting for approximately 81.3% of the global nickel ore trade volume.

Indonesia, one of the biggest nickel products export countries, reinstated the ban on the export of nickel ore on January 1, 2020. As a result, import-and-export traders and Chinese nickel industrial companies in Indonesia are expected to turn to invest in local smelting project and export ferronickel, which increased the export volume of ferronickel in Indonesia and the global ferronickel trade volume in 2020.

Global nickel ore trading volume, 2016-2026E



Global ferronickel trading volume, 2016-2026E



Source: United Nation Comtrade database, CIC Report

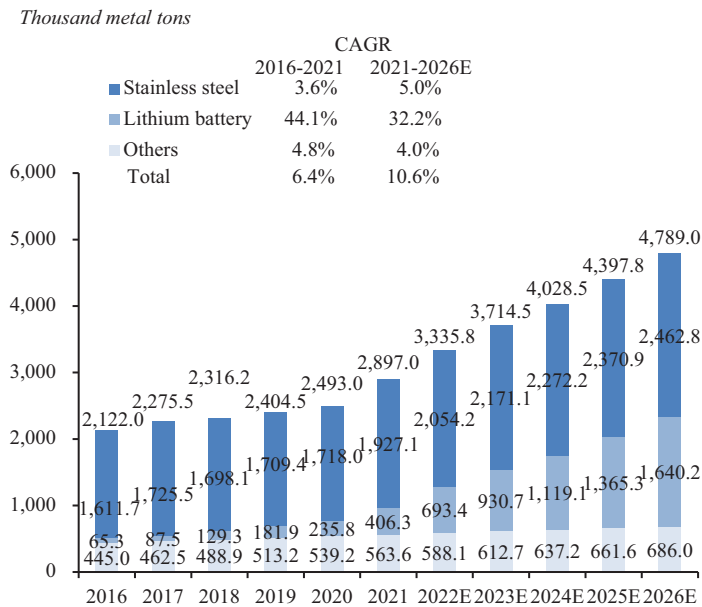
Global Nickel Consumption

The global consumption for nickel products increased from 2,122.0 thousand metal tons in 2016 to 2,897.0 thousand metal tons in 2021, representing a CAGR of 6.4% over the period, mainly driven by the development of the electric vehicles markets and the growth of stainless steel consumption. As sales of electric vehicles and the loading volume of power batteries are projected to maintain substantial growth in the future which will increase the demand of nickel in battery industry, the global consumption for nickel is expected to reach 4,789.0 thousand metal tons in 2026, at a CAGR of 10.6% between 2021 and 2026.

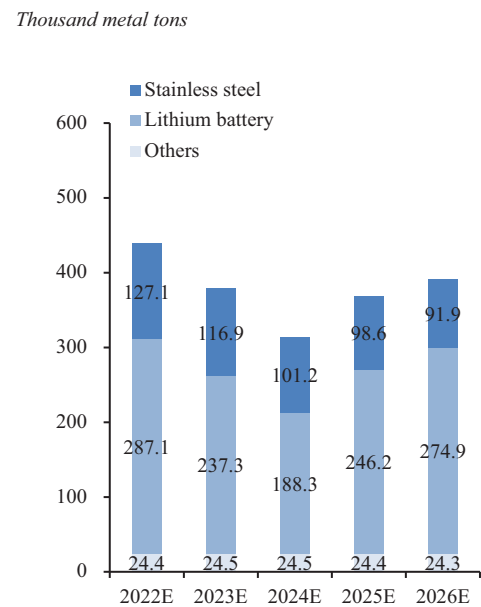
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Stainless steel has historically accounted for the largest share of the consumption of global nickel products. In 2021, nickel product consumption in stainless steel was 1,927.1 thousand metal tons, accounting for 66.5% of the global nickel consumption, while battery nickel consumption accounted for 14.0%. In the future, batteries, especially power batteries, are projected to be the main contributor to the growth of global nickel consumption. In 2026, battery is estimated to rank second in terms of global nickel consumption with a market share of 34.3%.

Consumption of nickel in terms of volume, by downstream application, Global, 2016-2026E



Nickel consumption incremental market, Global, 2022E-2026E



Note: The majority of battery refers to ternary battery for NEV industry, and may also include other forms of battery using Ni as cathode material.

Source: CIC Report

Price Analysis of Nickel and Cobalt

The nickel price maintained an upward tendency with fluctuations over the 2016-2021 period. Average annual LME cash price increased from USD9,595 per ton in 2016 to USD18,488 per ton in 2021. In the short term, the Russia-Ukraine conflict has led to speculation in the price of LME nickel which caused a LME nickel price spike in early 2022. LME canceled all nickel trades executed on March 8 because of nickel speculation. Meanwhile, low inventories of LME nickel and the market's concern over sanctions imposed on Russia also contributed to the increase in price of nickel. However, with the reduction in the speculative activities of nickel, the LME nickel price fell to, and kept fluctuating within, the price range of US\$22,900 per ton - US\$35,000 per ton during the second quarter of 2022. In the next few years, as ferronickel production capacities in Indonesia, one of the major countries of origin for nickel resources, are expected to ramp up, Indonesia is expected to provide more nickel-containing products, thereby greatly enhancing the global nickel supply and

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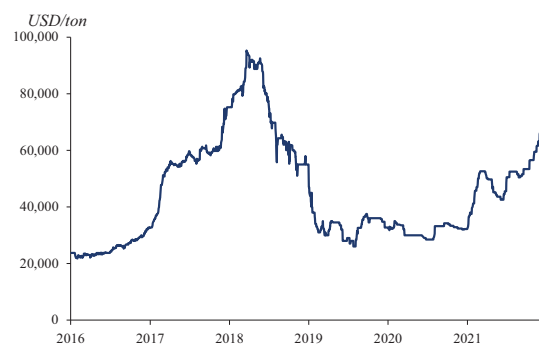
gradually bringing down the nickel price. At the same time, the nickel price is not expected to experience any significant decrease in the next few years, given the cash cost of nickel smelting projects and the strong market demand for nickel-containing power batteries. Considering a combination of these demand and supply factors, the LME nickel price is expected to fall to around US\$20,000 per ton in 2026.

Due to the increasing demand in cobalt downstream application, cobalt price rose sharply in 2017. After peaking in May 2018, the cobalt price declined sharply within one year, mainly because of the surplus of cobalt supply. With the recovery from the COVID-19 pandemic and substantial growth in downstream demand such as new energy vehicles, cobalt price began to rebound in 2021. With the cobalt demand expected to recover in the next few years, LME cobalt price are expected to remain at a relatively high level and reach around USD51,000 per ton in 2026.

