Mineral Resources Business

The Mineral Resources Business holds the most upstream position within the SMM Group's business model and has the important role of continuously providing a stable supply of non-ferrous metal materials not only within the Group, but also to various industries in both Japan and overseas.

Hiroshi Asahi
Director,
Senior Managing Executive Officer,
General Manager of
Mineral Resources Division

Business Environment

The global economy continued on a declining trend, against a backdrop of U.S.-China trade friction, among other factors. The global spread of COVID-19, which appeared in the fourth quarter of FY2019, made economic activity slow down and the resulting decrease in demand and decline in profitability had a huge impact on the entire non-ferrous metals industry. Therefore, we have been ensuring the profitability of our operational mines through measures such as cutting operating costs and postponing capital expenditure.

In the medium to long term, we expect to see a rise in demand for electric vehicles and from the infrastructure and construction industries in China and other emerging countries, so demand for copper and nickel is predicted to remain steady. Furthermore, there is currently an influx of speculative investment in the market for gold, which is seen as a safe asset, and prices are remaining at high levels, so we think we need to optimize assets by continuing to participate in superior projects and other means. In regard to resource development, which is crucial for the growth of the Mineral Resources Business, we are seeing the further manifestation of issues including a rise in resource nationalism, increasing geopolitical risk, stricter environmental measures in each country, rising costs due to development taking place in increasingly remote locations or at higher elevations, and higher levels of impurities.

Review of FY2019

Reviewing the status of our major mines in FY2019, mining operations at the Hishikari Mine remained steady, and the volume of gold produced was in line with the planned amount. Production volumes at the Morenci Copper Mine (U.S.) exceeded both the amount produced in the previous fiscal year and the planned amount, mainly due to a high level of cathode production. The production level at the Cerro Verde Copper Mine (Peru) fell from the previous fiscal year due mainly to a drop in the grade of ore. The effects of the COVID-19 pandemic also led to a reduction in operating capacity. The results of the accumulated operational improvements made to date were reflected in the production level at the Sierra Gorda Copper Mine (Chile), which achieved every major indicator according to plan, including ore processing volume, recovery rate, and production volume (see Investment in Growth). In the Quebrada Blanca Copper Mine Phase 2 Development Project (Quebrada Blanca 2 Project), which is one of the three major projects in our 2018 3-Year Business Plan, construction was progressing smoothly toward starting production in 2021, but we were forced to stop work in March due to the COVID-19 pandemic (see Investment in Growth). In the Côté Gold Project

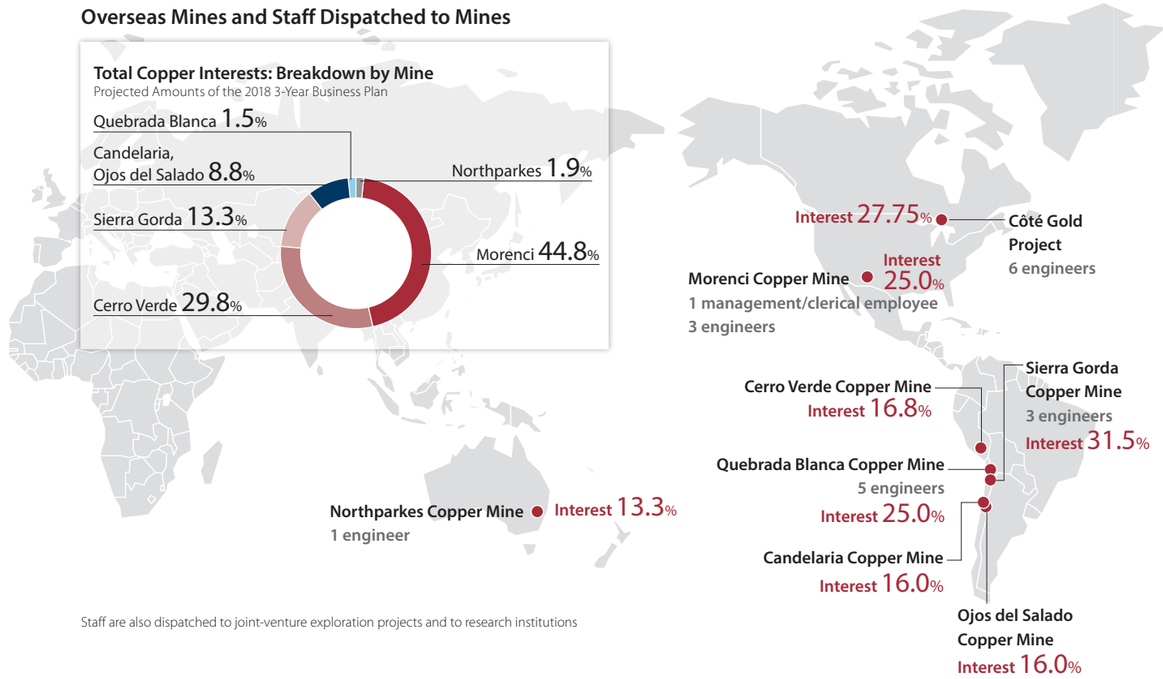
Progress and Issues in Our Top Priorities

	FY2019	FY2020	FY2021	FY2022	FY2023 and later
Cu Sierra Gorda Copper Mine	●110-kt production structure ●Debottlenecking underway	●130-kt production structure			
Cu Morenci Copper Mine	●Exceeded planned production volume	●Consideration of cost reductions and investment postponements			
Cu Cerro Verde Copper Mine		●Temporary operation under care and maintenance → Restart			
Cu Candelaria Copper Mine		●Planned increase in production based on effects of the mill reinforcement project			
Cu Quebrada Blanca 2 Project	●Acquisition of interest	●Temporary halt of construction			
Au Hishikari Mine		●Continuing lower orebody development			
Au Côté Gold Project		●Start of construction			●Start of production scheduled

Strategies for the Mineral Resources Business in the 2018 3-Year Business Plan

1. Promotion of the Quebrada Blanca 2 Project
2. Stabilization of operations at the Sierra Gorda Copper Mine
3. Promotion of the Côté Gold Project
4. Hishikari Mine: Establishment of a foundation for long-term stable operation

Overseas Mines and Staff Dispatched to Mines



Staff are also dispatched to joint-venture exploration projects and to research institutions

(Canada), we aimed to begin construction during 2019 but factors such as a downturn in the gold market meant that during this fiscal year, detailed design to reduce risk needed to take precedent, and in July 2020, we decided together with our business partner IAMGOLD Corporation (IMG) to move the construction period. Project members from both companies are advancing preparations to begin construction with the aim of starting production in 2023.

Role in the Three-Business Collaboration

With the discovery of superior mines getting more difficult and an upsurge in resource nationalism, the relationships of trust that we have built with our partner companies over the years are leading to the acquisition of new resource interests for the SMM Group. Collaboration among our business divisions is another strength of our Group. The Mineral Resources Division has the role of supplying raw material ore and other items to the Non-Ferrous Metals Division, reducing risk, and achieving control of costs.

Specifically, we estimate we will achieve our Long-Term Vision target of copper production from interests of 300 kt/year through the acquisition of an additional interest in the Morenci Copper Mine, enhancement of operations at the Cerro Verde Copper Mine, and start of production in the Quebrada Blanca 2 Project. Therefore, we recognize that getting the Quebrada Blanca 2 Project up and running on schedule is an important role for our business in supplying raw material ore. We also remain vigilant and collect information in a timely manner so that we can keep track of future movement in the resources industry. In particular, we leverage the diverse geological knowledge of resource engineers, not only concerning gold and copper, but also nickel, cobalt, and other mineral resources, to support the Non-Ferrous Metals Division, the Materials Division and their customers by providing information regarding the amounts and properties of mineral ore resources, even resources other than the non-ferrous metals produced by our Group. To strengthen three-business collaboration centered on cathode materials for batteries as stipulated in the 3-Year Business Plan, we will actively provide more support than ever through our knowledge gained from evaluating the Non-Ferrous Metals Division's nickel projects to contribute to expanding in-house procurement of nickel and cobalt resources.

Investment in Growth

Advancing the Quebrada Blanca 2 Project

Based on the construction promotion framework being advanced under the firm leadership of our business partner Teck Resources Limited, full-scale construction on the project began in January 2019 and had been progressing smoothly.

However, the COVID-19 pandemic meant that we had to temporarily halt construction work in order to ensure the health and safety of people involved in construction and their families, and to demonstrate maximum support as a large-scale mine project for efforts by the Chilean government and locals to prevent the spread of infection.

This is because the construction period prior to a mine opening involves a larger concentration of people than regular mine operations, and we needed to avoid the three C's (Closed spaces, Crowded places, and Close contact). However, even within this situation, we are doing what we can to restart construction, including advancing work that is possible under present conditions and increasing the number of rooms at the camp to decrease the risk of infection.

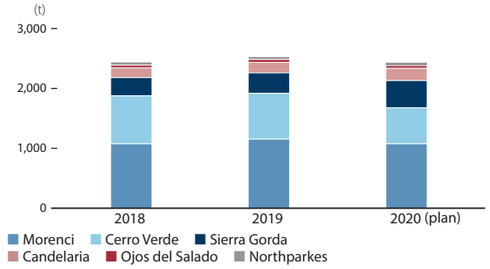
While the current environment does not allow our team members in Japan and North America to go to Chile freely, we are sharing information through various channels.

