

Climate Change Strategy

Basic Approach

Currently, there can be no doubt regarding global warming caused by anthropogenic greenhouse gas emissions. The amount and scale of damage caused by storms, floods, droughts and other abnormal weather is increasing, as is the sense of crisis due to the risk these present to the global economy.

The Group has set up the Sustainable Development Department within the Corporate Strategy Department to plan and promote strategic initiatives for risks and opportunities related to global warming in connection with group-wide management strategies. Furthermore, our "Climate Change and Energy Panel", a specialized subcommittee of the "Sustainable Management Office", promotes the examination of scenario analysis based on TCFD*1 recommendations, as well as discussion and sharing of information on measures to achieve GHG*2 reduction targets and other climate change measures.

To monitor the panel, its activities are reported to the Executive Officers' Meeting and Board of Directors' Meeting quarterly after being reported and deliberated by the "Sustainable Management Office."

Through appropriate evaluation and management of our risk and opportunity related to climate change, we are looking into reflecting these in our medium- to long-term management strategies and risk management. We will continue to improve our response to climate change and actively disclose information based on TCFD recommendations.

*1 TCFD: Task Force on Climate-related Financial Disclosures

The TCFD was established in 2016 by the Financial Stability Board, an international organization that seeks to stabilize financial systems.

*2 GHG: Greenhouse gas

Information Disclosure

In March 2020, the Group decided to endorse the recommendations of the TCFD and participate in the TCFD Consortium, which consists of companies, financial institutions and other organizations which support those recommendations. In March 2021, we established and analyzed scenarios based on the recommendations in order to ascertain the impact of climate change on the Group's business operations (risks and opportunities) and consider measures for reducing risks and securing opportunities. Going forward, we will continue to actively disclose information based on the recommendations.

The Group answers questionnaires for the CDP (a non-profit organization, formerly the Carbon Disclosure Project) on a yearly basis. In fiscal 2021, the Group scored "B" for CDP Climate Change and "A-" for CDP Water (on an 8-step scoring scale from A to D⁻) in its assessment.

For details, please see the following link.

[PDF CDP Score Report Climate Change 2020](#)

[PDF CDP Score Report Water Security 2020](#)

Governance

In April 2019, we established the Sustainable Development Department within the Corporate Strategy Department to plan and promote strategic initiatives for risks and opportunities related to global warming in connection with company-wide management strategies. Furthermore, the Climate Change and Energy Panel (a specialized subcommittee of the Sustainable Management Office that was established in April 2020) promotes the examination of scenario analysis based on TCFD recommendations, as well as discussion and sharing of information on measures to achieve GHG reduction targets and other climate change measures. To monitor the panel, its activities are reported to the Executive Officers' Meeting and Board of Directors' Meeting quarterly after being reported and deliberated by the "Sustainable Management Office." (Matters for deliberation by and reporting to the Executive Officers' Meeting and Board of Directors)

- Greenhouse gas emission reduction target setting and reduction plans
- Climate change-related information for disclosure

- Assessment of climate change-related risks and opportunities for each business

Target

In March 2021, the Group set the medium and long-term targets of reducing its overall greenhouse gas emissions by at least 17% by fiscal 2031 (in comparison with fiscal 2014), and achieving carbon neutrality by fiscal 2051.

In particular, in our product-type businesses (Advanced Products Business and Metalworking Solutions Business) we will work actively to reduce greenhouse gas emissions, with the goal of reducing emissions by at least 30% by fiscal 2031. As one of our reduction measures, we have set the goal of switching to the use of renewable energy to supply at least 20% of the electric power used in the Group's businesses by fiscal 2031.

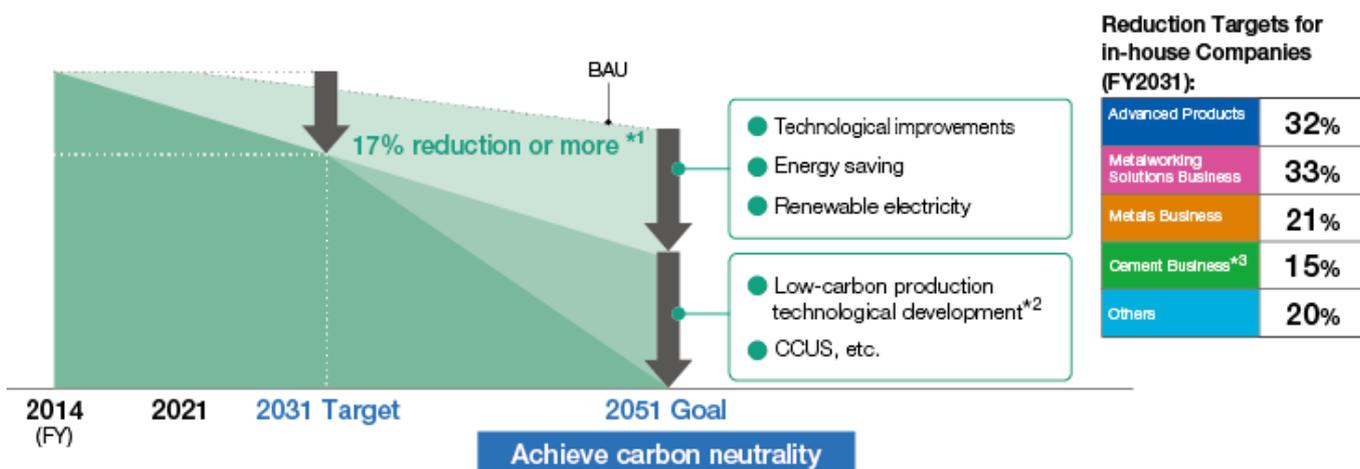
In terms of plans for executing initiatives aimed at achieving our targets for the reduction of greenhouse gas emissions, in addition to energy-saving and utilization of existing technologies, we are also advancing considerations and discussions—primarily through our Climate Change and Energy Panel—including those regarding R&D and capital expenditure for driving new innovation.

Going forward, we will continue to keep track of the Group's greenhouse gas emissions*—including Scope3 emissions (indirect emissions in the supply chain), which account for around 50% of all of the Group's emissions—and advance considerations and discussions aimed at reducing them.

* The Group's greenhouse gas emissions: Scope1+Scope2+Scope3

Greenhouse Gas (GHG) Emissions Reduction Target

- Reduce GHG emissions of the MMC Group by **17% or more by FY2031** (compared to FY2014)
- Reduce emissions by **30% or more in the Advanced Products and the Metalworking Solutions Business**, whose energy emissions are the most significant
- **Use renewable energy sources for over 20%** of the Group's total electricity consumption by FY2031.
- Aim to become **carbon-neutral company by the end of FY2051**



*1 Scope1 + Scope2

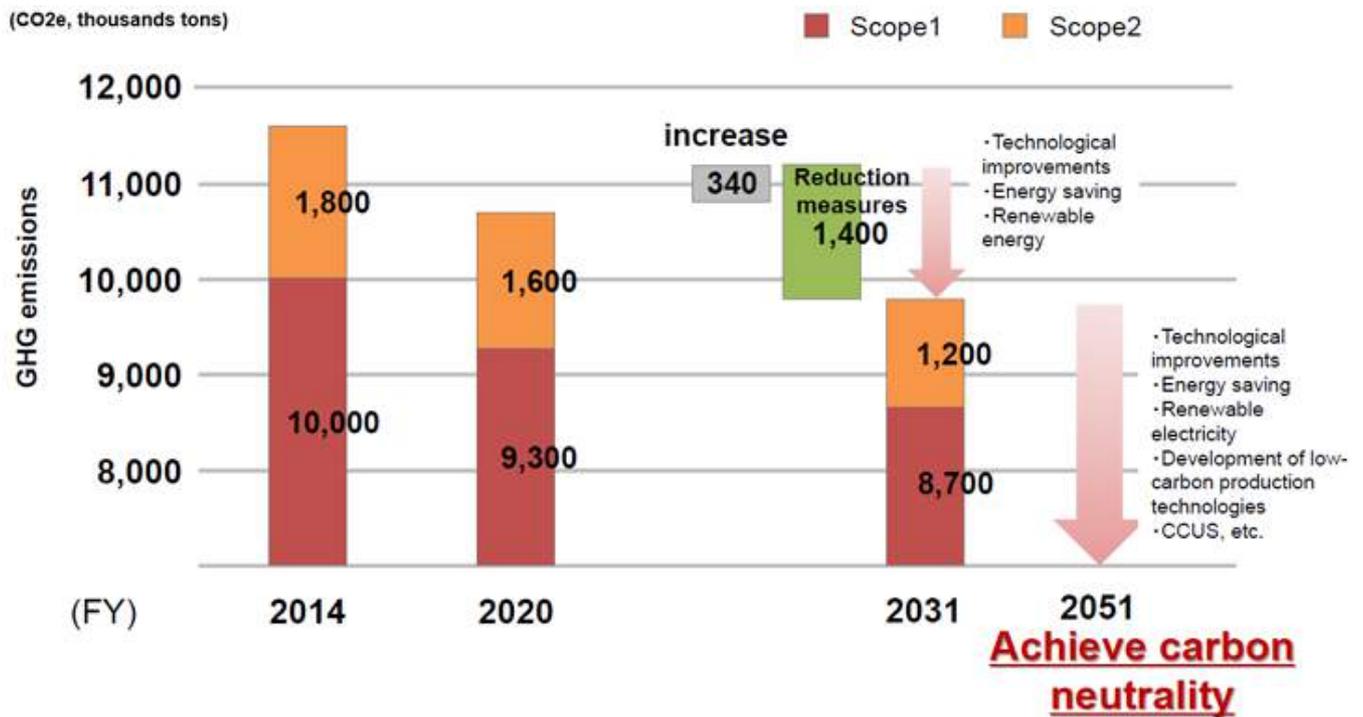
*2 Transition to a production process that utilizes hydrogen/electric energy

*3 Cement business: Does not include impact of April 2022 business integration.