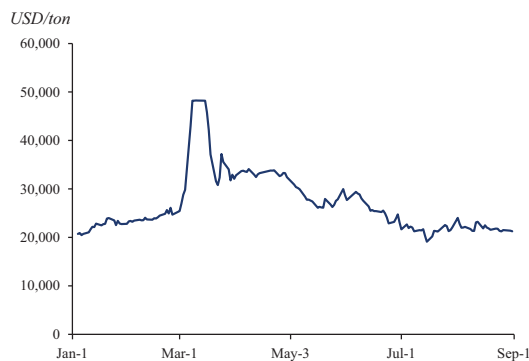
LME nickel cash price, 2016-2021



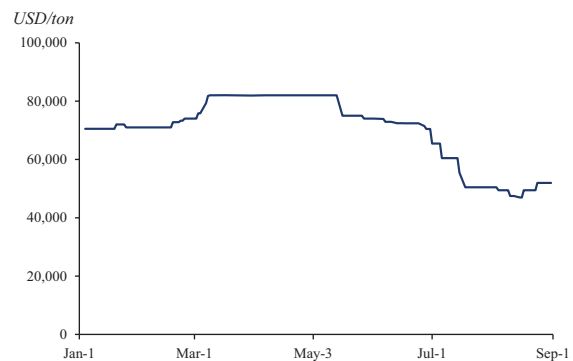
LME cobalt cash price, 2016-2021



LME nickel cash price, January 2022-August 2022



LME cobalt cash price, January 2022-August 2022



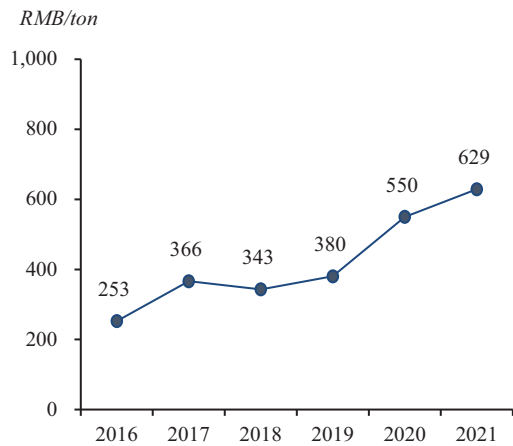
Source: CIC Report

China, the main consumer of nickel, is heavily reliant on the trade of nickel due to China's scarce nickel ore resources. Nickel ore price increased from RMB253 per ton in 2016 to RMB629 per ton in 2021, mainly driven by the increasing downstream application consumption. Indonesia's ban on nickel ore exports in 2020 also drove the nickel ore price to increase. The annual average price of ferronickel, primarily used for the production of stainless steel, increased from RMB795 per nickel point in 2016 to RMB1,269 per nickel point in 2021. In the long run, other key nickel ore exporting countries such as the Philippines and New Caledonia will gradually fulfill the supply gap caused by Indonesia's nickel ore export ban and nickel ore supply will become more stable.

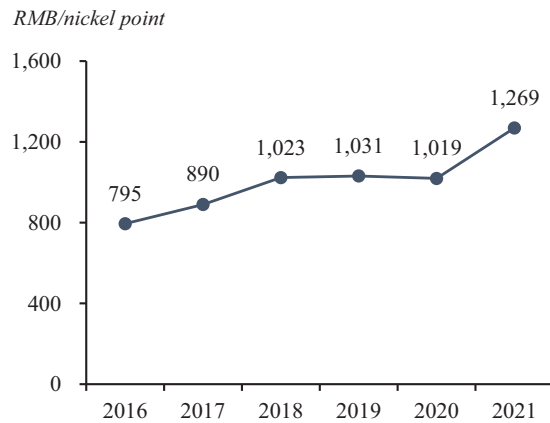
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Meanwhile, with the commissioning of the ferronickel project in Indonesia, the supply of ferronickel is expected to maintain a stable upward trend. When it comes to demand, increasing downstream application consumption will bring steady demand for nickel ore and ferronickel. Regarding the Russia-Ukraine conflict, nickel speculation due to the Russia-Ukraine conflict has caused relatively large fluctuations in the prices of LME nickel in the early 2022. The nickel industry generally uses nickel prices on LME as a benchmark for physical transactions. However, when there is extreme volatility in the LME nickel prices that is clearly dislocated from the actual demand and supply situation in the industry, the correlation between the LME nickel prices and the actual nickel product transaction prices tend to be more limited. In 2022, the average LME nickel price increased from \$22,326.0 per ton in January to \$38,496.3 per ton in March, representing an increase of 72.4% during this period. During the same period, the increases in the price of nickel ore and ferronickel were only 10.0% and 19.3% respectively. With the improvement of market regulations, speculation in the nickel product market will gradually decrease and nickel product price will base on supply and demand. Nickel ore and ferronickel prices are expected to become more stable in the next few years.

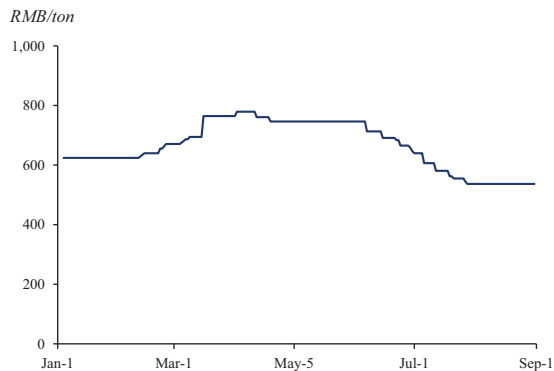
Nickel ore annual average nominal price (Ni:1.5-1.6%), 2016-2021



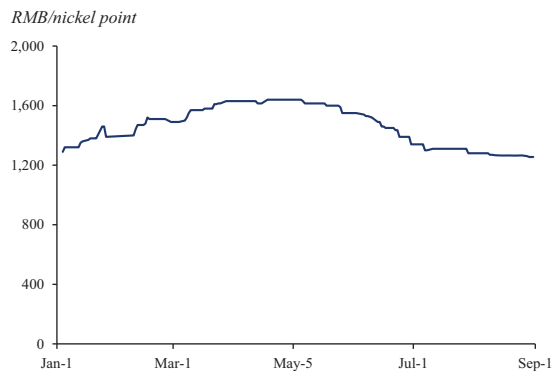
Ferronickel annual average nominal price (Ni:7-10%), 2016-2021