Location:
About 165 km southeast of Iquique, Region 1, Chile

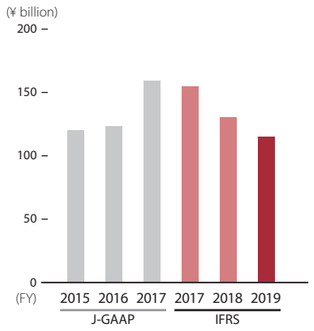
Overview of the Quebrada Blanca 2 Project

- Equity interest: Teck Resources Limited 60%, SMM 25%, Sumitomo Corporation 5%, other 10%
- Planned investment: US$5.2 billion (100% of the project, includes effects of inflation)
- Average annual copper production volume: 240 kt
- Location: About 165 km southeast of Iquique, Region 1, Chile

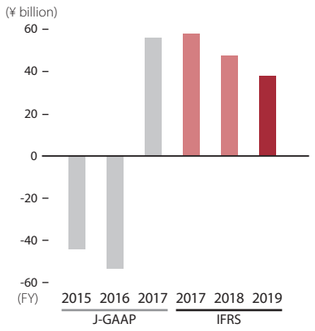
Copper Production from Interests



Segment Net Sales

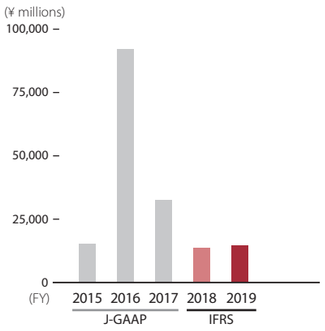


Segment Income



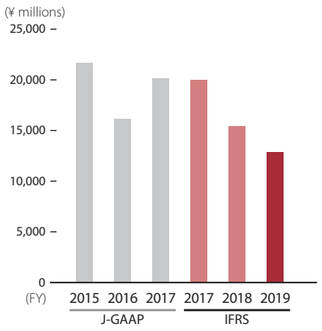
Mining operations at the Hishikari Mine remained steady, and the gold content in sold ore was in line with the planned amount, nearly unchanged from the previous fiscal year at 6 t. Production volumes at the Morenci Copper Mine (U.S.) increased year on year, mainly due to a high level of cathode production.

Capital Expenditure

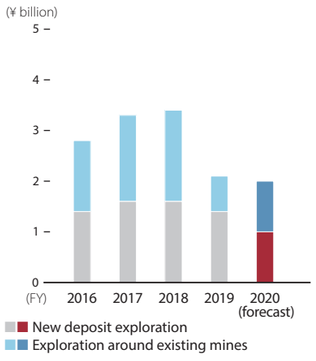


The SMM Group continued to carry out capital expenditure at Hishikari Mine, primarily focusing on exploration and development. We also carried out capital expenditure to support mining and production at overseas mines, including the Morenci Copper Mine.

Depreciation and Amortization Expense



Exploration Costs



We will continue exploration in FY2020, with a focus on gold. Costs for exploration in areas around operating mines are expected to increase for the Candelaria Copper Mine.

Recoverable Gold Reserves at the Hishikari Mine

(gold: tonnes)

2015	2016	2017	2018	2019
170	169	169	167	163

Recoverable reserves of gold at the Hishikari Mine, calculated as of December 31, 2019, are 163 tonnes (down 4 tonnes from last fiscal year).

Debottlenecking
A project to enhance operations by strengthening a portion of existing operational lines

Progress of Debottlenecking at the Sierra Gorda Copper Mine

The Sierra Gorda Copper Mine is operating at a level close to full production capacity due to work carried out to stabilize operations. In FY2019, we achieved copper a production volume amounting to 108 kt, exceeding the amount planned at the start of the year. In FY2020, we will continue advancing measures to reduce costs while aiming to establish a 130-kt/day production structure through the execution of a debottlenecking plan (initially planned capacity was 110 kt/day).

Additionally, Sierra Gorda S.C.M., which operates this project, was given the FY2019 National Mining Society Award by the Sociedad Nacional de Mineria, the Chilean mining industry association. The award was presented in recognition of its unflagging efforts and outstanding operational record, as exemplified by how it has increased ore processing quantity after overcoming numerous operational difficulties, and is continuing operations on a stable basis.

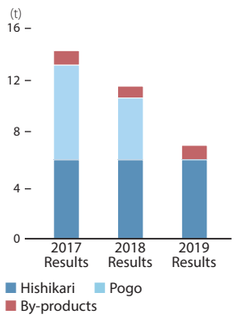
Location:
About 130 km south-southwest of Timmins in Ontario Province, Canada

Promotion of the Côté Gold Project

In the Côté Gold Project in Canada, in June 2017 we concluded the acquisition of 30% of the 92.5% interest held by Canadian gold producer IAMGOLD Corporation (IMG), an amount equivalent to 27.75% of the project overall. The interests that we acquired include periphery mining zones and are located within the Abitibi area in eastern Canada, one of the world's leading gold producing regions, so we expect that additional resource amounts may be added through future exploration. While we were discussing starting construction on the project with IMG, consideration of factors such as a downturn in market conditions meant we need a detailed design to reduce various risks before carrying out construction. As a result, although moving the construction period will delay the project by about two years, it will also extend the life of the mine and increase the total expected production volume, so we have decided to begin construction in July 2020. Project members from both companies are advancing preparations to begin construction with the aim of starting production in 2023.

Location:
Isa, Kagoshima Prefecture

Au Production (SMM's interests)



Long-Term Stable Operation at Hishikari Mine

The Hishikari Mine (Kagoshima Prefecture) has produced 248.2 tons of gold (as of the end of March 2020) since it opened in 1985. Worldwide, the amount of gold contained in gold ore is said to be three to five grams per ton. However, the Hishikari Mine is characterized by its high grade with 30 to 40 grams of gold per ton, or about 10 times the average. The mine continues to produce about six tons of gold per year. As of the end of December 2019, the mine has recoverable reserves of 163 tons. We have been continuing mine operations while taking measures to prevent COVID-19 infections and our planned annual gold production volume for FY2020 is six tons. We are also carrying out the ongoing development of the mine's lower orebody with safety as our first priority.

The Hishikari Mine is the only gold mine in Japan at which large-scale operations continue to be carried out on a commercial basis. We will also continue using the mine as a place for human resources development where resource engineers can accumulate the skills and experience needed for mine operation.

Exploration Plans and Acquisition of New Interests

The possibility of success in exploration is said to be on the decline worldwide. However, exploration experts in the SMM Group are taking actions to enhance the chance of success through the strict selection of projects. We actively carry out investigation of gold- and copper-related exploration and participation projects, mainly in the Pacific Rim, and conduct exploration both on our own and through joint ventures, with a focus on high-potential regions. To enhance the possibility of fast transition to production, we also take an interest in participation in exploration projects that deliver results at the initial stage. The difficulty of exploration is such that only about three in a thousand projects succeed, but we plan to deliver results through target management.

We have had to slow the pace of exploration activities due to the effects of the COVID-19 pandemic. The pace of global development in regard to considering the acquisition of new interests has also slowed and we think we have to respond through investigation and preparation. In addition to the minor participation in large-scale projects that we have undertaken in the past, we are also pursuing negotiations on medium-scale mine operations, where we can act as the operator.

Strategic Topics

Human Resources Active around the World

The SMM Group's engineers became active around the world with our acquisition of interest in the Morenci Copper Mine in the U.S. in 1986. Since then, by exposing engineers to experience through rotation among sites where we participate in business, we have accumulated skills and knowledge concerning mining operations at international standards.

In 2019, we dispatched two additional personnel to the Morenci Copper Mine, an exploration engineer and a geological engineer, and both of them have been contributing to activities at the mine. Also, on the Quebrada Blanca 2 Project, for which we acquired an interest in 2019, we have dispatched a total of five engineers specializing in resources and engineering to participate in managing construction work. Going forward, we will continue to cultivate our ability to manage overseas mines by providing a variety of personnel with opportunities, from a viewpoint of diversity, to gain experience by participating in the development and operation of overseas mining sites.

Striving Toward Digital Transformation in the Resources Business

As major resources companies are advancing measures such as using IoT and AI technology to improve resource business operations, automate heavy machinery, and realize remote monitoring, the Mineral Resources Division has been participating in initiatives at joint venture mines and continuously investigating the latest technologies. In our Vision for 2030 (See Special Feature 1 on p. 27), "the effective use of non-ferrous metal resources" is one of our 11 material issues and one of the KPI we have set is "improve productivity by introducing new technology." Specifically, we aim to introduce IoT, AI, and other digital tools into our mine operations to realize "smart mining" which seamlessly merges IT and non-IT areas to make mine management more efficient. First, we assessed the current situation, created a roadmap, and carried out Wi-Fi tests with the aim of establishing communications infrastructure within Hishikari Mine, which we fully own. Next, we plan to trial the installation of remote monitoring systems in our heavy vehicles. These initiatives will enable us ensure safety, respond to the aging of the workforce, and use digital data to maintain and improve cost competitiveness, and it will also be useful in operating mines overseas.