• Scope 1: Direct GHG emissions by business operators

• Scope 2: Indirect emissions resulting from the use of electricity, heat, and steam supplied by other companies

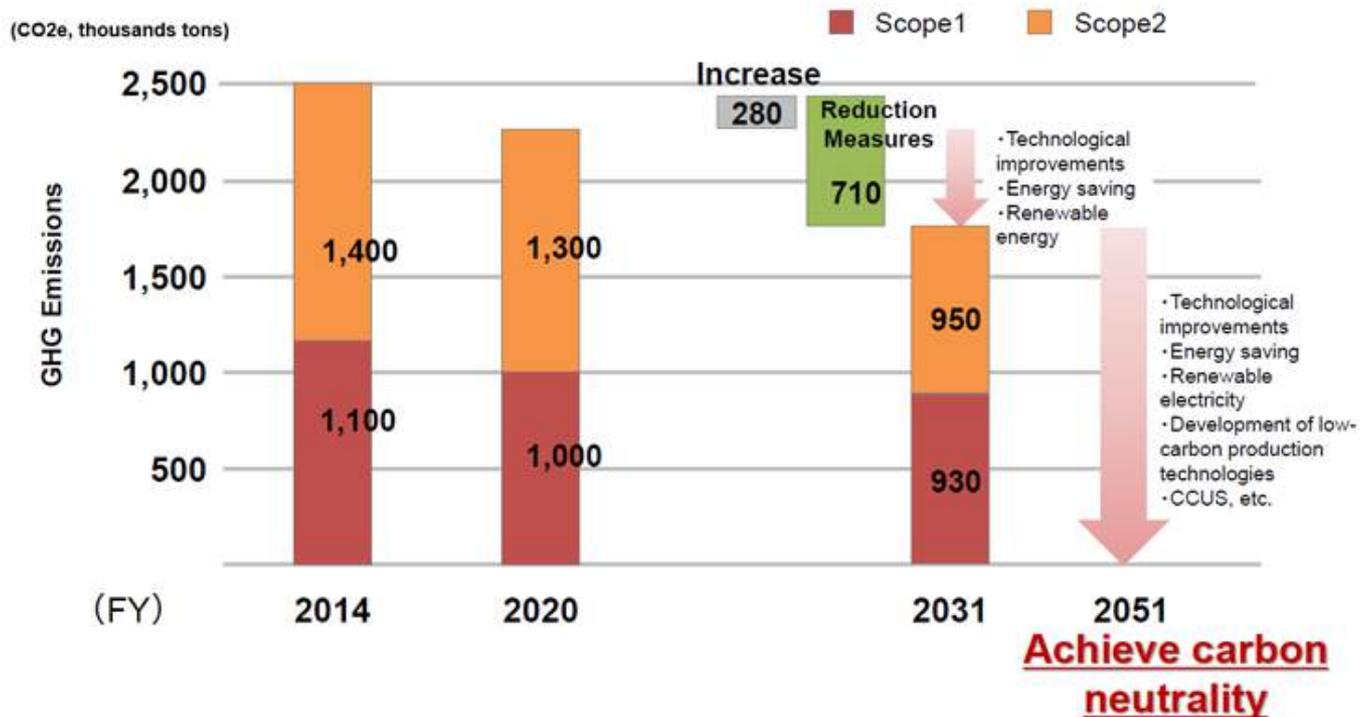
Reduction Plans for the FY2031 Target (MMC Group)



• Scope 1: Direct GHG emissions by business operators

• Scope 2: Indirect emissions resulting from the use of electricity, heat, and steam supplied by other companies

Reduction plan for achieving fiscal 2031 targets (excluding cement business)



Risks and Opportunities Related to Climate Change

Risks and Opportunities Related to Climate Change

As for the financial impact on the Group, additional costs will be incurred based on GHG emissions, such as when policies and regulations on climate change are strengthened and carbon pricing systems are introduced or enhanced. Furthermore, if we fail to keep pace with the global shift to decarbonized societies, this could invite a decline in our corporate value due to lost sales opportunities, etc. The world is rapidly moving to achieve carbon neutrality under the Paris Agreement. We also intend to rapidly respond to these changes in the social environment and continue to provide new value.

Specifically, we have defined GHG reduction targets. We will steadily reduce the amount of GHG emitted from Group business activities by introducing energy-saving equipment and increasing our use of renewable energy. Furthermore, in order to improve the market competitiveness of Group products, we will actively enhance our production processes, develop environmentally friendly products, and develop technologies such as CCUS* for reducing our environmental impact.

* CCUS: Carbon dioxide Capture, Utilization and Storage

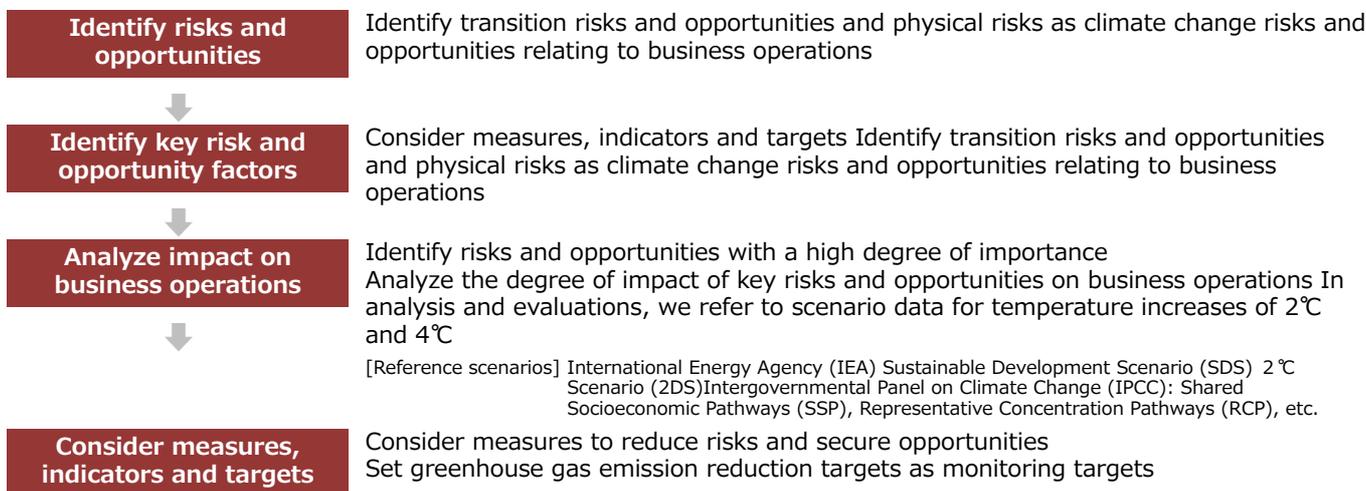
In our company-wide risk management activities, we manage physical water risks, including damage caused by acute and chronic risks such as torrential rains, floods, storm surges, and droughts, which are considered to be related to climate change. Concerning transition risks, we expect an increase in demand for technologies, products, and services that contribute to energy saving and GHG emissions reductions due to the tightening of government policies regarding climate change. We envision this as providing more significant business opportunities. The Group takes initiatives such as the development of materials, products, and technologies that contribute to decarbonization, the development and promotion of the use of renewable energy such as geothermal power, participation in projects pushing forward demonstration experiments or studies into suitable locations related to CO₂ capture and storage, and conservation activities for the forest land we own. Through these initiatives, we aim to create both economic and social value.

■ Scenario analysis

In March 2021, the Group established and analyzed scenarios to ascertain the impact of climate change on the Group's business operations (risks and opportunities) and consider measures for reducing risks and securing opportunities. Energy Panel will continue to consider strategic measures to address risks and opportunities for the Group due to climate change, which identified from the scenario analysis, in incorporating them into our medium and long-term management strategies and risk management.