Nickel ore annual average nominal price (Ni:1.5-1.6%), January 2022-August 2022



Ferronickel annual average nominal price (Ni:7-10%), January 2022-August 2022

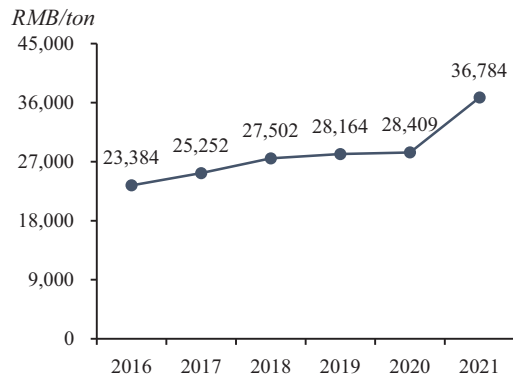


Source: CIC Report

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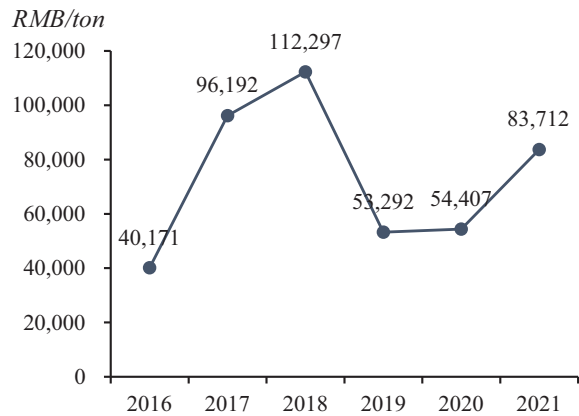
As one of the main raw materials for new energy vehicle batteries, the price of nickel sulfate increases with downstream demand. Nickel sulfate annual average price increased from RMB23,384 per ton in 2016 to RMB36,784 per ton in 2021. The price of cobalt sulfate fluctuated with the price of cobalt and increased from RMB40,171 per ton in 2016 to RMB83,712 per ton in 2021.

Nickel sulfate annual average nominal price, 2016-2021



Source: CIC Report

Cobalt sulfate annual average nominal price (Co:21%), 2016-2021



OVERVIEW OF CHINA'S NICKEL INDUSTRY

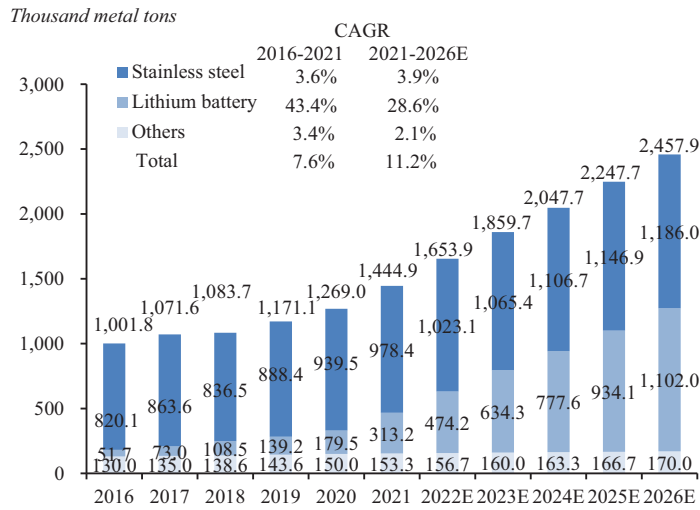
Nickel Consumption in China

China is the world's largest nickel consumer. China's consumption for nickel increased from 1,001.8 thousand metal tons in 2016 to 1,444.9 thousand metal tons in 2021, representing a CAGR of 7.6% during the same period. China's consumption for nickel is expected to reach 2,457.9 thousand metal tons in 2026, representing a CAGR of 11.2% between 2021 and 2026. China's share of the global nickel consumption increased from 47.2% in 2016 to 49.9% in 2021, and is expected to further increase to 51.3% over the next few years. The future growth of nickel consumption in China will account for substantial portion in global market.

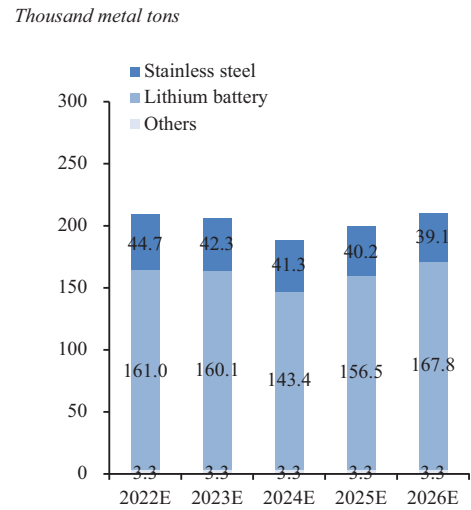
Stainless steel is the main downstream application of nickel in China, accounting for 67.7% of China's nickel consumption in 2021. It is expected that stainless steel will still account for the largest part of China's nickel consumption with a share of 48.3% in 2026. Battery grew at a faster pace in the 2016-2021 period and account for 21.7% of total consumption in 2021. Given battery's massive future growth potential, it is projected to grow at a rapid rate over the next few years and account for 44.8% of China's nickel consumption in 2026.

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Consumption of nickel in terms of volume, by downstream application, China, 2016-2026E



Nickel consumption incremental market, China, 2022E-2026E



Note: The majority of battery refers to ternary battery for NEV industry, and may also include other forms of battery using Ni as cathode material.

Source: CIC Report

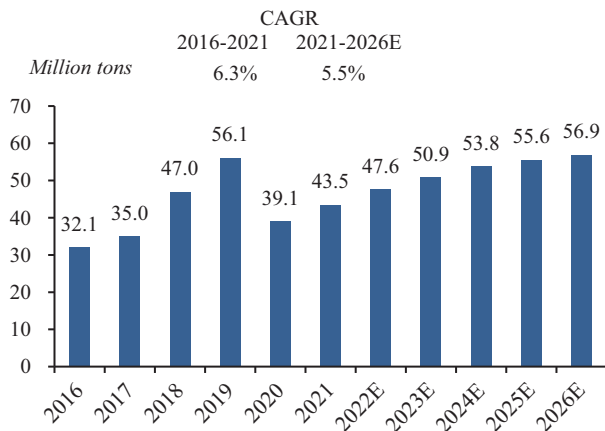
The Nickel Ore and Ferronickel Trade Market in China

With a limited nickel resources, more than 90% of nickel ores consumed in China rely on trading. The trade volume of nickel ore to China increased from 32.1 million tons in 2016 to 56.1 million tons in 2019, before decreasing to 39.1 million tons in 2020 caused by the ban on the export of nickel ore in Indonesia. In 2021, nickel ore trading volume from other key nickel ore exporting countries such as the Philippines and New Caledonia has gradually fulfilled the supply gap caused by Indonesia's nickel ore export ban and the trade volume of nickel ore to China has reached 43.5 million tons in 2021. Historically, China mainly imported nickel ore from Indonesia, the Philippines and New Caledonia. Due to the continuous change of policies, global trade volume of nickel ore to China has experienced significant fluctuation.