Binary Power Generation
A type of power generation that make use of geothermal energy

ESG Case Study

Binary Power Generation at the Hishikari Mine

At the Hishikari Mine, we are engaged in pumping thermal spring water discharged from underground in order to develop the mine below sea level. About a third of the spring water pumped is supplied to recipients such as local hot spring inns, and the remainder is kept in a cooling tower until it has cooled to a temperature below that stipulated by environmental standards, after which it is processed and released into a river. Since the mine opened, we have carried out environmental measures with the aim of realizing a clean mine, so this time we focused on the heat produced by the spring water and decided to introduce a binary power generation system that uses the steam produced by this heat to generate electricity, thereby reducing greenhouse gas emissions. Construction of the facility is scheduled to be completed within 2020.

Once the binary power generation system is operational, we expect to realize energy saving effects by reducing the amount of power needed to cool water in the cooling tower.

Tailing dams
Facilities for accumulating mineral solids resulting from a separating process that separates slag produced from mineral processing, smelting, and refining at mines into solids and water.

The Appropriate Management of Tailings Dams (Slag Accumulation Sites)

Sustainable mine development and operation require efforts to minimize impacts on the environment.

At closed mines, we treat wastewater containing heavy metals discharged from drifts and manage tailing dams that collect slag discharged by mineral ore processing facilities. We have enacted safety measures at 42 tailing dam locations we manage in Japan. In regard to stabilization work, we responded to revisions to management standards for accumulation sites made in light of the Great East Japan Earthquake in 2011, and in the period up to 2019, we invested a total of approximately ¥4.5 billion.

Furthermore, as treating wastewater requires removing heavy metals until water quality meets wastewater quality standards, it is a key part of the management of closed mines, so a portion of treatment costs are subsidized by the Japanese government. In recent years, there has been increasing attention on passive treatment technologies that use microbes to remove heavy metals.

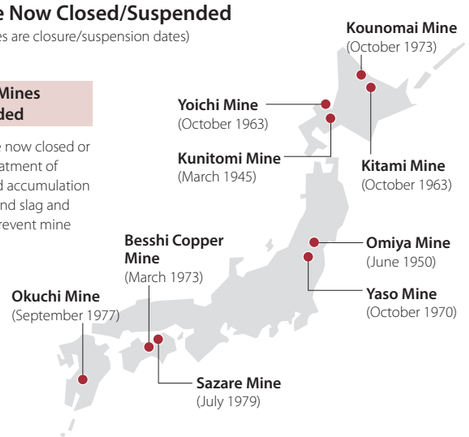
As passive treatment is a natural method of purifying wastewater that does not require the use of force or chemicals, it is expected to be introduced as a process that is lower cost and more environmentally friendly than wastewater treatment using chemicals. Since 2016, we have been working with JOGMEC to check the effectiveness of the technology through verification testing at our Yaso Mine (Fukushima Prefecture), which closed in 1970.

Domestic Mines That Are Now Closed/Suspended

(as of July 1, 2020, dates in parentheses are closure/suspension dates)

Management Framework for Mines That Are Now Closed/Suspended

SMM's management of mines that are now closed or suspended includes daily, 24-hour treatment of wastewater emerging from mines and accumulation sites, and maintenance of old mines and slag and spoil accumulation sites, in order to prevent mine pollution.



Smelting & Refining Business

The Smelting & Refining Business has its roots in Sumitomo's original business of copper smelting, which began in 1590. Today, we continue to tackle issues in the effective use of resources, through technological achievements that include establishing the HPAL process that enables efficient recovery of nickel from low-grade ores, and successfully achieving the world's first commercial production of nickel intermediates.

Nobuhiro Matsumoto
Director,
Managing Executive Officer,
General Manager of Non-Ferrous Metals Division

Business Environment

Amid concern over the impacts of U.S.-China trade friction on the global economy and stagnation of the global economy due to the COVID-19 pandemic, global demand for both copper and nickel is expected to decrease sharply from the previous year in FY2020. On the supply side, while our mining business was impacted by the COVID-19 pandemic in the first half of 2020, operations have mostly been restarted. Accordingly, as the decline in demand for copper and nickel was greater than the decline in supply, these metals are expected to face a slight surplus in FY2020.

Progress and Issues in Our Top Priorities

	FY2019	FY2020	FY2021	FY2022	FY2023 and later
Ni Pomalaa Project ›		●Decision on investment following in-progress DFS			●Operation to start in the mid-2020s (target)
Ni Taganito HPAL Nickel Corporations ›		●Achievement of at least 30-kt production volume ●Aim for start of commercial production of chromite ●Start of commercial production of scandium oxide			
Ni Nickel sulfate Niihama Nickel Refinery and Harima Refinery ›		●Achievement of record high production level ●Maximum production and output to meet cathode material demand			

Strategies for the Smelting & Refining Business in the 2018 3-Year Business Plan

1 Expansion of our nickel business

- Promotion of Pomalaa Project to achieve 150-kt production structure

2 Reinforcement of production capabilities

- THPAL: Establishment of a stable, full-scale production structure
- Toyo Smelter & Refinery: Establishment of a stable production system and the pursuit of earning capacity
- Niihama Nickel Refinery and Harima Refinery: Continuous implementation of productivity improvements and cost reductions
- Maximization of HPAL by-product recovery
- Hyuga Smelting Co., Ltd.: Maximization of production level under structure of two kilns and one electric furnace

Looking ahead, we anticipate an increase in demand for metals due to countries' economic measures and the resumption of economic activities in the short term, and the growth of the global economy in the medium to long term. However, the outlook remains uncertain due to factors including U.S.-China trade friction and the timing of the end of the COVID-19 pandemic.

Review of FY2019

We are continuing a definitive feasibility study (DFS) at the Pomalaa Project in Indonesia, one of the three major projects in our 2018 3-Year Business Plan. Upon completion of the study, we will progress to the step of deciding whether to invest.

Topics which we tackled in FY2019 include the strengthening of our ability to handle impurities in nickel raw material at the Niihama Nickel Refinery. Facing limits on the securing of nickel raw materials, we broadened our procurement of nickel raw materials through facility expansion and reinforcement over the past year, to achieve a system able to further eliminate impurities. We recognize the securing of nickel raw materials, the business models of our Smelting & Refining Business and Materials Business, the development of synergies, and the need to achieve planned production levels as issues that remain. (For details of production levels and initiatives at sites, see Investment in Growth.)

From the end of FY2019, impacts on the supply chain from the COVID-19 pandemic have become apparent in the Smelting & Refining Business as well. We are strengthening collaboration between our sites and outside ore suppliers and are working to minimize impacts on our operations, while enacting measures to prevent contagion.

Role in the Three-Business Collaboration

The Smelting & Refining Business smelts and refines raw materials procured from mines in which we hold interests or from other overseas mining companies, to create high-purity copper, nickel, cobalt, gold, and other metals which we then sell. Among these metals, demand is growing year by year for nickel and cobalt, which are used in battery cathode materials aimed at EVs and other vehicles.

Our Group stably procures nickel ore through means including investment in overseas nickel mining companies. We also recover nickel and cobalt through proprietary technologies such as the HPAL and MCLE methods, and supply nickel sulfate and other products to outside customers and to our Battery Materials Division. We are building a unique business model as one of the few companies in the world with a supply chain that spans the entire stream. Intermediate raw materials from Coral Bay Nickel Corporation (CBNC) and Taganito HPAL Nickel Corporation (THPAL) form the primary raw materials for our cobalt products, which our customers can use with confidence under our responsible mineral sourcing.

Examples of enhancing collaboration among our business divisions include maximizing our supply of nickel sulfate for use in battery materials, and recycling of used lithium-ion batteries (waste LIBs).

Strategic Topic

Expansion of Our Nickel Business

Our Long-Term Vision calls for annual nickel production capacity of 150 kt. In addition to CBNC and THPAL, we are forging ahead with a third HPAL plant, the Pomalaa Project. After the completion of the in-progress DFS, we will make a decision on investment.

Overview of the Pomalaa Project

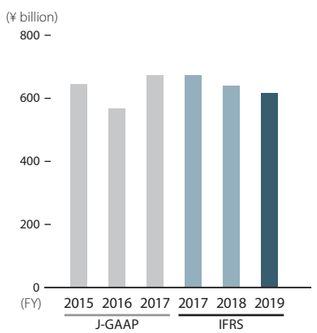
A third HPAL plant, following CBNC and THPAL in the Philippines

- Production level: MS-40 kt-Ni (roughly)
- Investment: Several billion US$ (100% of the project)
- Operation to start in the mid-2020s (target)

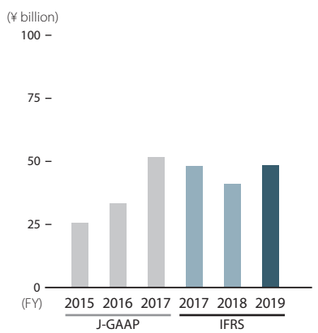
HPAL
An acronym for High Pressure Acid Leach. This technology enables the recovery of nickel from nickel oxide ores that had been conventionally difficult to process. The SMM Group was the first company in the world to apply it successfully on a commercial scale.