Process for identifying risks, opportunities and response measures

■ Establish scenarios where climate change is progressing, analyze business impact and consider measures to reduce risk and secure opportunities



Scenario analysis – World as envisaged in 2030–2050

■ World as envisioned in analysis

2°C Scenario (sustainable society)	4°C Scenario (society in which things are allowed to take their course)
<ul style="list-style-type: none"> Average temperature increase is limited to below 2°C until the end of the century, and ambitious political policies and environmental technology innovations are implemented to achieve sustainable development. In terms of social changes accompanying the transition to decarbonization that will impact business operations, we envisage the world as follows. <p>[World as envisaged]</p> <ul style="list-style-type: none"> Carbon price setting and price rises globally Advancement of the transition from fossil fuels to renewable energy Advancement of modal shift and EV shift Increase in demand for use of public transportation and vehicle sharing Preferential selection of decarbonized products by users Transition to a recycling-oriented society and an increase in waste recycling rates CO₂ Establishment and practical application of technologies for the recovery, storage, and effective use of CO₂ 	<ul style="list-style-type: none"> Although countries implement political policies aimed at achieving targets in line with the Paris Agreement, the level of international cooperation between countries, development of environmental technologies and shift in energy sources is insufficient, and the average temperature increases by around 4°C until the end of the century. This scenario envisages the world as follows, where measures to mitigate climate change are unsuccessful, and global warming is allowed to progress and take its course. <p>[World as envisaged]</p> <ul style="list-style-type: none"> Dependency on fossil fuels, increase in energy costs Remarkable economic growth of emerging and developing countries Slowdown in shift to modes of mobility with low CO₂ emissions Intensification of wind and water-related disasters and increase in disaster-related waste Increasing severity of water stress and heat stress

Scenario analysis – Analysis themes

Analysis theme	Description of analysis	Businesses covered by analysis
1. Change in direct burden of carbon taxes	<ul style="list-style-type: none"> Ascertain costs relating to implementing initiatives to reduce greenhouse gas emissions toward a global temperature increase of less than 2°C Consider capital expenditure toward reduction based on cost differences, etc., according to propriety of targets for reducing greenhouse gas emissions 	Common to all businesses
2. Change in water-related disaster risks at business locations	<ul style="list-style-type: none"> Ascertain financial impact of flood risks due to river flooding and tidal surges at Company business locations 	Common to all businesses
3. Change in demand for Company products due to EV shift	<ul style="list-style-type: none"> Consider change in demand for the Company's electronic materials toward a global temperature increase of less than 2°C 	Advanced Products Business
4. Change in demand for Company products relating to modal shift, EV shift and reducing weight of transportation devices	<ul style="list-style-type: none"> Ascertain demand and market growth potential for products relating to the Metalworking Solutions Business based on forecasts for the transportation sector shifting to low carbon, and use of modes of transportation in the 2°C and 4°C scenarios, etc. 	Metalworking Solutions Business
5. Change in demand for E-Scrap recycling due to the transition to a recycling-oriented society	<ul style="list-style-type: none"> Ascertain demand and market growth potential for E-Scrap recycling based on forecasts for the amount of E-Scrap that will be generated, etc. 	Metals Business
6. Change in costs caused by carbon pricing policies	<ul style="list-style-type: none"> Ascertain the extent of indirect impact on the Company's business costs, etc., from the burden of carbon taxes at upstream business enterprises 	Cement Business

Analysis theme	Description of analysis	Businesses covered by analysis
7. Change in demand for acceptance and disposal of disaster-related waste	<ul style="list-style-type: none"> Assess changes in demand for acceptance and disposal of waste, based on changes in the amount of disaster waste generated due to climate change 	Cement Business
8. Change in demand relating to home appliance recycling	<ul style="list-style-type: none"> Ascertain demand and market growth potential for the home appliance recycling business in the 2°C scenario accompanying the widespread adoption of alternative fluorocarbons and temperature increases, etc. 	Environment & Energy Business
9. Change in demand for renewable energy	<ul style="list-style-type: none"> Ascertain demand and market growth potential for the renewable energy business in the 2°C scenario accompanying high-impact changes in the external environment. 	Environment & Energy Business

Scenario analysis – analysis results (outline)

■ : Risk factors ● : Opportunity factors (Descriptions in parentheses and the arrows indicate the assessed impact for each business)

	Advanced Products	Metalworking Solutions Business	Metals Business	Cement Business	Environment & Energy Business
2°C Scenario	<ul style="list-style-type: none"> Increase in EV unit sales <p>Opportunity: Large </p>	<ul style="list-style-type: none"> Sudden change in the metalworking products market due to modal shift, etc. <p>Risk: Medium </p>	<ul style="list-style-type: none"> Increase in demand for the E-Scrap recycling <p>Opportunity: Medium </p>	<ul style="list-style-type: none"> Introduction and enforcement of the carbon tax (Procurement, Sales) <p>Risk: Medium </p>	<ul style="list-style-type: none"> Further penetration of and demand for renewable energy Demand for energy-saving home appliance replacements <p>Opportunity: Large </p>
	All businesses			<ul style="list-style-type: none"> Introduction and enforcement of the carbon taxation (operating costs) 	<p>Risk: Medium </p>
4°C Scenario				<ul style="list-style-type: none"> Increase in demand for flood disaster waste disposal <p>Opportunity: Small </p>	
	All businesses			<ul style="list-style-type: none"> Increase in water-related risks, such as floods, tidal waves, and droughts 	<p>Risk: Large </p>

1. Change in direct burden of carbon taxes (common to all businesses)

■ Risk factor: introduction and toughening of carbon pricing systems (operating costs)

Envisaged world and business impact	<p>Increase in production costs due to introduction and toughening of carbon pricing systems</p> <ul style="list-style-type: none"> • Increase in energy costs due to a toughening of taxation with respect to greenhouse gas emissions and an increase in electric power prices • Increase in cost of procurement for green power certificates and emission trading costs • Total energy costs will increase by a factor of around 1.59 in comparison with fiscal 2020 by fiscal 2031, and 1.63 by 2051 	
Impact analysis	<p>Carbon pricing will be a factor contributing to cost increases for the Company The impact of carbon pricing will have an impact on society overall. If the passing on of these costs to the price of Company products does not progress then there is a risk that it may lead to a decrease in earnings.</p>	<p>Business impact assessment</p>  <p>Risk: Medium</p>
Future strategy and response	<ul style="list-style-type: none"> • Introduce low-temperature firing technologies for cement manufacturing, consider technologies for recovering CO₂ emitted from factories, and pay close attention to the viability and cost aspects of innovative technologies such as CCUS • Promote energy saving measures and consider the possibilities of transitioning to electrification and alternative fuels • Reduce greenhouse gas emissions by 17% by fiscal 2031 (comparison with fiscal 2014) • Advance the introduction of renewable energy toward reducing electric power-derived emissions 	

2. Change in water risks at business locations (common to all businesses)

■ Risk factor: Increase in flooding, tidal surges, droughts and other water-related risks

Envisaged world and business impact	<p>Increase in the amount of damages due to the increase in the frequency of natural disasters worldwide</p> <ul style="list-style-type: none"> • Increase in property damages and damages from temporary closures, etc., due to the increase in the frequency of disasters • The amount of property damage at sites in Japan with a high risk of river flooding will be around 1.1 times the current level in fiscal 2051, and around 4 times the current level in fiscal 2086. At overseas sites (Thailand), property damage will be around 2.8 times the current level in fiscal 2051, and around 25 times the current level in fiscal 2086. 	
Impact analysis	<p>The increase in damages due to disasters will be a factor contributing to cost increases for the Company If global temperature rises are not suppressed and the world heads toward a 4°C scenario, depending on the location of the site, there is a risk of serious impact on operations and supply chains.</p>	<p>Business impact assessment</p>  <p>Risk: Large</p>
Future strategy and response	<ul style="list-style-type: none"> • Short-term risks will be assessed using Aqueduct (a water risk assessment tool developed by the World Resources Institute (WRI)), and regular interviews will be conducted to ascertain the detailed water risk situation at each individual site and respond to high-risk areas in order. • Appropriate measures against medium and long-term risks will be implemented by keeping tabs on the latest forecast information at IPCC, etc., and based on assessments of water disaster risks in the Company and its supply chain. 	

3. Change in demand for Company products due to EV shift (Advanced Products Business)

■ Opportunity factor: Increase in EV sales

<p>Envisaged world and business impact</p>	<p>Rapid increase in demand for EV-related products aimed at decarbonization</p> <ul style="list-style-type: none"> Overall automobile sales volume will increase toward fiscal 2031, and demand for terminals and connectors for use in automobile applications will increase by a factor of around 1.6 by fiscal 2031 (in comparison with fiscal 2020) and around 2.1 by fiscal 2051. EV automobile sales will increase by a factor of around 22 by fiscal 2031 in comparison with fiscal 2020. 	
<p>Impact analysis</p>	<p>The major increase in EV sales is expected to lead to a major increase in demand for the Company's copper & copper alloys and electronic materials products, etc. Drawing in demand by strengthening the production system for related products will offer opportunities to expand sales.</p>	<p>Business impact assessment</p>  <p>Opportunity: Large</p>
<p>Future strategy and response</p>	<ul style="list-style-type: none"> As of fiscal 2031, the Company aims to increase sales volume of copper components for new HVs and EVs by a factor of least 1.3 in comparison with fiscal 2020, and next-generation vehicles and environmentally friendly products by at least three times in comparison with fiscal 2020. We will contribute to the transition to a decarbonized society by making capital expenditures and developing products, etc., for constructing a supply system that can meet the rapidly expanding demand for products for use in EVs. 	

4. Change in demand for Company products relating to modal shift, EV shift and reducing weight of transportation devices (Metalworking Solutions Business)

■ Risk factor: Rapid changes in the market for Advanced Materials & Tools accompanying modal shift, etc.

<p>Envisaged world and business impact</p>	<p>Decline in demand for cutting tools for engines due to the increase in the percentage of EVs</p> <ul style="list-style-type: none"> Significant increase in EV sales and increase in usage rate for lighter materials Production of engine-equipped vehicles is expected to decrease (by a factor of 0.76–0.96 times by fiscal 2031 in comparison with fiscal 2020), and sales of cutting tools for engines and transmissions are expected to decrease. 	
<p>Impact analysis</p>	<p>With the expected increase in demand for tools for use on hard-to-cut materials, accompanying the expansion of the electrification and weight reduction markets, reviewing product composition and taking in demand could provide opportunities to increase sales. At the same time, there is a risk that sales of cutting tools for engine-equipped vehicles—a current flagship product—will decline.</p>	<p>Business impact assessment</p>  <p>Risk: Medium</p>
<p>Future strategy and response</p>	<ul style="list-style-type: none"> We will contribute to the transition to a decarbonized society by developing and supplying products that meet growing demand (for the 2°C scenario world), such as EV battery-related products and tools for difficult-to-cut materials. In the automotive product market we will continue to focus on the trend of EV shift, as trends in the growth or decline of product demand vary depending on the type of power source used in the vehicle. We will also continue working to develop new markets as alternatives to the automotive industry. 	