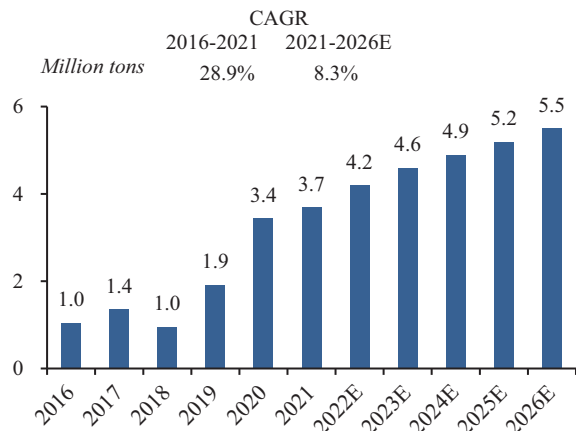
China is the country with the largest trade volume of ferronickel and mainly trades ferronickel from Indonesia, New Caledonia, etc. Indonesia has large nickel reserves and the production cost of ferronickel is much lower in comparison to China. The increasing production capacity of ferronickel and Indonesia's nickel ore export ban policy contributed to the rapid growth of ferronickel trade volume between 2019 and 2020. Global trade volume of ferronickel to China increased from 1.0 million tons in 2016 to 3.7 million tons in 2021. It is expected that the ferronickel trade volume to China will reach 5.5 million tons in 2026, representing a CAGR of 8.3% from 2021 to 2026.

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Nickel ore trade volume to China, 2016-2026E



Ferronickel trade volume to China, 2016-2026E

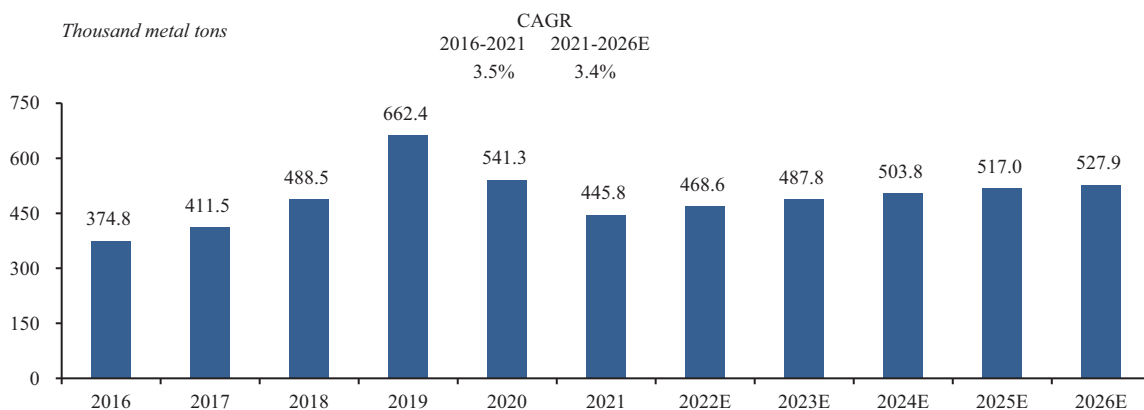


Source: United Nation Comtrade database, CIC Report

The Ferronickel Production Market in China

Ferronickel is commonly used in manufacturing of stainless steel and other alloys due to its high strength and resistance to corrosion. The production volume of ferronickel in China increased from 374.8 thousand metal tons in 2016 to 445.8 thousand metal tons in 2021, representing a CAGR of 3.5%. Under the impact of Indonesia's ban on nickel ore exports, Chinese leading companies have invested in smelting project abroad. In 2021, China's ferronickel production volume declined due to the energy control problem in China. As the energy supply gradually stabilizes, it is expected that the production volume of ferronickel will remain stable and reach 527.9 thousand metal tons in 2026, indicating a CAGR of 3.4% during the period of 2021-2026.

Ferronickel production volume, China, 2016-2026E



Source: CIC Report

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China's Nickel Industry Market Drivers

The key drivers of China's nickel industry include:

- ***Rapid growth of the power battery industry:*** The rapid growth of the NEV industry is driving up the loading volume of power batteries, which further increases the demand for nickel. China's loading volume of power batteries reached 154.5GWh in 2021, approximately two times of that in 2016. As one of the essential raw materials of power batteries, nickel has likewise enjoyed strong growth of demand over the past few years. With the accelerating promotion and adoption of new energy vehicles, demand for nickel from power batteries is expected to increase further. In addition, the application of autonomous driving on NEVs puts forward a higher requirement on the power battery capacity as it is expected to rise power consumption by approximately 20%.
- ***Rising application of high-nickel ternary battery:*** With its advantages of higher energy density, the high-nickel ternary battery has become the main lithium battery preference among commercial NEV manufacturers. Energy density is a key characteristic of NEV batteries, as higher energy density directly translates to higher endurance mileage. Nickel plays an important role in increasing the energy density of ternary material and, therefore, high-nickel ternary battery can effectively increase endurance mileage of NEVs and alleviate consumer anxiety. Moreover, as the price of nickel is significantly lower than the price of cobalt, high-nickel ternary materials can effectively reduce the cost of raw materials by reducing the relative percentage of cobalt used.
- ***Supportive government policies:*** Supportive government policies and regulations are guiding the healthy and stable development of the industry. The Ministry of Industry and Information Technology (MIIT) recently stated that the development of new energy vehicles is a strategic objective for China in its plans to achieve carbon neutrality and other goals. China's new energy vehicle industry is booming in market size. On June 1, 2021, the National Administration of Institutional Affairs and the National Development and Reform Commission issued the "14th Five-Year Plan for Energy and Resource Conservation by Public Institutions" (《“十四五”公共機構節約能源資源工作規劃》) to encourage public institutions to take the lead in using new energy vehicles and the proportion of new energy vehicles in new and updated vehicles should not be less than 30%. Moreover, with the progress of the "Belt and Road" initiative, a more favorable trading environment has been established between China and participating countries.
- ***Upward demand for stainless steel:*** Promoted by the acceleration of construction activities, demand for stainless steel has maintained an upward trend, which further promote the development of the nickel industry. Moreover, China's commercial launch of 5G commercial is boosting the demand for 5G base stations construction. Stainless steel is a major material used in the construction of public infrastructure. The demand for stainless

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steel is therefore expected to increase with the further development of 5G technology. Consequently, the rising consumption of stainless steel directly contributes to the development of the nickel industry.