MCLE
An acronym for Matte Chlorine Leach Electrowinning. This is a manufacturing process adopted at the SMM Group's Niihama Nickel Refinery. Matte and mixed nickel-cobalt sulfides (MS) are dissolved in chlorine at high temperature, then electrolysis is used to produce high-purity nickel. MCLE is more competitive than other methods in terms of cost, but poses significant operational challenges, and only two other producers outside of SMM have commercialized it using similar technology.

Segment Net Sales

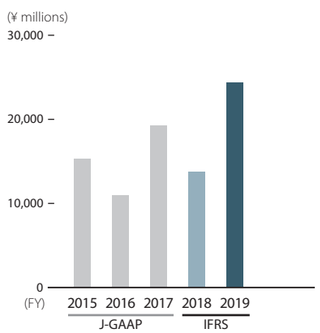


Segment Income



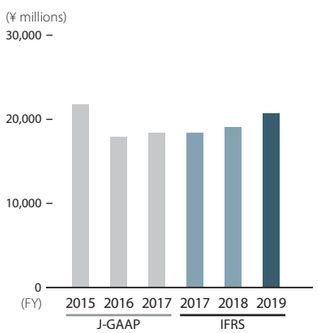
Despite a decline in copper prices, segment income increased year-on-year due mainly to increases in nickel and gold prices and to gains on the sale of land and buildings accompanying the business withdrawal of Taihei Metal Industry Co., Ltd.

Capital Expenditure

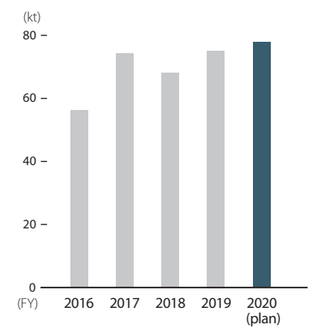


Capital expenditures in FY2019 include those related to upkeep and renewal of facilities at refineries and chromite recovery at THPAL.

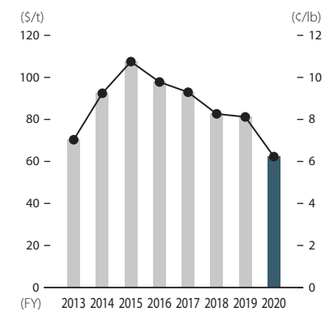
Depreciation and Amortization Expense



Production Volume of Nickel Sulfate



TC/RC (benchmark)



Demand for battery cathode materials and other nickel advanced materials is predicted to continue growing. We believe that the nickel used in these advanced materials will center on the pure nickel known as class 1, or nickel chemicals such as nickel sulfate with low levels of impurities. With few class 1 nickel development projects available, we expect that our HPAL technology, which can produce intermediate raw materials for class 1 nickel production from relatively abundant laterite deposits, is extremely effective. Moreover, as an initiative aimed at building a sustainable, circular economy, we are tackling the development of LIB recycling technology (see the ESG Case Study: Recycling of Waste LIBs for details).

Investment in Growth

Reinforcement and Improvement of Production Capabilities

• Coral Bay Nickel Corporation (CBNC)

Located in the province of Palawan in the Philippines, CBNC operates our Group's first HPAL plant. In FY2019, the production level of mixed nickel-cobalt sulfides (MS) was 19.1 Ni-kt (or 19,100 tons of nickel), falling short of the 21.5 Ni-kt in our May plan due to reasons including small-scale equipment troubles and ore composition.

• Taganito HPAL Nickel Corporation (THPAL)

Located in the province of Surigao del Norte in the Philippines, THPAL increased its MS production capacity by 20% in FY2017 to 36 Ni-kt. In FY2019, the plant achieved production of 32 Ni-kt, its first year of production in excess of 30 Ni-kt. The plant aims to establish a stable full-scale production structure while making increased use of ICT.

THPAL Plant

• Toyo Smelter & Refinery

Located in the city of Saijo, Ehime Prefecture, the Toyo Smelter & Refinery is a large-scale coastal smelter where we have established world-class smelting and refining technology, production management technology, and environmental preservation technology. Due to factors including planned regular stoppage and fluctuations in copper concentrate composition, the smelter's production level of electrolytic copper was 399 kt in FY2019. The smelter plans an electrolytic copper production level of 444 kt in FY2020, and will strengthen its earning capacity through further streamlining and cost reductions. While working to increase the facility's operating ratio through planned upkeep, renewal, and preventive maintenance of facilities, we are working to establish a stable production structure and bolster earning capacity through means including increased collection of recycled materials.

• Niihama Nickel Refinery and Harima Refinery

Located in Niihama, Ehime Prefecture, Niihama Nickel Refinery is the only plant in Japan producing electrolytic nickel and electrolytic cobalt, and is distinguished by its adoption of the extremely efficient production method called MCLE. Niihama Nickel Refinery produces electrolytic nickel, electrolytic cobalt, nickel sulfate, and other products using MS produced at CBNC and THPAL in the Philippines, and using the raw material called matte procured from locations including Indonesia.

Nickel sulfate is produced at Harima Refinery in Hyogo Prefecture as well as Niihama Nickel Refinery. These refineries are meeting growing demand in the battery business through strong production of nickel sulfate, and together achieved a record high production level of nickel sulfate in FY2019. The Harima Refinery engages in efficient end-to-end production that extends from nickel sulfates to the precursors that are raw materials for battery cathode materials.

• Production Status at Other Plants

Hyuga Smelting Co., Ltd., which produces ferronickel, achieved its planned production level in FY2019 through sustained full-load operation with two kilns and one electric furnace. Shisaka Smelting Co., Ltd., which recovers and recycles the zinc contained in steelmaking flue dust, achieved its planned production level of crude zinc oxide in FY2019.

• Maximization of HPAL By-Product Recovery

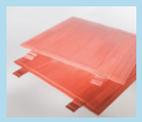
The nickel ore used as a raw material in HPAL contains trace amounts of scandium and chromite, which THPAL is working to recover. Commercial production of scandium oxide began in January 2019, while commercial production of chromite is currently planned to begin in FY2020. Scandium oxide for use in solid fuel batteries and aluminum alloys, and chromite for use in stainless steel and other specialty steels, are expected to see wide-ranging

MS
An abbreviation for mixed sulfides of nickel and cobalt.

Precursors
Intermediate products in the production of cathode materials. We produce cathode materials by combining these with lithium and calcining.

SMM Group Refineries and Their Main Products

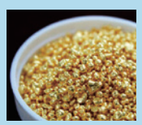
Toyo Smelter & Refinery


Electrolytic copper


Copper sulfate

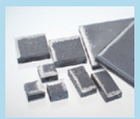

Gold ingots


Slag sand


Gold shot


Silver shot

Niihama Nickel Refinery and Harima Refinery


Electrolytic nickel

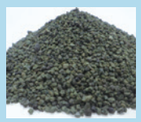

Electrolytic cobalt


Nickel sulfate


Nickel chloride

Hyuga Smelting Co., Ltd.


Ferronickel shot


Green sand

Shisaka Smelting Co., Ltd.

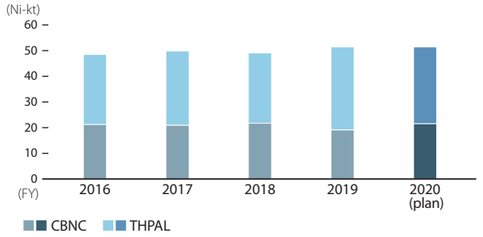

Zinc oxide pellets

Coral Bay Nickel Corporation Taganito HPAL Nickel Corporation


MS (mixed nickel-cobalt sulfides)

demand. By efficiently recovering such by-products, the SMM Group is enhancing the added value of HPAL technology.

MS Production Volume

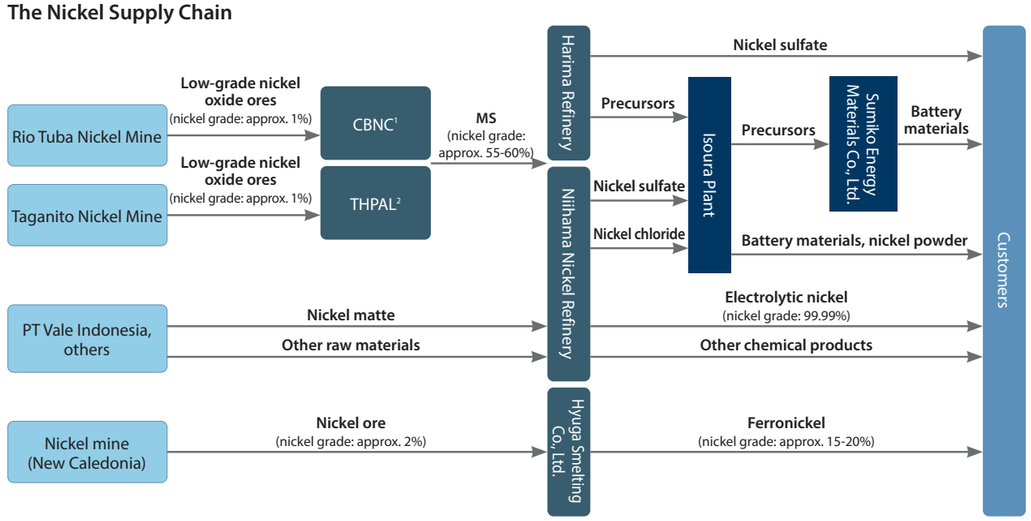


ESG Case Study

Utilizing Low-Grade Nickel Ore for HPAL

The HPAL process adopted at CBNC and THPAL is able to recover metals such as nickel and cobalt from low-grade nickel oxide ore conventionally not subject to smelting and refining, and is noted for its effective utilization of unused resources. The SMM Group boasts unique strengths in the stable provision of nickel and cobalt, which face growing demand for use in automobile secondary batteries, and in responsible mineral sourcing throughout our supply chain that lets customers use our products with confidence.