5. Change in demand for E-Scrap recycling due to the transition to a recycling-oriented society (Metals Business)

- Opportunity factor: Increase in demand for E-Scrap recycling

<p>Envisaged world and business impact</p>	<p>Increase in demand for recycling of scrap electronic appliances accompanying economic growth of various countries</p> <ul style="list-style-type: none"> • Volumes of E-Scrap from scrapped automobiles will increase due to the increase in global vehicle sales (increase by a factor of 1.1 by 2030 in comparison with fiscal 2020), increase in percentage of EVs, and growth of GDP • Demand for valuable metals will increase further as a result of the increase in demand for electronic devices due to the advancement of digitalization 	
<p>Impact analysis</p>	<p>The volume of E-Scrap generated globally is expected to increase to 142% by 2030 in comparison with fiscal 2020. Increasing the volume of E-Scrap that the Company can process by augmenting the Company's recycling capabilities will create an opportunity to increase sales.</p>	<p>Business impact assessment</p>  <p>Opportunity: Medium</p>
<p>Future strategy and response</p>	<ul style="list-style-type: none"> • The Company will contribute to build a recycling-oriented society by augmenting its waste handling capabilities, exploring ways of expanding opportunities for accepting waste through technology development, for increasing the sophistication of pretreatment, and focusing on E-Scrap recycling operations. • Going forward, we expect to see a decline in the amount of PGM* contained in electronic circuit boards and an increase in sales of EVs in Japan. We will therefore continue to focus on the surrounding environment relating to valuable metals. <p>* PGM: platinum group metals</p>	

6. Change in costs caused by carbon pricing policies (Cement Business)

- Risk factor: Introduction and toughening of carbon pricing systems (procurement and sales)

<p>Envisaged world and business impact</p>	<p>Increase in raw material procurement and cement transportation costs due to introduction and toughening of carbon pricing systems</p> <ul style="list-style-type: none"> • Increase in cost burden on the Company from carbon pricing at upstream suppliers passed on to the Company • Increase in transport costs for cement raw materials due to changes in energy costs, etc. • Decline in cost competitiveness due to imported products from countries with low carbon pricing (until adjustment measures are applied) 	
<p>Impact analysis</p>	<p>Introduction and toughening of carbon pricing will be a factor contributing to cost increases for the Company. At the same time, since this impact will affect the industry overall, in order to maintain the competitiveness of the Company's products it will be necessary to suppress carbon price cost burdens by steadily advancing measures for achieving greenhouse gas emission reduction targets.</p>	<p>Business impact assessment</p>  <p>Risk: Medium</p>
<p>Future strategy and response</p>	<ul style="list-style-type: none"> • Comprehensively consider measures for energy saving and thermal energy conversion in manufacturing processes with a view to the reduction of risks relating to raw material procurement • Work to reduce CO₂ emissions by reviewing and revising transportation processes (mode of transportation, procurement channels, etc.) from the standpoint of the cargo owner • Focus on policy trends in carbon border adjustment mechanisms both in Japan and overseas, and respond as an industry 	

7. Change in demand for acceptance and disposal of disaster-related waste (Cement Business)

■ Opportunity factor: Increase in demand for disposal of disaster waste accompanying water-related disasters

<p>Envisaged world and business impact</p>	<p>Increase in water-related disasters such as floods, landslides / mudslides and tidal surges accompanying climate change</p> <ul style="list-style-type: none"> • Rainfall and flood water volumes will increase, the scope of water-related disasters will expand, and the depth of inundation will increase • The frequency of flooding in Japan will increase by around four times under the 4°C scenario, and by around twice under the 2°C scenario • Disaster waste will increase as a result of the increase in water-related disasters 	
<p>Impact analysis</p>	<p>Given the regionality of water-related disasters, volumes of disaster waste produced and unsteady timing with which disasters occur, the impact on business operations is expected to be minimal. At the same time, as the threat of water-related disasters is expected to increase, there will be an increase in opportunities for the cement industry (which has the capabilities for accepting and handling disaster waste) to emphasize the significance of its existence, and contribute to society.</p>	<p>Business impact assessment</p>  <p>Opportunity: Small</p>
<p>Future strategy and response</p>	<ul style="list-style-type: none"> • Moving forward, we will continue to fulfill our role in society by catering to requests for disaster waste disposal processing services. • We will work to develop de-chlorination technologies to expand processing waste with high chlorine content*. • In addition to expanding the range of waste types we are able to process, we will continue to contribute to reducing CO₂ emissions by expanding our use of thermal energy alternative waste. • Based on the national strategy measure of enhancing resilience, we will maintain and continue to provide a stable supply of products catering to public works project needs relating to disaster readiness and reduction. <p>* High concentrations of chlorine cause problems in manufacturing processes, such as blockage of pre-heaters for cement raw materials, and also affect quality.</p>	

8. Change in demand relating to home appliance recycling (Environment & Energy Business)

■ Opportunity factor: Increase in demand for home appliance recycling

<p>Envisaged world and business impact</p>	<p>Increased frequency of replacement of home appliances with energy-saving appliances due to global warming and rising energy costs</p> <ul style="list-style-type: none"> • Progressive degradation of air conditioners due to prolonged use, and increase in number of air conditions owned by each household • Increased frequency of replacement due to low-carbon regulations and increasing energy costs (increase in volume of waste home appliances) • Increase in home appliance recovery rate due to toughening of recycling regulations 	
<p>Impact analysis</p>	<p>An increase in volume of waste home appliances is expected due to factors such as temperature increase, change in number of households, and toughening of carbon regulations and recycling regulations This will be accompanied by an increase in the volume of waste home appliances processed of by the Company, which will present an opportunity for increasing sales. (209% in fiscal 2051 in comparison with fiscal 2020)</p>	<p>Business impact assessment</p>  <p>Opportunity: Large</p>

Future strategy and response

- We will seek to expand business operations through the automation of facilities aimed at increasing the number of home appliance units recycled, and by working to improve processes for increasing the value of recovered appliances.
- In particular, we will focus on market trends given the growing market scale for air conditioners and flat-panel TVs, for which the increase in the amount of appliances processed is expected to be particularly great.
- We will also create new recycling operations—including recycling of lithium-ion batteries and solar panels—while at the same time focusing on trends in overseas markets.

9. Change in demand for renewable energy (Environment & Energy Business)

■ Opportunity factor: Spread and increase in demand for renewable energy

Envisaged world and business impact

Medium to long-term expansion of the renewable energy market aimed at building a net-zero society

- Due to the state of widespread popularization and demand for renewable energy, environment value ranges between 1.3 and 1.4 yen/kWh.
- Although we expect to see mass widespread adoption of renewable energy with costs reduced through technology development, a decline in renewable energy purchase preference systems, and a fall in the unit selling price of electric power, sales will increase due to the increased demand for renewable energy.

Impact analysis

While unit electricity prices and non-fossil fuel certificate prices will fluctuate due to environmental policies and technological advances, **the demand for renewable energy itself will increase, presenting an opportunity for us to expand our renewable energy business operations. (Power generation: 286% in fiscal 2051 in comparison with fiscal 2020)**

Business impact assessment

Opportunity: Large

Future strategy and response

- In order to increase the total output of renewable energy power plants to 533GWh by fiscal 2031, we will focus on augmenting the power output of existing power plants, and surveys and development of new geothermal and hydroelectric power plants, including overseas expansion.
- We will work to reduce the cost of power generation by focusing on trends in solar and wind power generation R&D, the state of their widespread adoption, and unit electricity prices.

Water-related management

The vast majority (approx. 91%) of the water we consume at the Mitsubishi Materials Group is seawater used as cooling water. Consumption of fresh water (such as industrial water and groundwater) is relatively low. However, because a shortage of fresh water may affect our business activities, securing the necessary quality and amount of water is essential for the business operation of the Group. In addition, we have considered the seriousness of the water-related problems that have occurred frequently in recent years, such as flooding caused by typhoons or torrential rains, and the great impact of these problems. We manage the risks related to these problems accordingly.

We implement measures for reducing water risks at individual facilities. To secure water resources, we save water through measures including the recycling of water, the introduction of equipment with low water consumption, and the renovation of equipment to reduce water consumption. To counteract the risk of flooding, we take initiatives including the elevation of buildings, pumps, and electric equipment, the installation of drainage pumps, as well as the implementation of disaster drills assuming high water events. We also take measures to prevent abnormalities in the quality of the effluent from our facilities and to prevent water quality accidents. These measures include the management of effluent under our own standards that are stricter than laws and regulations, as well as the introduction of sensors that detect abnormal water quality and a system that stops water discharges automatically.