China's Nickel Industry Market Trends

The key trends of China's nickel industry include:

- **Technical routes diversifications:** Companies equipped with multiple technical routes suitable for different level of nickel content have competitive advantages in producing diversified products. Hydrometallurgy has been adopted to produce nickel sulfate, the key raw material of the cathode of ternary battery, from laterite nickel and is able to achieve less energy consumption, less pollution, and superior output quality. Driven by the strong demand for high-nickel ternary batteries, hydrometallurgy brings new growth potential. Meanwhile, the stable downstream demand for stainless steel positions pyrometallurgy technology used for the production of ferronickel, indispensable for the long-term development of a nickel industry player.
- **Value chain integration:** With nickel resources integration being the core development direction of the industry, market participants are accelerating their vertical extension to both upper and lower streams of the industrial chain, aiming to achieve integration of the entire chain. In order to strengthen competitive advantages, market participants are paying more attention to the vertical integration within the nickel industry. By covering upstream sourcing and trading of nickel resources, supply chain service, production of nickel products, technique improvement, engineering design, together with industry park construction and operation, companies are able to offer one-stop solutions that allow clients fully access to each phase within the nickel life-cycle. The integrated industrial chain can potentially benefit the nickel industry by reducing the frequency of delays in delivery and transportation, guaranteeing raw materials supply and achieving greater efficiencies in the production process.
- **Overseas business development:** China's nickel market participants will further develop their overseas business in order to fully link international resources with domestic market. Downstream demands for mineral resources such as nickel, cobalt, and lithium continue to rise. The ability to maintain a stable supply of nickel ore and achieve higher capabilities of nickel ore exploration is becoming increasingly significant to market participants in the nickel industry. Through cooperation with overseas nickel companies, China's nickel market participants are able to secure a stable nickel supply and further increase their number of overseas factories and overseas production operations, which help them better serve their downstream clients and alleviate the impact of the international nickel ore export ban. Since the Indonesian government has introduced a total ban on the export of nickel ore, China's ferronickel production enterprises are facing an insufficient supply of

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raw materials. Industry participants turn to invest in midstream value-added production facilities such as nickel sulfate projects and RKEF projects. By developing production business in advance, a nickel market participant can significantly mitigate the impact of the Indonesia Ban on its business of nickel ore by trading nickel products as alternatives.

Entry Barriers of the Nickel Industry

The entry barriers of the nickel industry include:

- ***Stable access to nickel ore resources:*** As the nickel industry is a resource-dependent industry, companies with stable access to nickel ore resources have distinct competitive advantage. It is not easy for Chinese companies to maintain a steady supply of raw materials, since most of nickel ore reserve is in several countries and regions, whose policy can have a great impact on the supply. Indonesia and the Philippines, which are located near the equator, are the two countries with the highest output due to the low mining cost and low transportation costs. These two tropical countries are major nickel ore suppliers for China, so changes in these countries' policies exert a large impact on the nickel ore supply. Therefore, enterprises having stable access to nickel ore resource presents a remarkable competitive advantage.
- ***Large capital investment:*** The nickel industry has significant economies of scale that have already been exploited by the existing firms to a large extent. For market participants involved in the production process of the nickel industry, large companies maintain a considerable scale of operation to reduce unit costs, achieving cost advantages. New entrants will be deterred by substantial initial investment in raw materials and fixed assets. Leading companies can increase concentration through low-cost advantages, further increasing the entry barrier for new entrants. For market participants involved in the trading of nickel ore, new entrants are difficult to compete with those industry giants in establishing stable upstream and downstream source.
- ***High requirements for operational capabilities:*** The HPAL process places extremely high requirements on operational capabilities. A slight improper operation of the core components will cause damage in a short period of time. Follow-up repairs can take several months, which will bring tremendous losses to the company. With the low level of fault tolerance of HPAL, professional technicians are required to accurately examine and respond to any operation challenges in order to avoid malfunctioning and the subsequent downtime. Moreover, research of targeted nickel ore and adaptive design are the key factors that directly affect the production cost of a HPAL project, which requires much experience in operation. Technology and material adopted by production equipment also generate crucial impacts on the capability utilization rate of the HPAL project. As such, the high requirement for operational capability presents a major barrier to new market entrants.

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Opportunities, Threats and Challenges of the Nickel Industry

The opportunities, threats and challenges of the nickel industry include:

- ***A large amount of investment shifts to Indonesia:*** With its public infrastructure becoming more complete and reliable, more companies in the nickel industry are seeking to invest in Indonesia. With China well-accustomed to being the major player in the nickel smelting industry, the domestic nickel industry is going to be hurt if a large amount of investment shifts to Indonesia.
- ***Increasing nickel price for domestic manufacturers:*** Strict nickel policies from Indonesia and the Philippines are going to decrease the nickel ore supply available for export and import, driving up the nickel price and decreasing the profitability for domestic manufacturers.

OVERVIEW OF MAJOR DOWNSTREAM INDUSTRIES OF GLOBAL AND CHINA NICKEL CONSUMPTION

Analysis of major downstream industries of nickel consumption

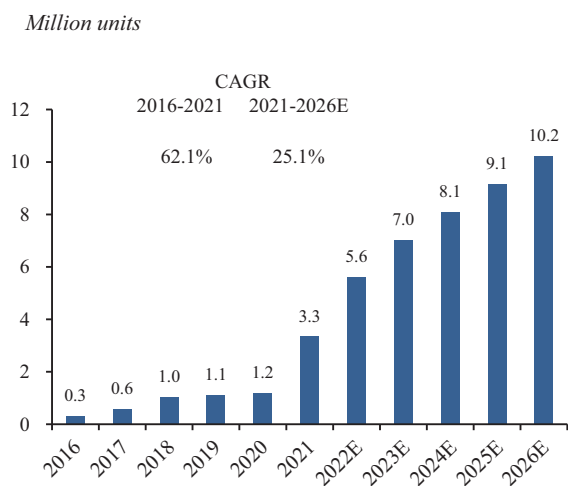
NEV industry

The NEV sales volume in China increased from 0.3 million vehicles in 2016 to 3.3 million vehicles in 2021, representing a CAGR of 62.2%. Driven by the sales of NEV, power battery installed volume increased from 28.6 GWh in 2016 to 154.5 GWh in 2021. Ternary battery is one of the most common types of power battery and the cathode material is the key component of power battery affecting the performance of power battery. Ternary battery raw materials include nickel-cobalt compounds such as nickel sulfate which can be obtained from MHP and MSP. With the growth of ternary battery, the demand of nickel sulfate from NEV industry in China is expected to increase from 223.7 thousand metal tons in 2021 to 977.7 thousand metal tons in 2026, representing a CAGR of 34.3%. According to the Technology Roadmap for Energy Saving and New Energy Vehicles 2.0 issued by China Society of Automotive Engineers, the proportion of NEV sales as of the total vehicle sales will rise to approximately 40% by 2030. By 2035, NEVs will account for over 50% of the total vehicle sales. Driven by favorable policies, evolving vehicle technology, and rapid battery cost reduction, as well as wider consumer acceptance of NEVs resulting from improved understanding and increasing demand for intelligent technology and connectivity, the NEV sales volume in China is expected to grow at a fast rate in the next few years. The penetration rate of NEVs, which is calculated by new energy passenger vehicle sales volume divided by all passenger vehicle sales volume, has increased significantly from 1.2% to 15.2% between 2016 and 2021. Given the fact that NEV sales volume in China achieves rapid growth in early 2022 with a year-on-year growth rate of 132% in January and 180% in February, and most motor vehicle groups also declared that the launch of NEV will be accelerated, it is expected that penetration rate of new NEV sales will reach 39.8% in 2026.