The Nickel Supply Chain



1. Coral Bay Nickel Corporation (CBNC): Shareholders: Sumitomo Metal Mining Co., Ltd. (54%); Mitsui & Co., Ltd. (18%); Sojitz Corp. (18%); Nickel Asia Corporation (10%). Head Office: Rio Tuba, Bataraza, Palawan Province, Philippines.
2. Taganito HPAL Nickel Corporation (THPAL): Shareholders: Sumitomo Metal Mining Co., Ltd. (75%); Mitsui & Co., Ltd. (15%); Nickel Asia Corporation (10%). Head Office: Taganito, Surigao del Norte Province, Philippines.

CBNC Captures the Top ASEAN Mineral Award

The ASEAN Mineral Awards are presented to outstanding mining, smelting, and refining companies in order to promote resource industries in ASEAN countries. CBNC is working to achieve responsible operations while contributing to society through infrastructure development in surrounding areas, expansion of employment, and local procurement of materials, and while preserving biodiversity through operations that minimizes environmental impact, prevention of environmental accidents, and restoration of ecosystems through the greening tailing dams.

The latest ASEAN Mineral Awards mark a second round of the awards, following the first in 2017. The 11 ASEAN countries nominate one representative company in each category; three companies which pass screening and selection then conduct final selection of award recipients. CBNC was selected as an awardee after receiving a recommendation from the government of the Philippines as a representative company in the metallic and mineral processing category.

ASEAN Mineral Awards ceremony

Recycling of Spent LIBs

As an initiative aimed at building a sustainable, circular economy, the SMM Group is tackling the development of spent LIB recycling technology (see Research & Development: Innovation Topics on p. 65 for details). Research and development into new recycling processes, including for cobalt, are now underway, with the aim of commercialization in 2022. We also continue the recovery of valuable metals from spent LIBs at the Toyo Smelter & Refinery and Niihama Nickel Refinery, and from spent nickel–metal hydride batteries (Ni-MH) at Hyuga Smelting Co., Ltd. These initiatives also directly connect to "demonstrate and commercialize automotive secondary battery recycling technology," a KPI for "effective use of non-ferrous metal resources," one of the 11 material issues in our Vision for 2030 (see Special Feature 1 on p. 27 for details). In the Smelting & Refining Business, on the technical side we are cooperating in technological development involving equipment technology, dealing with slag, and our expertise in separation and refining technology cultivated through pyrometallurgical smelting and hydrometallurgical refining. On the commercial side, we are engaging in market research, marketing, and cooperation and collaboration with other vital industries involved in recycling.

GHG Emission Reduction and Smart Factory Initiatives by Our Sites

To achieve "reduce GHG emissions," a KPI for "climate change" as a material issue in our Vision for 2030, our plants are enacting the following specific initiatives: (1) improvement of fuel consumption per unit through high-utilization, stable operation of smelting and refining furnaces; (2) recovery of waste heat from smelting and refining exhaust gas; (3) expansion of the use of recycled fuels; (4) introduction of highly efficient energy-conserving equipment; (5) LED lighting for plants.

In addition, in studies aimed at building a model for smart factories at our existing plants, we are tackling these measures: (1) infrastructure improvements in plants (e.g., introduction of wireless LANs in plants); and (2) improvement of maintenance work efficiency through mobile devices (e.g., distribution of tablets in workplaces, introduction of voice recognition systems for inspection journal entry in workplaces).

Pyrometallurgical smelting

A refining method in which precursor ore is smelted at high temperature in a furnace and metals are separated in a molten state. While this technique allows processing large volumes of ore at once, it also requires periodic repair of the heatproofing equipment.

Hydrometallurgical refining

A refining method in which metals and impurities are dissolved in a solution, and chemical reactions are used to separate them. The method is stable and enables continuous processing, but incurs the costs of chemical reagents.

Materials Business

Battery Materials Business and Advanced Materials Business

The Materials Business is composed of the Battery Materials Division, aimed at creating an organization that can respond swiftly and flexibly to the rapid expansion of our battery business, and the Advanced Materials Division, an organization for realizing sustainable growth in fields of advanced materials, particularly the energy, environment, and information communications fields.

Isao Abe
Executive Officer,
General Manager of
Battery Materials
Division

Kazunori Takizawa
Executive Officer,
General Manager of
Advanced Materials
Division

Business Environment

The Battery Materials Division mainly produces battery cathode materials for automobiles. In the environment surrounding the business, electrification—the switch to hybrid vehicles and electric vehicles—is a tide sweeping the automobile industry. In particular, the EU's Corporate Average Fuel Efficiency (CAFE) standards on CO_2 emissions mandate high fines for exceeding standards, providing impetus to automobile manufacturers in electrifying their product lines. In China, too, the New Energy Vehicle (NEV) mandate policy regulates sales of a certain volume of hybrid and electric vehicles. Due to the COVID-19 pandemic, poor demand for vehicles is forecast for FY2020, with global unit sales expected to fall 20% year-on-year to about 70 million vehicles. As meeting regulatory standards will call for sales of a large number of relatively expensive electric vehicles, regulations may be relaxed in the short term in light of economic conditions. However, the medium- to long-term outlook for high battery demand is unchanged. SMM, which commands a world-class share in cathode materials for automobile batteries, will act with a sense of urgency as electrification makes steady progress in the industry.

With the energy, environment, and information communications fields as its main business domains and with "Global Niche Top" as its slogan, the Advanced Materials Division stably provides products that leverage SMM's unique technologies in niche markets found between existing industries and aims to secure high share and profitability. In the division's business environment, sales of smartphones, automobiles, industrial machinery, and other products face short-term stagnation under the pandemic, but information communications and digitalization are making rapid advances amid telework and other changes in work styles. In 2020, 5G communication made a full-fledged debut, becoming a part of our social infrastructure, and investment continues in data centers and 5G infrastructure.

The information communications field is expected to undergo market growth, greater capacity, and greater functionality once the COVID-19 pandemic subsides, accompanied by full-scale proliferation of 5G smartphones, global demand for infrastructure, and the achievement of an IoT-based society in which all things connect. With regard to materials handled in this business, we anticipate an increasing need for the resolution of heat management issues to enable higher thermal resistance in heat-generating devices, as frequencies and integration densities increase in devices.

CAFE standards

CAFE standards calculate and regulate fuel economy for automobiles on the basis of weighted harmonic mean fuel economy, not by model but for all shipments by a manufacturer. The standards have been adopted by the EU, and have also been adopted in Japan for use in FY2020 fuel economy standards.

NEV mandate policy

New Energy Vehicle mandate policy China's New Energy Vehicle mandate policy applies to automobile companies in China that produce or import 30,000 or more finished vehicles annually. The companies must obtain credits awarded on the basis of their NEV production record, based on their volume of production or importation of conventional vehicles in China. The targets were 10% for 2019 and 12% for 2020. Companies without the required credits must make up the shortfall by buying credits from other companies.

Review of FY2019

Demand was sluggish in industries related to the Materials Business through the end of FY2019, due to the COVID-19 pandemic and U.S.-China trade friction.

In the Battery Materials Business, the impact of pandemic-related production cuts by automobile manufacturers started to become apparent, but demand remained firm for our cathode materials for automobile batteries. We finished the creation of a monthly 4,550-t production structure for lithium nickel oxide (NCA), and maintained full production. Moreover, our NMC was adopted for use in a new-model hybrid automobile (see Battery Materials Business: Strategic Topic for details). How the automobile market will progress in FY2020 is unclear, given the COVID-19 pandemic. Because the status of electric vehicle production differs by country and region, we will closely watch market movements, closely share information with customers, and act with agility.

In the Advanced Materials Business, growth in the smartphone market reached a ceiling due to increased penetration and maturation, and inventory adjustments for components started to become apparent toward the end of the fiscal year due to the COVID-19 pandemic. Around the end of the fiscal year, orders started coming in again for products for which China is the main market, but consumption trends in major advanced countries are unclear, and future waves in demand are cause for concern. Under this environment, our manufacturing sites continued operations while enacting contagion control measures. Our 2018 3-Year

Progress and Issues in Our Top Priorities

	FY2019	FY2020	FY2021	FY2022	FY2023 and later
Battery materials ❯	●Completion of 4,550 t/month production structure				10-kt/month cathode material production by FY2027 (NCA + NMC + nickel hydroxide)
Crystal materials ❯			●SiC launch for consumer markets		FY2025 ●SiC launch for automotive markets

Strategies for the Materials Business in the 2018 3-Year Business Plan

1 Continuous creation of new products and renewal of business portfolio

- Make energy and the environment, and information and communications our domain, and continually create new products
- Materials business portfolio for the 2024 3-Year Business Plan

2 Become self-sufficient as a true core business

- Establish a strategic implementation structure for the battery materials business and sustainable growth for the advanced materials business

SiC

Silicon carbide, a semiconductor material used in the control of electric power.