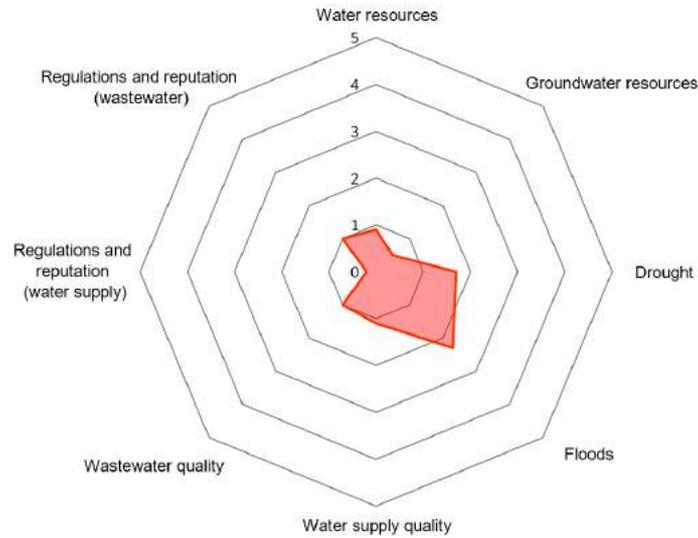
■ State of water risk assessment initiatives

To ascertain the state of water risks at the Group's manufacturing facilities (including some research institutes), we are utilizing the Aqueduct water risk assessment tool developed by the World Resources Institute (WRI) to conduct individual risk assessments for each facility, covering various water risks including those relating to securing water resources and those of incurring flood damage.

Additionally, in order to ensure that water risk assessments are in line with actual conditions at these facilities, we supplement the results of water risk assessments performed using Aqueduct by taking into account the history of any past water risk manifestations at each facility (history of occurrences of flood, drought, and water supply quality deterioration, etc., at each location) and information on water usage associated with business activities (amount of fresh water and groundwater used, emissions of pollutants contained in wastewater).

The results of these supplemented water risk assessments are used to produce visual representations of water risks for each facility, using radar charts displaying risk scores for each assessment item, and shared with each business location. Each business site registers items assessed as high risk as risk factors for that particular facility, and engages in risk management by planning and implementing measures including the reduction of water risks.

Example radar chart showing water risks for each facility



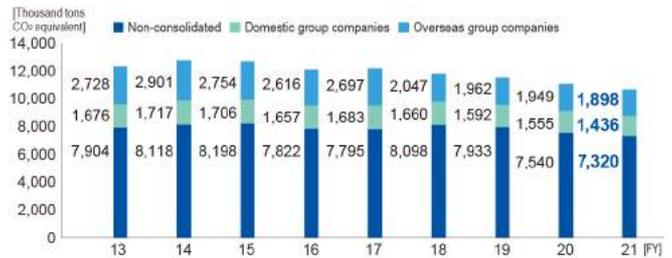
"Water quality risks" are assessed separately for both water supply and wastewater, from the viewpoints of impact on operations due to the deterioration of water supply water quality and impact on the environment due to wastewater at business sites. "Regulatory and reputation risks" are also assessed for both water supply and wastewater, from the perspectives of toughness water supply and wastewater regulations and the reputation of the region.

GHG emission results and initiatives

Fiscal 2021 Reduction Activities

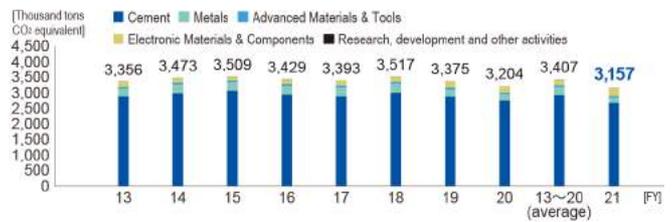
Total greenhouse gas emissions (non-consolidated + main consolidated subsidiaries)★

Total greenhouse gas emissions (non-consolidated + main consolidated subsidiaries) for the Group in fiscal 2021 was 10,653 thousand tons. Which was a decrease of 391 thousand tons compared to the previous year.



Greenhouse gas emissions derived from energy sources (non-consolidated)★

In fiscal 2021, our non-consolidated greenhouse gas emissions from energy sources were 3,157 thousand tons. It decreased by 47 thousand tons compared to the previous year.



* Greenhouse gas emissions derived from non-energy sources comes mainly from limestone, which is used as a raw material. As it is difficult to substitute or reduce volumes of limestone, however, our emissions target covers greenhouse gas emissions derived from energy sources, which can be reduced by energy saving initiatives.

Changes in greenhouse gas emissions per unit (non-consolidated)

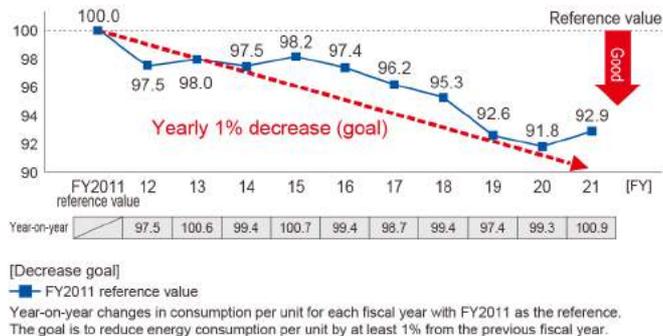
Greenhouse gas emissions on a non-consolidated basis were reduced by 220 thousand tons CO₂ (3% reduction) compared to the previous year, mainly due to a decrease in cement production. Emission intensity remained at a similar level to the previous fiscal year, due to the impact of the reduction in production volume for each business.



[Decrease goal]
 ■ FY2011 reference value
 Year-on-year changes in emissions per unit for each fiscal year with FY2011 as the reference. The goal is to reduce emissions per unit by at least 1% from the previous fiscal year.

■ Changes in energy consumption per unit (non-consolidated)

As a result of the addition of two locations (Sambo Plant and Wakamatsu Plant) and the decrease in cement production volume, energy consumption increased by 1.1% in comparison with the previous fiscal year. Despite the increase in the use of thermal energy alternatives such as waste plastic and recycled oil, unit consumption (consumption intensity) also worsened by 0.9% due to the impact of the decrease in production volume for each business Business Operator Classification Evaluation System: A class (A class: failed to achieve S class evaluation, for which improvement of basic unit of 1% or more on average over the past 5 years is required).



* Energy consumption per unit is calculated in accordance with the periodic report guidelines prescribed under Japan's Act on the Rational Use of Energy (Energy Conservation Act). As the Company's business is diverse, we identify a "value intimately related to energy use" for each business and use it as the denominator for calculations. We calculate each business's contribution by multiplying the year-on-year of each business's energy consumption per unit with that business's share of the Company's total energy use. The product is the Company's total consumption per unit (year-on-year). Greenhouse gas emissions per unit is calculated in the same way.

■ Breakdown of total emissions for Fiscal 2021 [Thousand tons CO₂ equivalent] ★

Category		Non-consolidated	Domestic group companies	Overseas group companies	Total	
SCOPE1 (direct)	From energy sources (fuel, etc.)	2,621	511	671	3,803	
	From non-energy sources	From processes	3,716	159	701	4,575
		From waste	428	291	20	740
		Greenhouse gases other than CO ₂	19	35	4	58
	(Reference) Total from non-energy sources	4,163	485	725	5,373	
	Subtotal	6,784	996	1,397	9,176	
SCOPE2 (indirect)*	From energy sources (power, etc.)	536	439	501	1,477	
(Reference) Total from energy sources		3,157	951	1,173	5,280	
Total		7,320	1,436	1,898	10,653	

* "Group companies" includes 125 consolidated subsidiaries (61 domestic, 64 overseas).

* The above data has been calculated in accordance with Version 4.6 of the Manual for Calculating and Reporting Greenhouse Gas Emissions.

* SCOPE2 (Indirect) emissions are market-based emissions. Location-based SCOPE2 emissions are 1,600 thousand t-CO₂e.

■ Scope 3 emissions for fiscal 2021 [Thousand tons CO₂ equivalent]

	Item	Object	Non-consolidated	Group	Total	Approach to determining the amount of activity
Category 1	Purchased products and services	Same as organizations covered by environmental data other than greenhouse gas emissions	1,290	5,071	6,361	The use of raw materials accepted from outside the Group (excluding waste as raw materials and by-products as raw materials) in terms of physical quantity
Category 2	Capital goods	Same as consolidated financial statements	114	159	273	Capital expenditure in the reportable fiscal year
Category 3	Fuel and energy-related activities that do not fall under Scopes 1 and 2	Same as organizations covered by data on greenhouse gas emissions	505	274	779	Fuel consumption by type and volume of electric power and steam purchased from outside the Group
Category 4	Transportation and distribution (upstream)	Same as organizations covered by environmental data other than greenhouse gas emissions	572	1,414	1,987	1) Emissions from the physical distribution of products and services, which were purchased in the reportable fiscal year, from suppliers to the company <ul style="list-style-type: none"> · A transportation scenario was set for each major raw material (excluding waste as raw materials and by-products as raw materials). · Distances between countries were set using the IDEA database on distances between countries, and other distances were set using a distance search site (with distance given by an in-house company in a questionnaire adopted in some cases). 2) Emissions from the physical distribution of products that were shipped and transported in the reportable fiscal year at the expense of the company <ul style="list-style-type: none"> · A transportation scenario was set for each major shipped product. · Distances between countries were set using the IDEA database on distances between countries, and other distances were set using a distance search site.
Category 5	Waste generated from operation	Same as organizations covered by environmental data other than greenhouse gas emissions	1	19	20	The amount of industrial waste (waste recycled into resources and landfilled waste) was included.