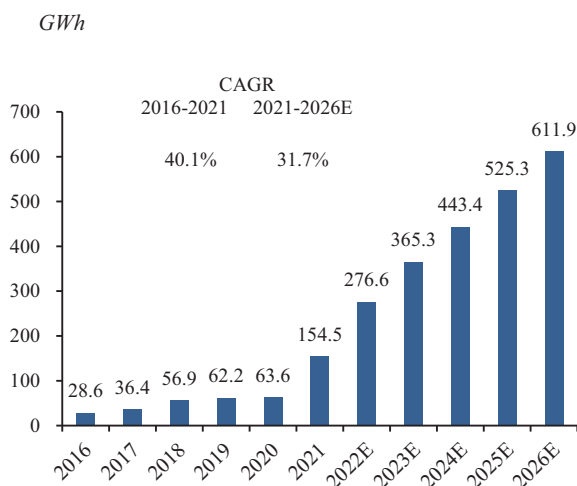
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Key drivers including favorable policies; consumer awareness and acceptance of NEV; improvements in charging infrastructures; technology innovation and advancement of V2X¹ and autonomous driving; and rising application of high-nickel ternary battery will drive the continuous growth of NEV industry as well as the nickel consumption in China.

NEV sales volume, China, 2016-2026E



Power battery installed volume, China, 2016-2026E



Source: CIC Report

Stainless steel industry

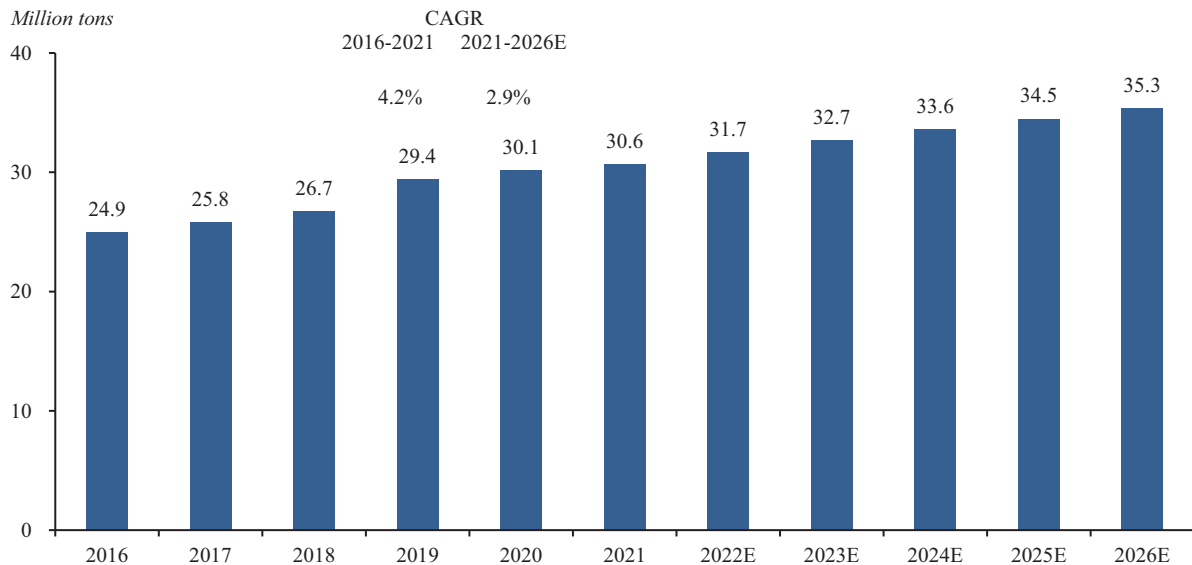
With the development of stainless steel production, the raw materials of stainless steel have changed from pure nickel to ferronickel, and the proportion of ferronickel used as the main raw material gradually increases. As the production volume of stainless steel increases, the demand for ferronickel will also increase. China's production volume of stainless steel increased from 24.9 million tons in 2016 to 30.6 million tons in 2021, representing a CAGR of 4.2% over the period. China's production volume of stainless steel is expected to reach 35.3 million tons in 2026, indicating a projected CAGR of 2.9% over the 2021-2026 period. Production growth is mainly being driven by the renovation of old residential areas, development of new infrastructure, development of high-tech manufacturing, increasing demand for modern kitchen appliance and increasing consumption for high-nickel steel as a material for gas containers.

Key drivers including increasing renovation of old residential areas; continuous development of high-tech manufacturing, railway transportation, satellites, etc.; increasing need for modern kitchen appliances; development of 5G infrastructure; and increasing demand for nickel-rich austenitic stainless steels as material of gas containers will drive the sustainable demand of stainless steel as well as the nickel consumption in China.

Note: 1. V2X refers to vehicle-to-everything, which is a communication system that supports the transfer of information from a vehicle to moving parts of the traffic system that may affect the vehicle.

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Production volume of stainless steel, China, 2016-2026E



Source: CIC Report

COMPETITIVE LANDSCAPE OF NICKEL ORE AND PRODUCT TRADING INDUSTRY IN GLOBAL AND CHINA

Market participants of global nickel product trading are mainly sizable trading companies and large multinational companies owning mines. In 2021, the Company ranked first globally in terms of nickel product trade volume and ranked first in China in terms of nickel ore trade volume.

As the reserves of nickel ore are relatively limited in China, there exists a considerable shortfall in the supply of nickel ore. Over 90% of nickel ores consumed in China rely on imports from Philippines, New Caledonia, etc., especially since the comprehensive ban on the export of nickel ore of Indonesia in 2020. As a capital-intensive, resource-dependent, and downstream-driven industry, China's nickel industry has relatively high entry barriers. Nickel ore suppliers play a significant role in providing nickel ore for downstream clients who do not have access to ore resources. It is not uncommon that nickel ore trading happens between nickel ore suppliers. It is common for companies engaged in nickel product trading business to procure from or sell to each other products including nickel ore and ferronickel of different nickel content depending on the availability and favorable pricing of these products.