NCA

An acronym for a type of secondary battery cathode material composed primarily of N (nickel), C (cobalt), and A (aluminum).

NMC

An acronym for a type of secondary battery cathode material composed primarily of N (nickel), M (manganese), and C (cobalt).

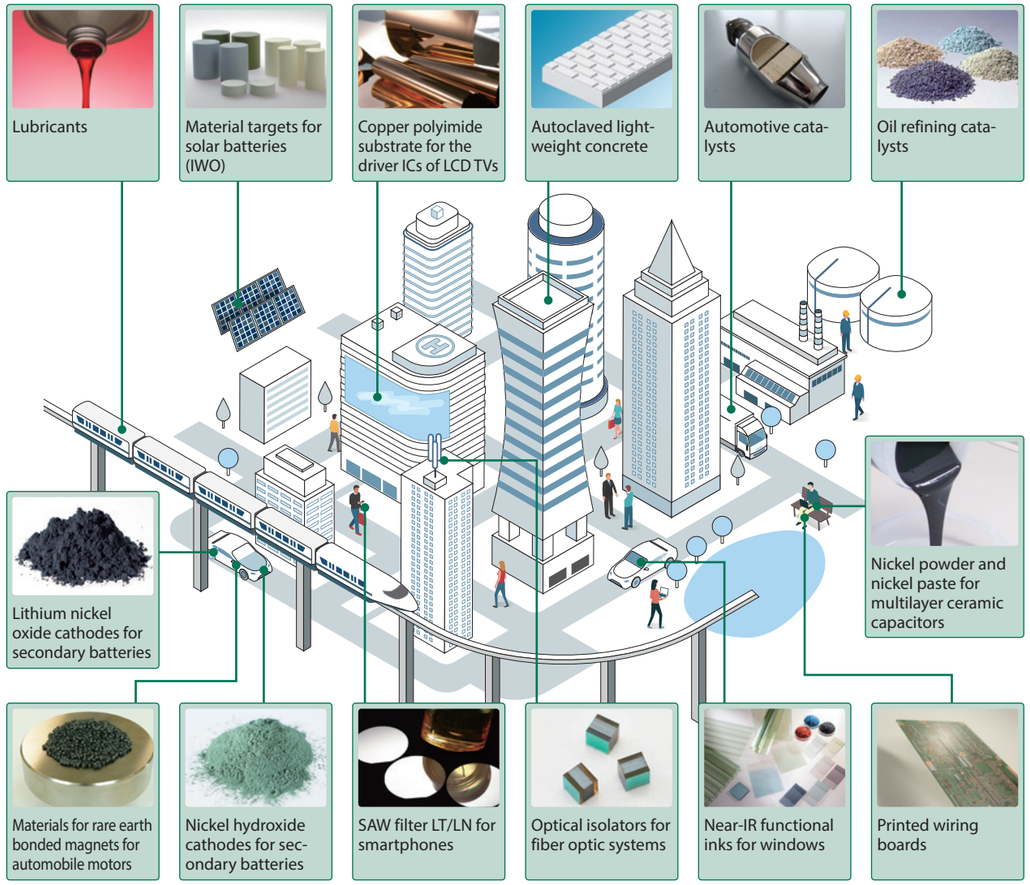
Business Plan calls for creating new business, and advancing incubation. Unfortunately, in FY2019 we were unable to achieve noteworthy results in this area. However, as a mechanism for continually creating new products, the Technology Division, Battery Materials Division, and Advanced Materials Division are collaboratively developing a new business generation system that covers from the search for new products to proposals for commercialization. As an initiative to complement this effort, in FY2020 we began new activities to clarify and share the direction and goals for the Advanced Materials Business over a 10-year span. In FY2020, we will work to create new businesses, incorporating perspectives on what changes the COVID-19 pandemic will have on social life and industrial activities in the future.

Technical Strengths of the Materials Business and its Role in the Three-Business Collaboration

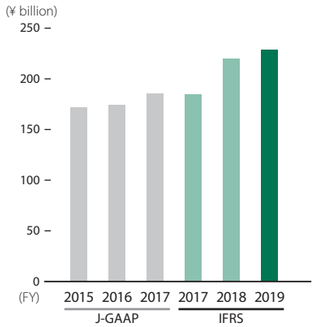
We believe that the strengths of our Materials Business lie in both powder synthesis and processing technology and in crystal growth and processing technology, primarily for metals. While maintaining this technological backbone, we are strengthening initiatives in which we engage in development after our sales people communicate with customers to clarify their needs. Within our three-business collaboration, our Battery Materials Business is positioned particularly close to customers, and is in a position to directly obtain information about the automobile industry's extremely broad supply chain. Accordingly, the business has functions for collecting market information such as growth in the percentage of electric vehicles and changes in the battery material specifications demanded by customers, and for feeding this information back to the Materials and Smelting & Refining businesses, as well as functions for securing new buyers for the products created by the Smelting & Refining Business. The Battery Materials Business is further able to provide customers with up-to-date information obtained from the Mineral Resources Business, such as the volume and forms of mineral resources other than the non-ferrous metals currently produced by our Group, in preparation for future growth in the usage of resources as electrification advances. This three-business collaboration helps us earn the trust of customers.

The three-business collaboration among our Mineral Resources, Smelting & Refining, and Materials businesses places priority on sharing information about markets and assessing customer activity. While coordinating closely within the Company, the Materials Business will

SMM Products in Daily Life

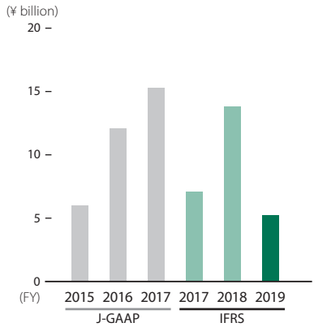


Segment Net Sales



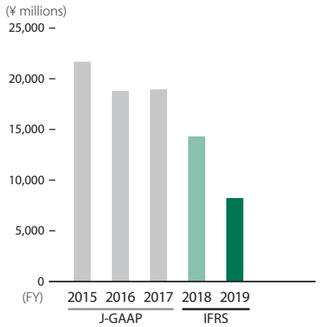
Demand for our automotive battery materials remained firm. Growth in the smartphone market has reached a ceiling due to increased penetration and maturity.

Segment Income



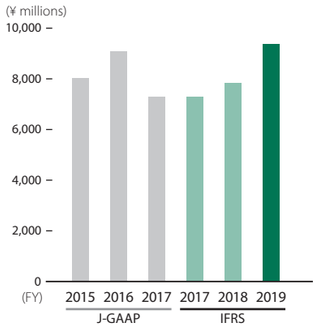
Although sales volume of battery materials increased under growing demand for automotive applications, segment income decreased year-on-year due to deterioration caused by inventory valuations, decline in sales volume of powdered materials, and crystal material inventory adjustments by customers.

Capital Expenditure

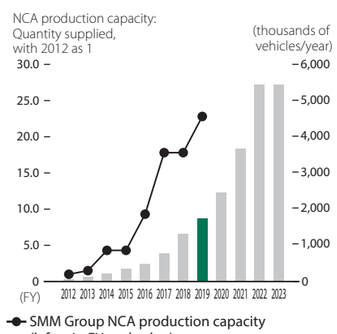


Some investments were postponed.

Depreciation and Amortization Expense



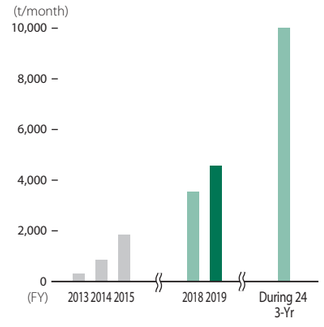
NCA Production Capacity and Number of Electric Vehicles Shipped



Demand for automobile batteries is forecast to continue to grow significantly. SMM is increasing production of NCA, a cathode material, in accordance with this growth.

Source of EV shipped units: B3 Report

Growth of Cathode Materials Production Capacity and Future Plans



build relationships of trust with customers that purchase materials, and will assess trends in order to discern the timing for production increases and investments in new products.

Battery Materials Business

Investment in Growth

Increasing Production Capacity of Automobile Battery Cathode Materials

In the Battery Materials Business, understanding customer trends is of utmost importance. Amid the extremely dynamic movements of the business environment, we believe it is vital to analyze information accurately and make speedy decisions. As an initiative aimed at expansion of the battery materials business, one of the three major projects of our 2018 3-Year Business Plan, we are working to establish a 10-kt/month production structure for automobile battery cathode materials (NCA, NMC, and nickel hydroxide) during the 2024 3-Year Business Plan (i.e. by FY2027). As global competition continues to intensify, we will adapt to meet it while remaining even more conscious of quality, performance, costs, and the predominance that we hold.

Strategic Topic

SMM's Battery Cathode Material NMC is Selected for Hybrid Automobile from Toyota Motor Corporation

NMC produced by SMM is being used in the hybrid version of Toyota Motor Corporation's new Yaris automobile, which went on sale in February 2020. As electric vehicles increase against a backdrop of increasingly rigorous environmental regulations around the world, market expectations are building for the development and supply of high-performance secondary batteries. For about 20 years, SMM has worked with customers such as Toyota Motor Corporation to develop and manufacture cathode materials for secondary batteries in electric and hybrid vehicles. We are currently the top manufacturer in this area. Of the four main materials in secondary batteries, cathode materials hold the key to increasing battery performance and capacity. Given the demand for electric vehicles with longer cruising ranges and fuel-efficient hybrid vehicles, SMM expects demand to grow for our high-performance cathode materials.