	Item	Object	Non-consolidated	Group	Total	Approach to determining the amount of activity
Category 6	Business trip	Consolidated	0	3	3	For Mitsubishi Materials (non-consolidated), the number of employees at each base (plants and offices) was used for the calculation. However, in consideration of the voluntary restraint on business trips for controlling the spread of COVID-19, travel expenses in the reportable fiscal year were compared with those in a normal fiscal year, and the value obtained by multiplying the number of employees by the ratio of travel expenses in the reportable fiscal year to that in a normal fiscal year was regarded as the value for the amount of activity. For consolidated subsidiaries, the number of employees of each in-house company from human resources information given in the securities report was used for the calculation.
Category 7	Employee commute	Consolidated	2	8	10	For Mitsubishi Materials (non-consolidated), the number of employees at each base (plants and offices) was used for the calculation. For the head office and other offices, however, in consideration of the voluntary restraint on going to workplaces to control the spread of COVID-19, the value obtained by multiplying the number of employees by the rate of employees who commuted to work for the reportable fiscal year was regarded as the value for the amount of activity. For consolidated subsidiaries, the number of employees of each in-house company from human resources information given in the securities report was used for the calculation.
Category 8	Leased assets (upstream)	—	—	—	—	While there are leased assets, they were excluded from the calculation because they are included in Scope 1 and Scope 2.

Item		Object	Non-consolidated	Group	Total	Approach to determining the amount of activity
Category 9	Transportation and distribution (downstream)	Same as organizations covered by environmental data other than greenhouse gas emissions	120	295	415	Emissions from physical distribution of products that were shipped and transported to sales destinations at the expense of other companies. Transportation from sales destinations to final consumers was excluded. Distances between countries were set by using the IDEA database on distances between countries, and other distances were set by using a distance search site (with the distance given by an in-house company in a questionnaire adopted in some cases).
	Fabrication of sold products	Same as organizations covered by environmental data other than greenhouse gas emissions	202	521	724	For products sold, the value for the amount of products shipped by each in-house company to companies other than group companies was regarded as the value for the amount of activity. Emissions from processing were calculated by setting the primary processing assumed for each product.
Category 11	Use of sold products	—	—	—	—	Products sold were excluded from the calculation because they are materials and parts that are used by a wide range of users and it is therefore difficult to follow their paths to final products.
Category 12	Disposal of sold products	Same as organizations covered by environmental data other than greenhouse gas emissions	106	258	364	For products sold, the value for the amount of products shipped by each in-house company to companies other than group companies was regarded as the value for the amount of activity. Emissions from disposal were calculated by setting a disposal method assumed for each product.
Category 13	Leased assets (downstream)	—	—	—	—	Leased assets were excluded because virtually no such asset is owned.
Category 14	Franchises	—	—	—	—	Franchising business was excluded because the company does not operate such a business.
Category 15	Investment	—	—	—	—	Investments made in the pure pursuit of profit were excluded from the calculation because no such investment is made.

Item	Object	Non-consolidated	Group	Total	Approach to determining the amount of activity
Total		★2,913	8,022	10,934	

* The calculation was made by referring to the Basic Guidelines on Accounting for Greenhouse Gas Emissions Throughout the Supply Chain Ver. 2.3 from the Ministry of the Environment and the Ministry of Economy, Trade and Industry. Greenhouse gas emissions per unit was calculated by referring to the emission intensity database for calculating greenhouse gas emissions of an organization through the supply chain (ver. 3.1) from the above ministries.

■ Principal Initiatives at Each Business

We regard it as a top priority to save energy wherever possible at our manufacturing facilities and plants. That is why we are so committed to energy saving activities. Specific activities include switching fuels, making effective use of untapped energy, upgrading processes and equipment, installing high-efficiency equipment, optimizing device specifications, and reviewing equipment controls and operating practices. We are constantly working to save energy at smaller facilities, too, including Head Office, branches, sales offices and research facilities, through measures such as installing LED lighting.

Logistics Initiatives

Our CO₂ emissions from transportation for fiscal 2021 totaled 41,198 tons for Mitsubishi Materials (down 1,142 tons from the previous fiscal year), and 72,070 tons for the Mitsubishi Materials Group*¹ (down 6,449 tons from the previous fiscal year). Meanwhile, energy consumption per unit*² came to 17.54 kiloliters per million ton-kilometers for Mitsubishi Materials, which was 9.5% worse than the previous fiscal year. This is attributable primarily to an increased rate of use of road transportation, which resulted from the absorption-type merger of Mitsubishi Shindoh Co., Ltd., a group company which was a Specified Consigner and uses road transportation as the main means of transportation. We conducted this absorption-type merger in April 2020. The figure for the Group as a whole was 21.18 kiloliters per million ton-kilometers (3.4% worse than the previous fiscal year).

We will continue to promote a modal shift with a focus on long-distance transport and optimize logistics throughout the Group in our efforts to build a logistics system with low environmental impact.

*¹ Figures for the overall Group refer to ones for Mitsubishi Materials and five domestic group companies classified as Specified Consigners under the Act on Rational Use of Energy. The combined amount of emissions from the six companies accounts for more than 90% of emissions from all domestic group companies.

*² Value obtained by converting energy consumption into crude oil (kl) and dividing it by transportation in ton-kilometers (million ton-kilometers)

■ CO₂ emissions according to mode of transport (Unit: Tons CO₂)

			FY2020		FY2021	
			Mitsubishi Materials	Group companies* ¹	Mitsubishi Materials	Group companies* ¹
CO ₂ emissions from logistics	Total		43,340	35,179	42,198	29,872
	Breakdown	Road	8,705	28,340	13,586	22,708
		Rail	3	29	23	5
		Ocean	34,579	6,810	28,563	7,159
		Air	53	0	26	0

Targets for 2020 and results/progress in the final fiscal year

The Group's efforts to realize a sustainable society include establishing global warming prevention targets to be met by 2020 and acting on our total commitment to achieving higher energy efficiency through such means as actively pursuing energy saving at our facilities. We are monitoring progress toward achieving our targets at 13 facilities (with five plants counted as one in the Cement Business). Performance in fiscal 2021 (the final fiscal year of the plan) was over 100% achievement of our targets at one facility, but under 50% at the remaining sites. Going forward, in addition to pursuing CO₂ reduction initiatives, we will set and continue working to achieve new clearly defined targets, such as effective use of recycled resources, aimed at contributing to a recycling-oriented society.

Sector	Applicability	Details	Preventing global warming		Creating a recycling-oriented society/contributing to the environment	
			Targets	Results/Progress	Targets	Results/Progress
Advanced Products	Sakai Plant	Upgrade equipment to energy saving models as part of manufacturing processes for copper and brass materials, copper alloys and processed copper products.	Energy consumption per unit Reduction of 1% per year (14% overall reduction compared to FY2006)	9% Increase compared to FY2006 -64%	Waste oil/acid reduction of 40% (compared to FY2006)	65% Increase -163%
	Sanda Plant	Upgrade coolant water systems and other equipment to energy saving models as part of the manufacturing process for functional materials. Continue to develop next generation components for high efficiency inverters.	Energy consumption per unit Reduction of 1% per year (20% overall reduction compared to FY2006) * Specific to this plant	43.2% decrease compared to FY2006 ☆☆☆☆216%	Develop next generation components for high-efficiency inverters (Effect of reduction in CO ₂ emissions when using products: at least 3.4 times that in FY2009)	0.8 times ☆23%
	Ceramics Plant	Upgrade air conditioning systems and other equipment to energy saving models as part of the manufacturing process for electronic devices. Develop commercial temperature sensors for motorcycles.	CO ₂ per unit Reduction of 30.8% (compared to FY2006)	9.8% decrease compared to FY2006 ☆32%	Number of environmentally friendly products At least one per year	Pb-free Inverter temperature sensor for next-generation vehicles ☆☆☆☆100%
	Yokkaichi Plant	Upgrade refrigeration systems and other equipment to energy saving models as part of the manufacturing process for silicon products, and improve treatment processes for wastewater.	Energy consumption per unit Reduction of 1% per year (14% overall reduction compared to FY2006)	12.2% Increase compared to FY2006 -87%	Industrial waste generated per unit (tons per ton-products) Reduction of 56.3% (compared to FY2006)	56.6% decrease ☆☆☆☆101%
Metalworking Solutions	Tsukuba Plant	Upgrade water chillers and heaters as part of air conditioning systems, and other equipment, to energy saving models in the manufacturing process for cemented carbide tools, and improve the overall efficiency of production equipment.	Energy consumption per unit Reduction of 20% (compared to FY2006)	31.4% Increase compared to FY2006 -157%	Scrap generated Reduction of 40% (compared to FY2010)	4.7% Increase -12%
	Gifu Plant	Upgrade compressed air systems as part of the manufacturing process for cemented carbide tools, reduce liquid waste through measures to prevent leaks, and focus on development of environmentally friendly products.	Energy consumption per unit Reduction of 15% (compared to FY2006)	1% decrease compared to FY2006 ☆7%	Incorporate industrial waste indicators (volume of industrial waste produced per production value) into each medium-term plan, and continue to achieve 100%. (Milestone: 29.0% decrease)	39.0% decrease compared to FY2013 reference value ☆☆☆☆134%
	Akashi Plant	Reduce losses as part of the manufacturing process for cemented carbide products, through TPM activities, and improve wastewater processes.	Energy consumption per unit Reduction of 10% (compared to FY2011)	1.5% decrease compared to FY2011 -15%	COD load No more than 1 ton per year	0.355 t/year ☆☆☆☆282%
Metals	Naoshima Smelter & Refinery	Install high-efficiency equipment, and upgrade or install heat recovery and other such equipment at copper smelting facilities, in order to improve energy efficiency. Cater to growing volumes of E-Scrap overseas, reinforce pre-treatment facilities, and step up recycling operations.	Energy consumption per unit Reduction of 1% per year (14% overall reduction compared to FY2006)	2.3% decrease compared to FY2006 ☆16%	Volume of E-Scrap processed Over 100,000 tons per year	82,000 t/year ☆☆☆☆82%
Cement	All facilities (Aomori, Iwate, Yokoze, Kyushu, Higashitani)	Improve energy efficiency by ensuring the installation of energy-saving equipment and driving the introduction of low-temperature burning technology as an innovative technology. Promote the use of waste and byproducts from other industries as alternative raw materials for cement.	Energy consumption per unit Reduction of 1.2% (compared to FY2011)	1.25% Increase compared to FY2011 -104%	Alternative waste/byproducts per unit 435 kg per ton (Baseline: 406 kg per ton)	438 kg/t ☆☆☆☆96%
					Percentage of alternative thermal energy Increase of 2% (compared to FY2011)	0.8% Increase ☆40%

*We have set out the following scale to indicate progress. Achievement of milestones at the end of fiscal 2021 for achieving the 2020 targets: ☆☆☆☆: 100% or higher, ☆☆☆: between 80% and 100%, ☆☆: between 50% and 80%, ☆: less than 50%.