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Global top five nickel product suppliers, in terms of trade volume in 2021

Ranking	Company	Nickel product supply volume in 2021 (thousand metal tons)
1	The Company	~227.3 ⁵
2	Company E ¹	~215.2 ⁶
3	Glencore ²	202.0
4	Nornickel ³	200.0
5	Vale ⁴	182.0

Source: CIC Report

Notes:

1. Company E is a Philippine-listed mining company established in 1969, which primarily mines laterite nickel ore, and the total revenue of the whole group was approximately US\$0.6 billion in 2021 with a net profit of approximately US\$0.2 billion in 2021. Company E is based at the Bonifacio Global City in Taguig, Metro Manila.
2. Glencore is one of the largest globally diversified natural resource companies headquartered in Switzerland, engaging in the production and trading of metal and minerals and energy products, listed on LSE and JSE. The total revenue of the whole group was approximately US\$204 billion in 2021 with a net profit of approximately US\$4 billion in 2021.
3. Nornickel is a leader in Russia's metals and mining industry producing palladium, nickel, platinum, copper, etc., listed on MCX and LSE. The total revenue of the whole group was approximately US\$18 billion in 2021 with a net profit of approximately US\$7 billion in 2021.
4. Vale is one of the world's largest mining companies headquartered in Brazil and is listed on B3, NYSE, and LATIBEX, which also engages in logistics, steel making, and energy businesses. The total revenue of the whole group was approximately US\$55 billion in 2021 with a net profit of approximately US\$25 billion in 2021.
5. Assuming the average nickel content of nickel ore is 1.5%, based on Company E's annual report which states that the nickel content of its nickel ore reserve ranges from 0.8% to 1.8% and its nickel ore exported to China is mostly used for ferronickel smelting, therefore the nickel content is relatively high.
6. Assuming the average nickel content of nickel ore is 1.2%, as the nickel content of laterite nickel ore traded by the Company ranged from 0.6% to 1.8%.
7. Listed companies generally disclose sales of nickel products in terms of nickel metal ton, given different nickel content of various nickel products.
8. Nickel product supply volume in terms of nickel metal ton of Glencore, Nornickel and Vale is directly disclosed in their respective annual reports.

Currently, the nickel ore trading industry in China is relatively concentrated as few companies have stable access to nickel ore resources, of which the top five market participants accounted for approximately 56.2% of the gross nickel ore trade volume to China in 2021. In 2021, the Company ranked as the largest nickel ore supplier in China in terms of trade volume, with a market share of approximately 26.8%. The Company is also one of a few nickel industry service providers engaged in the whole process of the industrial chain.

Apart from the Company, other nickel ore suppliers' trade volume is far below that of the Company. Company A was the second largest nickel ore supplier by trade volume in 2021 with a market share of 16.1%. Other sizable market participants, Company B, Company C and Company D, accounted for approximately 4.6%, 4.6% and 4.1% of market share, respectively, in 2021.

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China top five nickel ore suppliers, in terms of trade volume in 2021

Ranking	Company	Trade volume in 2021 (million tons)	Market share of gross nickel ore trade volume to China in 2021
1	The Company	11.7	26.8%
2	Company A ¹	~7.0	~16.1%
3	Company B ²	~2.0	~4.6%
4	Company C ³	~2.0	~4.6%
5	Company D ⁴	~1.8	~4.1%
	Others	24.5	56.2%
	Total market	19.0	43.8%
		43.5	100.0%

Source: CIC Report

Notes:

1. Company A, established in 1999, is a Chinese A-share listed metal products wholesales company that also offers integrated supply chain services. The total revenue of the whole group was approximately RMB178 billion in 2021 with a net profit of approximately RMB1 billion in 2021.
2. Company B, established in 1988 with a registered capital of approximately RMB250 million, is a private comprehensive trading company wholly owned by a state-owned conglomerate in China.
3. Company C, established in 2016 with a registered capital of approximately RMB50 million, is a Chinese private enterprise engaged in mineral product mining, trading, logistics, and terminal smelting process.
4. Company D, established in 1986 with a registered capital of approximately RMB1.5 billion, is a private trading company wholly owned by a large Chinese state-owned iron and steel company, and mainly engages in the trading of raw material, metallurgical equipment, spare parts, and related products applied in the stainless industry.

The Company is also tapped into the production of ferronickel. As of the Latest Practicable Date, the aggregate designed production capacity of the Company's Jiangsu Facilities is 18,000 metal tons of ferronickel per annum, ranking as the No. 9 ferronickel manufacturer in China, with a market share of 3.4%.

ANALYSIS ON NICKEL INDUSTRY IN INDONESIA

Overview of Nickel Ore Reserve in Indonesia

Indonesia has abundant nickel resources and it reserves approximately 21 million metal tons of nickel ore accounting for 20.0% of the global reserves in 2021, most of which are laterite nickel ore. Indonesia's nickel ore is mainly distributed in Obi island, Sulawesi island, and Halmahera Island. The average grade of nickel ore in Indonesia is comparatively high, and most of which can be directly obtained through low-cost open-pit mining. The government of Indonesia is encouraging the transformation of the nickel industry chain from direct export of nickel ore to focusing on nickel processing with higher added value. In recent years, the Indonesian government has issued a series of policies to encourage more investment in nickel industry value chain, such as production facilities in Indonesia.

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Competitive Landscape of Nickel Product Production Industry in Indonesia

The Company plans to build 6 HPAL production lines and 20 RKEF production lines with a full production capacity of 120 thousand and 280 thousand metal tons, respectively. RKEF technology has been rolled out in Indonesia at a massive scale and global leading market participants have established RKEF projects in Indonesia with considerable capacity. Indonesia is also one of the popular investment destinations for many HPAL projects. The two production lines under phase I of PT OBI, the Company's HPAL project, have reached full production capacity.

The companies in this industry that are engaged in the ferronickel production and nickel ore trading business typically target the downstream stainless steel industry. Other companies that operate HPAL projects are typically targeting the downstream NEV industry.

To compare with other HPAL projects, PT OBI takes a leading position in terms of technology chalking up records in several aspects:

- the shortest construction period of greenfield project
- the lowest capital expenditure per nickel metal ton
- the shortest duration of reaching production

Comparative analysis of HPAL projects in Indonesia

HPAL Project	Location	Annual full production capacity of nickel (thousand metal tons)	Product	Actual / planned commissioning time	Market share in terms of annual full production capacity of nickel	Project status
Project Huashan ¹	NA	~123	MHP	NA ⁸	22.2%	Announced the construction plan
PT OBI ²	OBI island	~120 37 (1 st phase) 18 (2 nd phase) 65 (3 rd phase)	MHP&MSP	2021.05 (1 st phase) 2022 (2 nd phase) 2023 (3 rd phase)	21.6%	1 st phase in operation 2 nd & 3 rd phase under construction
Project Huafei ³ . . .	Weda Bay	~120	MHP&MSP	2023-2024	21.6%	Under construction
Project Huayue ⁴ . . .	Morowali	~60	MHP	2021.12	10.8%	In operation
Project QMB ⁵	Morowali	~50	MHP	2022-2023	9.0%	1 st phase in operation 2 nd phase under construction
Project BASF ⁶	Weda Bay	~42	MHP	After 2025	7.6%	Under construction
Project Pomalaa ⁷	Pomalaa	~40	MSP	After 2025	7.2%	Under construction

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Source: CIC Report

Notes:

1. Project Huashan is operated by a Chinese listed company Huayou Cobalt and a Singapore private company Glaucous International, which has not commenced operation as of the Latest Practicable Date.
2. PT OBI is operated by the Company and its Indonesia partner.
3. Project Huafei is operated by a Chinese listed company Huayou Cobalt, a Chinese listed company EVE Energy, a Singapore private company Glaucous International, and a Singapore private company LINDO INVESTMENT.
4. Project Huayue is operated by a Chinese listed company Huayou Cobalt, a Chinese listed company China Molybdenum, a Chinese private company Tshingshan, a Chinese private company Huaqing Hualong Consulting, and Long Sincere.
5. Project QMB is operated by a Chinese listed company GEM, a Chinese private company New Horizon International, a Chinese listed company CATL, a Sino-Indonesian joint venture IMIP, a Korean listed company Ecopro, and a Japanese public company Hanwa.
6. Project BASF is operated by a German listed company BASF and a French listed company Eramet, which has not commenced operation as of the Latest Practicable Date.
7. Project Pomalaa is operated by a Brazilian listed company Vale and a Chinese listed company Huayou Cobalt, which has not commenced operation as of the Latest Practicable Date.
8. The announcement issued on June 20, 2022 did not disclose the production time or other information.