ESG Case Study

Initiatives by the Battery Materials Business to Address Climate Change

The Battery Materials Business is tackling "reduce GHG emissions," a KPI for the issue of climate change, which is named as one of the 11 material issues in our Vision for 2030. (See Special Feature 1 on p. 27 for details.) The automobile industry, a customer for our battery materials, is increasing electrification of vehicles to reduce CO_2 emitted during driving. SMM will contribute to reducing CO_2 by providing high-performance cathode materials for the automobile batteries that are crucial to electric vehicles. We recognize the presence of issues such as methods for calculating contributions to GHG reduction and the defining of products other than battery materials that contribute to a low-carbon society, and are taking these issues into consideration.

Advanced Materials Business

Strategic Topics

GRANOPT Co., Ltd. Included among the New Global Niche Top Companies Selection 100

In July 2020, GRANOPT Co., Ltd., an SMM Group company that manufactures and sells Faraday rotators (FRs), was selected by the Ministry of Economy, Trade and Industry for inclusion in the New Global Niche Top Companies Selection 100. FRs from GRANOPT are key devices in semiconductor laser diodes (LDs) used for optical communications and in optical isolators, optical components inserted between optical fibers. Boasting a market share in excess of 50% for its FRs and a high growth rate, GRANOPT is literally a global niche company. With few FR suppliers in the world, GRANOPT's stable supply of product is key to the construction of optical communication infrastructure. New advances will transpire along with the proliferation of 5G, such as self-driving automobiles, the adoption of AI, and the spread of the IoT. Communications volume is expected to expand rapidly worldwide in the era of living with the COVID-19. GRANOPT established a sales subsidiary in Shenzhen, China, in FY2019, and is working now to further expand sales.

Open Innovation Site for Our Powder Materials Business Launching "X-MINING" (Cross-Mining)

In January 2020, SMM established the Project Planning & Development Dept. within the Applied Powder Materials Business Unit, as a marketing organization to open up new markets based on our existing powder products. We launched X-MINING (Cross-Mining), a website to communicate product information for creating value, and began releasing information on the site in October 2020. The basic concept of the site is uncovering ("mining") the new value and new ideas of the diverse people with whom we co-create ("cross"). Our aim is to co-create new value through our materials and the ideas of researchers, marketers, and other diverse people who are now sketching out the future of the environment, energy, communications, and more. Through these efforts, we also want to let employees, especially the young ones who will shoulder the Advanced Materials Business in the future, experience the joy of taking on new challenges.

ESG Case Study

Initiatives Aimed at the Development of Products Contributing to a Low-Carbon Society

SMM is tackling "reduce GHG emissions," a KPI for the issue of climate change, which is named as one of the 11 material issues in our Vision for 2030. (See Special Feature 1 on p. 27 for details.)

The development of products that use sunlight-shielding inks shows great promise in contributing to a low-carbon society. We will expand these from sunlight shielding for automobiles, the current key application, to applications including covering materials for agricultural use and heat-generating fibers, contributing to energy savings. We are also undertaking the commercialization of fine, high-purity nickel oxide powder for use in electrodes for fuel cells, a market that is expected to grow rapidly. Nickel oxide powder is a product in which we can demonstrate the strength of our three-business collaboration manufacturing process that spans nickel raw material to the manufacturing of highly advanced material. Looking ahead, we will continue to meet market needs by leveraging our technological development capabilities and mass production technologies.

X-MINING logo

X-MINING

https://crossmining.smm.co.jp/en/

This logo expresses an image of co-creating new value through the crossing of diverse individualities.

Research & Development

The SMM Group has four research and development sites and we are engaged in raising our competitiveness by evolving existing technologies while also advancing research and development into next-generation metal smelting and refining technologies and pioneering new materials.

Shuichi Ogasawara
Executive Officer,
General Manager of Technology Division

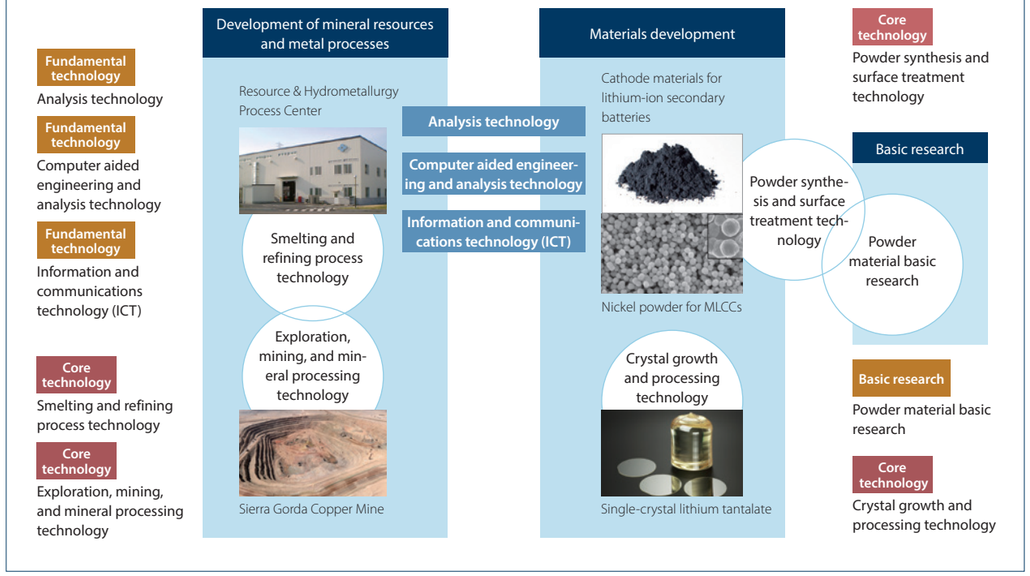
Business Environment

Regarding the business environment, while U.S.-China trade friction and the global spread of COVID-19 have stalled the global economy in the short term, demand for materials driven by factors such as the evolution and development of digital technology and infrastructure enhancement has not slowed and it is expected to grow further. In order to meet this demand, we will not only work on supplying the materials themselves, but we also hope to expand their applications by drawing out new functions from these materials in the medium to long term. The Technology Division will accelerate our initiatives pursuing future-oriented technological development.

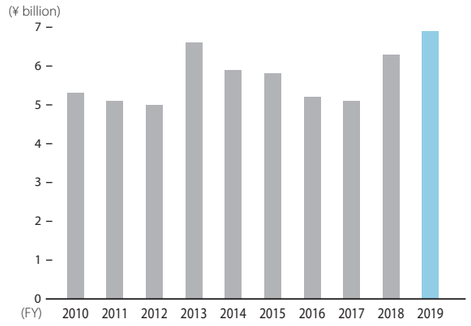
Review of FY2019

In our 2018 3-Year Business Plan, the three major themes for research and development were (1) create new businesses with a view to 10 years from now, (2) develop products that customers will prefer, and stay ahead of competitors, and (3) develop new processes that can differentiate us and support sustainable growth. Looking back on our progress on these themes in FY2019, in regard to (1) creating new businesses, we centered exploration and research on themes that will contribute to new business creation with a focus on fields that are expected to grow in the future, such as automobiles, environment, energy, and communications, while also investigating the possibilities of functions we develop as a materials manufacturer and starting preliminary experiments. Also, in regard to the themes proposed through the Foresight Project carried out in FY2017, the Technology Division is collaborating with the business divisions to consider research methods that can make greater contributions through investigations and preliminary experiments, and to match themes to markets. In regard to (2) developing products that customers will prefer, we focused on development that will enhance our competitiveness, such as raising productivity and the performance of products such as battery cathode materials for automobiles and crystal materials for SAW devices. Also, in regard to (3) developing new processes, we continued to secure battery

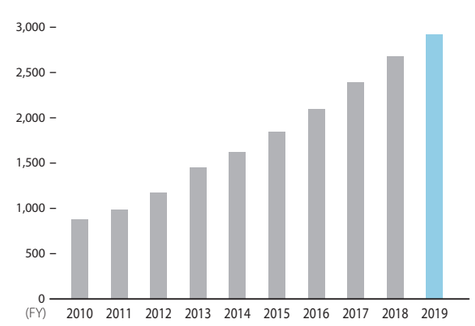
Research and Development by the SMM Group



Research and Development Expenses



Number of Patents Held by the SMM Group



materials and develop manufacturing processes while also advancing the verification of new lithium-ion battery (LIB) recycling processes through pilot tests.

Role of the Technology Division in the Three-Business Collaboration

Our Group has four research and development sites around the country, each of which is dedicated to a specialist field. Niihama Research Laboratories is positioned as a smelting- and refining-related process laboratory that further raises the level of the smelting and refining technology that is the foundation of our Group's technology. The neighboring Battery Research Laboratories works on the development of high-performance cathode materials for LIBs. Materials Laboratories performs research and development of crystal materials and paste materials. The Ichikawa Research Center is specialized in basic research that bears the function of sowing the seeds of the Group's materials development, centered on basic research into functional powders.