■ Cement Business

We are working to reduce power consumption, through measures such as ensuring adequate mill maintenance, reviewing maintenance of exhaust heat power generation systems, increasing electrical equipment efficiency, and switching to LED lighting, while also striving to improve energy efficiency through initiatives such as increasing the amount of alternative thermal energy sources that we use, making energy-saving upgrades to burning equipment, and introducing low-temperature burning technology as an innovative technology.

■ Metals Business

We are working to increase energy use efficiency through measures such as saving energy from compressors and related equipment, increasing efficiency from transformers and motors, and switching to LED lighting, as well as to improve energy efficiency through initiatives such as reviewing operations for individual furnaces, in order to reduce fuel oil consumption.

■ Advanced Products & Metalworking Solutions Business

We are working to reduce power consumption through measures such as improving water pump controls, saving energy from air conditioning, refrigeration, compressors and related equipment, installing higher efficiency electrical equipment, switching to LED lighting, and upgrading various other processes, as well as to improve energy efficiency through initiatives such as optimizing controls on boilers and heat recovery equipment.

Eleventh Eco Contest

We have been running an award scheme to promote activities at facilities throughout the Mitsubishi Materials Group since fiscal 2011, aimed at preventing global warming, preserving resources, and protecting the environment. The results of our fiscal 2021 contest are outlined as follows.

■ Two prizes for excellence in promoting excellent eco activities: Central Research Institute

Theme: Improving pit wastewater processing at Takatori Mine

The Central Research Institute engages in research and development activities that contribute to the Company's recycling operations and environmental conservation activities. On this occasion, researchers explored the pit wastewater processing flow at Takatori Mine, where wastewater treatment is regarded as being particularly difficult (even in comparison with the Group's other abandoned mines). As a result, researchers created a groundbreaking process flow that enables the treatment of wastewater by centralizing the discharge systems for two systems of waste sludge, achieving a reduction in the total amount of wastewater treatment sludge generated, and also a reduction in the amount of effort needed to transport it to collection sites. The award was presented in recognition of this.

Theme: Demonstrative testing of algae cultivation utilizing cement plant exhaust gases
Focusing on the CO₂ emitted from cement plants, researchers established a technology for cultivating algae (which convert CO₂ into organic constituents via photosynthesis) using cement exhaust gas, and a technology for synthesizing bioplastics from the compounds extracted from the algae. The award was also given in recognition of promoting the Group's initiatives for reducing CO₂ emissions through press releases and other media, and also presenting new options that go beyond the framework of existing businesses.



Cultivation Tank

■ Environmental contribution award: Akita Plant, Japan New Metals Co., Ltd.

Theme: Improvement of tungsten recycling technologies

We are engaged in efforts to recycle scrap that includes tungsten, in order to distribute the risks of procuring raw materials from overseas, and to contribute to building a recycling-oriented society. Recycling using the oxidizing roasting method uses large amounts of thermal energy. Japan New Metals' Akita Plant was presented this award in recognition of its efficient and energy-saving recycling activities, utilizing waste heat conversion and processing technologies that make use of the properties of tungsten.

Initiatives to Help Build a Decarbonized Society

Initiatives to Help Build a Decarbonized Society

Products and Services that Contribute to Building a Decarbonized Society

For the Group, tackling climate change has been one of its most important tasks for building a decarbonized society. Reflecting this, the Group has been approaching manufacturing with a view to reducing the environmental impact and has developed and promoted the use of renewable sources of energy, such as geothermal energy.

TOPICS

Development of elemental technologies essential for next-generation vehicles

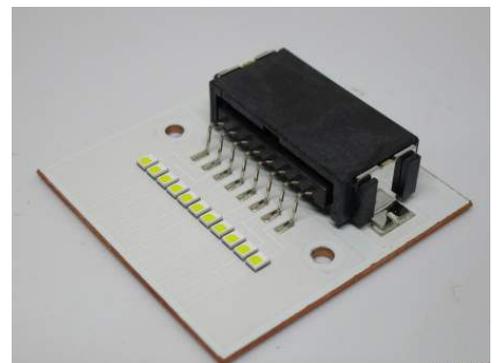
We regard "next-generation vehicles," "IoT and AI," "urban mining" and "clean energy and decarbonization" as social needs that the Group should grasp in our medium-term management strategy. In the areas of "next-generation vehicles" and "IoT and AI," we will expand the scope of its copper and aluminum products, seals, wear-resistant tools, and sensors, while developing new products and businesses. In the areas of "urban mines" and "clean energy and decarbonization," we will create new products and businesses from among those related to recycling, renewable energy and hydrogen society. As specific examples, we have been making announcements since 2019 on the development of metal base substrates for high-brightness LEDs for next-generation vehicles, uniform electrodeposition coating technology for high-heat-resistant and high-insulation resins, and die-bonding sinter materials for next-generation power modules. We are promoting dissemination by advancing the elemental technology development which is indispensable for these next-generation vehicles. We will continue our development to be put into practical use in stages by around 2050.

■ Metal base substrates for automotive high-brightness LEDs

In the headlamp of the next-generation vehicle, the adoption of the high-brightness LED advances in place of the conventional light source for the energy saving. We have developed a metal base substrate that is lower in cost than conventional ceramic substrates while having the high heat dissipation required for high-brightness LEDs.

We intend to build the reliability of the printed circuit boards and launch a mass production process in order to commercialize and disseminate them by around 2022.

- ▶ [Developing nBoard™ metal base substrates for automotive high-brightness LEDs \(Japanese\)](#)



■ Uniform electrodeposition coating technology for high heat resistance and high insulation resin

High insulation reliability under high temperature is required for coils used in power inductors, motors and reactors, which are used in inverters for controlling high-output motor power supply of next-generation vehicles. Recently, with demand for further miniaturization of those coil devices, a uniform coating technology is getting required to perform insulation of complex-shaped conductors. We have developed a unique electrodeposition technology that can uniformly coat resin film with high heat resistance and high insulation property even for complex shapes.

In the future, further upgrading of film characteristics will be carried out, and the construction of mass production process of electrodeposition machining will be aimed at by around 2022.

- ▶ [Development of Uniform Electrodeposition Coating Technology for Highly Heat-Resistant and Highly Insulating Resins for Next-Generation Vehicles \(Japanese\)](#)



■ Die-bonding sinter materials for next generation power modules

In the next-generation type power module used in the inverter for high output motor power supply control of the next-generation vehicle, there is a demand for the function enhancement in the die bonding for high-temperature operating semiconductor element such as SiC to the copper material. Previously, it was necessary to apply precious metal plating such as gold and silver to the substrate surface, and pressurize while heating. We have developed a die bonding material that can bond semiconductor die to substrate without pressure nor precious metal plating to the copper surface of the substrate, and can exhibit the bonding strength and heat resistance equivalent to the conventional die bonding products. In the future, further improvement of reliability and optimization of the process will be carried out, and the commercialization and dissemination will be aimed at around 2021.



- ▶ [Development of die-bonding sinter materials for next-generation power modules that can be bonded to copper components without pressure \(Japanese\)](#)

TOPICS

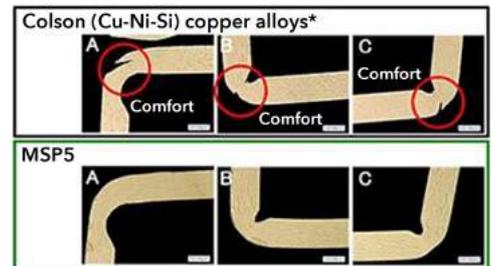
Started full-scale production of MSP5 copper alloy for automotive small terminals

Mitsubishi Materials Corporation has started full-scale production of its Cu-Mg solid-solution strengthened*1 copper alloy "MSP5". With the development of autonomous driving cars and increase in electrical components as represented by Connected, Autonomous, Shared & Service, and Electric (CASE) mobility trends, the need for smaller automotive terminals has been increasing. The push to simplify manufacturing processes and to reduce environmental burden has also led to an increase in demand for solderless press-fit terminals, in Japan and elsewhere.

The alloy materials for these small terminals used in automotive electrical components must have high strength, high electrical conductivity, and high stress relaxation resistance (resistance against decrease in stress due to heat). Excellent formability is also required in order to prevent cracks or fractures from arising during press-forming, especially for box-shaped terminals.