With the continuous exploration of the HPAL technology in the past few decades, several projects have been successfully commissioned so far. Among all nickel hydrometallurgy projects utilizing the HPAL process that have commenced production or are under construction globally, PT OBI ranked first in terms of annual designed production capacity, with a market share of approximately 17.1% (total of three phases) as of the Latest Practicable Date. Among all nickel hydrometallurgy projects utilizing the HPAL process that have commenced production or are under construction in Indonesia, PT OBI ranked first in terms of annual full production capacity with a market share of 34.3% (total of three phases) as of the Latest Practicable Date. The two production lines under phase I of PT OBI have reached full production capacity.

Comparative analysis of RKEF projects in Indonesia

Operating Company	Annual full production capacity of nickel (thousand metal tons)	Project status
Company F ¹	~800	Partially in operation & partially under construction
Company G ²	~400	Partially in operation & partially under construction
The Company	280	Under construction
Other Chinese Companies ³	~120	Partially in operation & partially under construction
Companies other than Chinese companies ⁴	~200	Partially in operation & partially under construction
Total	~1,800	

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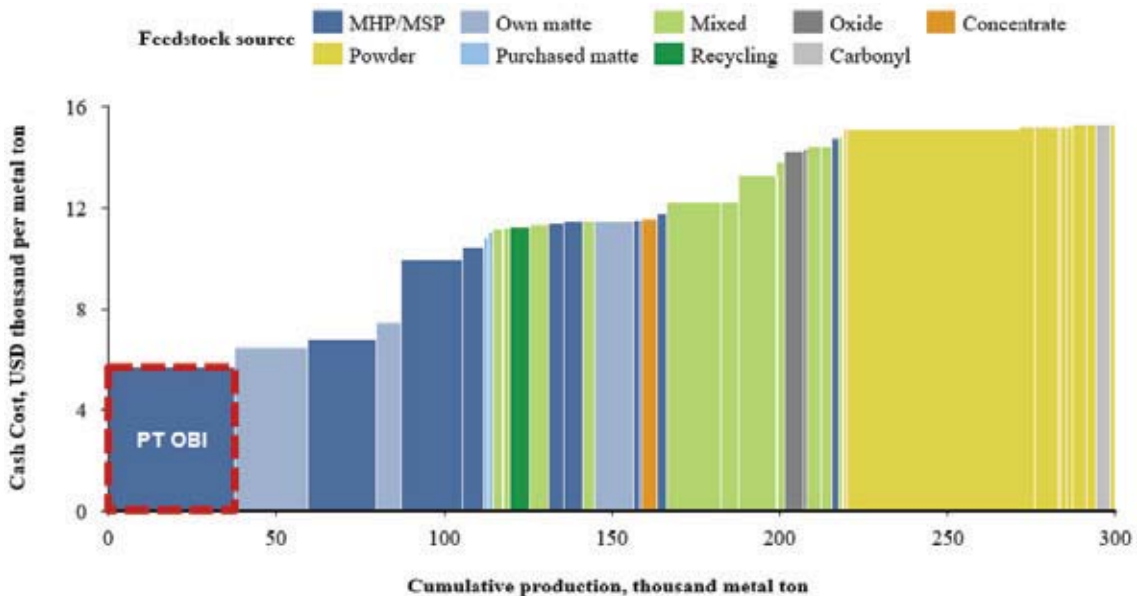
Source: CIC Report

Notes:

1. Company F, established in 1988, is a private company that is the largest stainless steel manufacturer in China. Company F recorded over RMB300 billion of revenue in 2021.
2. Company G, established in 2010, is a Chinese private company focusing on stainless steel smelting. Company G recorded over RMB100 billion of revenue in 2021.
3. Approximately 20 remaining Chinese companies also operate RKEF objects in Indonesia, which mostly are engaged in the smelting of stainless steel.
4. Companies other than Chinese companies mainly refer to private Indonesian and other listed foreign companies engaging in mining business, with a total number of less than 15.

In addition to its HPAL project, the Company’s RKEF project is ranked the third largest RKEF project among all projects that have commenced production or are under construction in Indonesia, with a market share of approximately 15.6 % in terms of designed production capacity as of the Latest Practicable Date. As of the Latest Practicable Date, the total designed production capacity of RKEF projects in Indonesia that have commenced production or are under construction in Indonesia is approximately 1,800 thousand metal tons. The top two RKEF projects in Indonesia are operated by Chinese private leading stainless steel manufacturing companies. The Company’s RKEF project accounts for a market share of approximately 9.0% of the total RKEF projects that have commenced production or are under construction globally, in terms of designed production capacity as of the Latest Practicable Date.

Cash cost curve of global nickel-cobalt compound product and/or nickel sulfate smelting projects¹



Source: CIC Report

Note:

1. Refer to projects that were under production in 2020.

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Different technical routes of nickel-cobalt compound product and/or nickel sulfate smelting require various types of feedstock sources. Each color of pillars in the graph represents a type of feedstock source used for nickel-cobalt compound product and/or nickel sulfate smelting, including MHP and MSP, own and purchased nickel matte, NiO, concentrate, Ni(CO)₄, nickel ore powder, recycling nickel and mixed of multiple feedstocks. Each pillar stands for a single project, while the largest pillar in yellow stands for the aggregation of other facilities in China. As the conversion from MHP/MSP to nickel-cobalt compound product and/or nickel sulfate requires lower cash cost due to the higher recovery rate of nickel and cobalt, it generally sits in the low-cost tail of the related field's smelting projects' cash cost curve. While other projects using mixed materials, nickel oxide, nickel concentrate, own and purchased nickel matte, recycling, powder and nickel carbonyl as feedstock sources to produce nickel-cobalt compound product sits in the high-cost tail of the cash cost curve, which is primarily on account of the relatively low recovery rate. By adopting one of the most advanced production technology, PT OBI has the lowest cash cost among all nickel-cobalt compound production projects worldwide that were under production in 2020.