The SMM Group's Mineral Resources, Smelting & Refining, and Materials three-business collaboration functions as a supply chain for non-ferrous metal resources. Non-ferrous metal resources secured by the Mineral Resources Business are processed into metals and chemical products by the Smelting & Refining Business and then made into highly advanced material products by the Materials Business.

While we must raise the research and development capabilities of each of these business areas, the Technology Division also has the role of working to optimize the inter-business area overall of the three businesses. We achieve this by providing robust support to research and development efforts by each business, advancing research and development ranging from basic analysis to the application of technology onsite, and providing feedback to each business.

The role of the Technology Division in the strengthening of three-business collaboration centered on cathode materials for batteries is to develop battery materials for automobiles, an area where long-term growth is expected, test and verify battery recycling technologies, and develop processes such as lithium refinement. We work on each of these areas separately but at the same time, we also interlink initiatives. On the other hand, we have to respond to factors such as customers' needs in accordance with changes in the business environment. Going forward, we will implement measures such as the reallocation of business resources as needed in line with factors such as changes in targets and timelines, and the emergence of new themes.

Investment in Growth

Research and Development Strategy for FY2020

In the 2018 3-Year Business Plan, we are making investments that are at least 20% more than the three-year cumulative research and development expenses under the 2015 3-Year Business Plan, and in FY2020, we will implement research and development primarily focused on growth businesses. In battery cathode materials, which has been positioned as a target growth market, at the same time as carrying out development aimed at raising performance, we will also advance the development of next-generation battery materials, including solid-state batteries, and work on improving processes and developing new processes to raise productivity. These efforts will be centered on the Battery Research Laboratories and a large portion of the increased investment will be spent in this area.

At the Materials Laboratories, we are continuing development that aims to realize larger diameters and increase the length of crystal materials for SAW devices, as well as the development of silicon carbide (SiC) which we expect to use in next-generation power devices. At the Ichikawa Research Center, we are continuing to focus investment on research related to powders and crystal materials. At Niihama Research Laboratories, we are advancing research and development related to the recycling of waste LIBs and lithium refinement processes. Furthermore, we will continue development closely related to business activities, such as improving mineral processing technologies for the Mineral Resources and Smelting & Refining businesses, and in this field, we are beginning to explore themes that will contribute to solving social needs included in our Vision for 2030.

When formulating Vision for 2030, we considered how the world will be in 2050 or 2100, and thought about ways to generate materials without damaging the global environment and discussed what the non-ferrous metals industry needs to do now to realize these. Also, we will take a medium- to long-term perspective and constantly watch how trends in society change and transform in the 10-year period up to 2030, so we can respond swiftly in line with these changes and transformations and strengthen initiatives for realizing the effective use of non-ferrous metal resources.

Innovation Topics

We are currently focused on developing LIB recycling technologies and lithium refinement processes as specific initiatives for the effective use of non-ferrous metal resources, a material issue in our Vision for 2030. These are priorities alongside creating new products and businesses.

• Developing LIB Recycling Technologies and Lithium Refinement Processes

The development of LIB recycling technologies is driven by concern that the shift to LIBs as a main power source for vehicles that is accompanying the electrification of vehicles, an area where long-term growth is expected, will result in demand that could potentially strain the nickel, cobalt and copper metal resources that are essential for these batteries, particularly cobalt. Cobalt production areas are extremely unevenly distributed, making it hard to secure volumes in response to demand. Furthermore, it is in great demand as an essential item in advanced metal materials, so in order to effectively use resources, the development of recycling technologies is a pressing issue. We have used existing metal, smelting, and refining technologies to start operations for recovering and recycling copper and nickel from spent LIBs, and as a result of further developing these technologies, we have established a recycling technology that can also recover cobalt. Verification testing at a pilot plant for this technology has been underway since March 2019.

The development of lithium refinement processes involves developing technologies that recover the lithium needed for LIBs from saltwater. One technology under development uses

Saltwater
Natural water containing salts such as sodium chloride.

a specialized adsorption agent that can selectively recover just lithium, enabling it to be recovered from saltwater containing many impurities, which was previously difficult to do. This technology can also greatly reduce lead times for producing lithium, making it superior in terms of both technology and cost to businesses for recovering lithium from saltwater being commercially operated in South America and other areas.

• Development of Cathode Materials for Solid-State LIBs

We are advancing development of solid-state LIB cathode materials based on a strategy of establishing SMM cathode materials as the standard for solid-state LIBs, which are promising, when sulfide-based solid-state batteries for use in automobiles, start to be deployed. These batteries are expected to be deployed several years from now.

Also, it is predicted solid-state LIBs that use solid oxide electrolytes will have various applications, such as use in wearable devices, so future demand is expected to grow in this field as well. Therefore, we are continuing investigations in this area.

Also, in regard to the development of solid-state LIBs, as a member of LIBTEC, we have started participating in the Development of Fundamental technologies for All Solid-State Battery applied to Electric Vehicles project backed by NEDO. This project is building a framework for realizing collaborations and partnerships between automobile, storage battery, and material manufacturers and using the scientific knowledge and public research results of universities and research institutions to advance the development of shared underlying technologies centered on solid-state LIB material research and evaluation technologies that can function as shared indicators for the industry.

LIBTEC
Consortium for Lithium Ion Battery Technology and Evaluation Center

NEDO
New Energy and Industrial Technology Development Organization

ESG Case Study

Start of Initiatives Based on a Vision Co-Creation Partnership with Tohoku University

The SMM Group has started initiatives aimed at 2050 based on a Vision Co-Creation Partnership with Tohoku University. We aim to achieve our vision for the creation of a Solar Energy Society by conducting joint research that contributes to solutions for energy and environmental problems that are global in scale through the creation of innovative materials science.

Over the past two years, starting from FY2018, we have conducted discussions that have involved academic staff from arts subjects as well as technical subjects to expand our field of vision. Through these discussions, we have formulated an ideal state for 2050 as "meet the world's energy demands with solar energy" and a vision for 2050 as "create a Solar Energy Society through the creation of innovative materials science." Backcasting from that, we have laid out steps for FY2020 through which we aim to create new value by starting the joint research and development of new materials, as well as their commercialization and societal implementation.

Efforts to Help Prevent the Spread of COVID-19

The response incumbent upon companies from a social responsibility standpoint

Since the fourth quarter of FY2019, COVID-19's global spread has come to the surface.

To address these circumstances, in the SMM Group, the president has communicated to employees some important points. In this message he states that he will give the highest priority to the safety of customers, business partners, employees, and local communities while working to prevent the spread of COVID-19 infections. It also says that, despite the limitations we face, we will continue our on-going efforts to stably supply indispensable materials to society.

The pages for each business division contain information on the impacts for that division, as well as corresponding countermeasures (see details starting on p. 42).

Furthermore, with regard to necessary responses from the standpoint of social responsibility, we are carrying out the following initiatives.

Efforts to prevent the spread of COVID-19

- In principle, employees at the Head Office, Osaka Branch, and Nagoya Branch worked from home during the nationwide state of emergency.
- Measures are being taken against the risk of infection for employees of mines and refineries in Japan.
  E.g.: Response measures have been established to handle new infections; on-site employees are working in two cohorts and interaction between the two is prohibited.
- Measures are being taken against the risk of infection at overseas mines.
  E.g.: We have formulated COVID-19 protocols and spread out the times during which cafeterias are in use.
- Countermeasures shared across locations
  - Employees are not to come to work if there is the possibility of having been infected.
  - There are restrictions on holding and attending meetings, events, etc.
  - There are restrictions on business trips, etc.
  - Employees are asked to voluntarily restrict their trips outside the house.
  - Education and training activities are being carried out online.

Efforts addressing employee programs, wages, and hiring

- We adopted a special, paid leave program for at-home child-raising, applicable to employees who needed to stay home because their child/children's elementary school, kindergarten, or nursery school temporarily closes.
- We are paying 90% of the temporary leave benefit.
- We are committed to maintaining employment and avoiding layoffs.
- We are paying appreciation bonuses to all Group employees.

Efforts for local communities

- In areas where we have business sites inside or outside Japan, we are donating to fundraising campaigns and supplying beverages, infection prevention goods, and the like.
- We are supporting healthcare institutions and providing them with masks and personal protective equipment.

Cooperation with industry group initiatives and international initiatives.

- We support the Open COVID-19 Declaration addressing intellectual property.[1]
- We support the Declaration of Partnership Building.[2]

Going forward, the SMM Group will continue to urge greater awareness and thorough implementation of countermeasures as we swiftly carry out any necessary responses to prevent the spread of COVID-19 infections.

1. A declaration started voluntarily by companies, universities, and other groups, stating that signatories will "not assert any patent, utility model, design, or copyright," nor seek any payment or compensation for intellectual property, during the stated period, "with respect to the activities whose sole purpose is stopping the spread of COVID-19."
2. A declaration intended to support the development of a "system to promote the introduction of appropriate trade practices among companies, along with other actions, in order to prevent SMEs and small businesses from bearing the burdens of worsened business environments resulting from impacts of the novel coronavirus disease and other factors." This was prepared by the Cabinet Office and the Small and Medium Enterprise Agency and the new partnerships were asked to involve "efforts for increasing value added across supply chains."