Our sales, development and research departments have been working closely to commercialize and launch products that better meet the needs of our customers, making use of the unique copper and copper alloy processing technologies that we have honed over the years. In 2015 we developed MSP5, which has excellent formability as well as excellent strength, high electrical conductivity, and high stress relaxation resistance, making it ideal for small automotive terminals and press-fit terminals. Samples provided to our customers have led to positive feedback regarding its high performance and reliability, and we are now proud to announce the start of its full-scale production.

* Solid-solution strengthening: A method of strengthening a material by dissolving other atoms (solute atoms) into the matrix of parent atoms (solvent atoms).



* Comparison with the Group's existing products

- ▶ [Press release link](https://www.mmc.co.jp/corporate/en/news/2021/news20210520.html)
<https://www.mmc.co.jp/corporate/en/news/2021/news20210520.html>

TOPICS**Started operation of solar power generation facilities based on the PPA model**

The Group has commenced operation of solar power generation facilities installed at two of its facilities using an onsite solar power generation service (PPA model*). This will enable a portion of the electric power consumed at those locations to be covered using renewable energy.

1. Mitsubishi Materials Corporation Akashi Plant

- PPA business operator: Kansai Electric Power
- Planned annual power generation capacity: approx. 350,000kWh
- Contractual date of commencing operation: October 1, 2020

2. Eco-Management Corporation (a fully owned subsidiary of Mitsubishi Materials) Myoho Plant

- PPA business operator: Ryoken Corporation (a subsidiary of P.S. Mitsubishi Construction Co., Ltd., an equity method affiliate of Mitsubishi Materials)
- Planned annual power generation capacity: approx. 30,000kWh
- Contractual date of commencing operation: January 1, 2021

* The PPA (Power Purchase Agreement) model is a business model in which power companies and other PPA business operators lease land or rooftops, etc., from power consumers, install solar power generation equipment and sell the electric power generated using those facilities to the power consumers.

▶ [Press release link](https://www.mmc.co.jp/corporate/ja/news/press/2021/21-0305.html) <https://www.mmc.co.jp/corporate/ja/news/press/2021/21-0305.html>

TOPICS**Expansion of geothermal power generation business**

We contribute to reducing greenhouse gases by maintaining operation of existing geothermal power stations sustainably and launching new geothermal power stations gradually in areas currently under construction and exploration.

In order to build more efficient geothermal power plants at lower cost, we improve engineering skills regarding resources exploration, resources development, plant engineering and operation management, which currently the Group owns.

Geothermal power generation is characterized by extremely low lifecycle CO₂ emissions among renewable energies like hydroelectric power generation and also featured by a domestic energy source among renewable energies and a stable power source that is not affected by weather.

We started operation of the Onuma Geothermal Power Station (Kazuno City, Akita Prefecture, 9.5MW), which is the third geothermal power station in Japan in 1974, and started a steam supply project to the Sumikawa Geothermal Power Plant of Tohoku Electric Power Co., Inc. (Kazuno City, Akita Prefecture, 50MW) in 1995 in cooperation with Mitsubishi Gas Chemical Company, Inc. In May 2019, Wasabizawa Geothermal Power Station (46.2MW in Yuzawa City, Akita Prefecture) began operation, jointly sponsored by Electric Power Development Co., Ltd. Mitsubishi Materials Corporation, and Mitsubishi Gas Chemical Co., Inc. In August 2019, Appi Geothermal Energy Corporation, a joint venture of Mitsubishi Materials Corporation, Mitsubishi Gas Chemical Company, Inc. and Electric Power Development Co., Ltd., began construction of the Appi Geothermal Power Station (14.9MW in Hachimantai City, Iwate Prefecture) and is scheduled to begin operation in 2024. All of the power stations are located in heavy snowfall areas, and the Appi Geothermal Power Station, in particular, has the highest altitude in Japan and is expected to accumulate snow in excess of 4m, making it extremely challenging in terms of construction and operation.

Geothermal power generation is a technique of generating electricity by extracting steam and hot water from the underground, so exploration and development skills for underground resources hold the key to success. We plan to improve the skills

cultivated over many years in mine development, and to explore promising geothermal resources by conducting geothermal surveys in new regions throughout Japan, mainly in the Tohoku region, and to start up geothermal power plants gradually. Preliminary surveys have already been conducted in multiple areas, and full-scale surveys involving drilling of wells are scheduled to start one after another from when preparations are completed.

- ▶ [Producing Renewable Energy](#)
- ▶ [Environment & Energy Business](#)

Participation in Challenge Zero for Building a Decarbonized Society

The Group has joined Challenge Zero,* a project launched by the Japan Business Federation (Nippon Keidanren; hereinafter, the "Keidanren"). In this project, the Group will deploy technologies, products, and services that contribute to building a decarbonized society, in Japan and in other countries. The Group will also proactively collaborate with companies from the same industry and from other industries, and also with academia, government organizations, and others, thereby committing itself further to resolving issues related to climate change.

Information about specific initiatives the Group is taking as a part of Challenge Zero will be provided on the official Challenge Zero website maintained by the Keidanren.

- ▶ [The Keidanren's official Challenge Zero website: https://www.challenge-zero.jp/en/](https://www.challenge-zero.jp/en/) 

* A project in which the Keidanren and the Government of Japan collaborate to publicize and support the innovation by companies and organizations to build a decarbonized society, a long-term goal of the Paris Agreement, the international framework on climate change.

Producing Renewable Energy

Geothermal Power Generation Business

■ Activities for the Stable Operation of Existing Power Plants

We stably generate environmental loading-reducing electric power through our Ohnuma Geothermal Plant and Sumikawa Geothermal Plant (steam supply only, power generated by Tohoku Electric Power Co., Inc.), both in the Hachimantai area of Kazuno, Akita prefecture, as well as the Wasabizawa Geothermal Power Plant (owned by Yuzawa Geothermal Power Corporation, established jointly with Electric Power Development Co., Ltd. and Mitsubishi Gas Chemical Company, Inc.), which began commercial operation on May 20, 2019 in the Takamatsu and Akinomiya areas of Yuzawa, Akita prefecture. In fiscal 2020, we generated a total of 601 GWh of power. The operation of our geothermal plants and steam supply systems effectively reduced CO₂ emissions by approx. 190,000 tons (*calculated based on emissions from Sumikawa Geothermal Plant of Tohoku Electric Power Co., Inc. and our equity stake in Wasabizawa Geothermal Power Plant of Yuzawa Geothermal Power Corporation). In conducting the geothermal power generation business, we have to confirm the geothermal systems of Sumikawa area, in order to maintain continual and stable supplies of steam. We are working to maintain a geothermal reservoir at the Sumikawa Geothermal Area, with the aim of increasing the amount of power generated in the future. We have been examining data, and reanalyzing geothermal systems since we started operations at the site, as we continue to focus on maintaining stable operations.

■ Activities for New Geothermal Development

In addition to operating existing power plants, we are currently working on new projects too. Yuzawa Geothermal Power Corporation, established jointly with Electric Power Development Co., Ltd. and Mitsubishi Gas Chemical Company, Inc. started construction of Wasabizawa Geothermal Power Plant in May 2015 and began commercial operation of this plant on May 20, 2019. In October 2015, we established Appi Geothermal Energy Corporation in conjunction with Mitsubishi Gas Chemical Company, Inc. We were joined by Electric Power Development Co., Ltd. in June 2018. The three companies are promoting commercialization and started construction in August 2019.

We are also in the process of conducting joint surveys with other companies in the Bandai-Azuma-Adatarara area of Fukushima prefecture. We are hoping to carry out further studies in the Komonomori area of Kazuno, Akita prefecture, providing that we can secure support from the local community.



Wasabizawa Geothermal Power Plant (Akita prefecture)
 Main business operator: Yuzawa Geothermal Corporation
 Operation commenced in May 2019
 Output: 46,199kW



Appi Geothermal Power Plant (Iwate prefecture, under construction)
 Main business operator: Appi Geothermal Energy Corporation
 Operation scheduled to commence in April 2024
 Output: 14,900kW

Hydroelectric Power Generation Businesses

We have a long history of generating hydroelectric power, dating back to 1898, when we built seven hydroelectric power plants in Akita prefecture, for the purpose of supplying enough power to run Osarizawa Mine (opened as a gold mine, later operated as a copper mine, closed in 1978) and homes in the local area. We were compensated for one of those power plants when a dam was built and the plant was submerged in 2000. The remaining six however are still operating today, selling all of the power that they generate to a power company. Since 2014, we have successfully completed upgrades at three hydroelectric power plants, in an effort to deal with aging facilities. We also completed updates at Oyu Hydroelectric Power Plant (Kazuno) in March 2018. In addition, in May 2019, we began to construct the New Komatagawa Hydroelectric Power Plant in the Komata River, a branch stream of the Ani River in the reservoirs along the Yoneshiro River in Kita-Akita City, Akita since the No. 4 Komatagawa Hydroelectric Power Plant, which was completed in 1953. We are determined to continue securing both stable operations and stable revenue in the future.

In fiscal 2021, the combined total of power generated by all six hydroelectric power plants was 83 GWh. Our operation of hydroelectric power plants effectively reduced CO₂ emissions by approx. 40,000 tons.



Komatagawa New Power Plant (Akita prefecture, under construction)
 Main business operator: Mitsubishi Materials Corporation
 Operation scheduled to commence in December 2022
 Output: 10,326kW

Solar Power Businesses

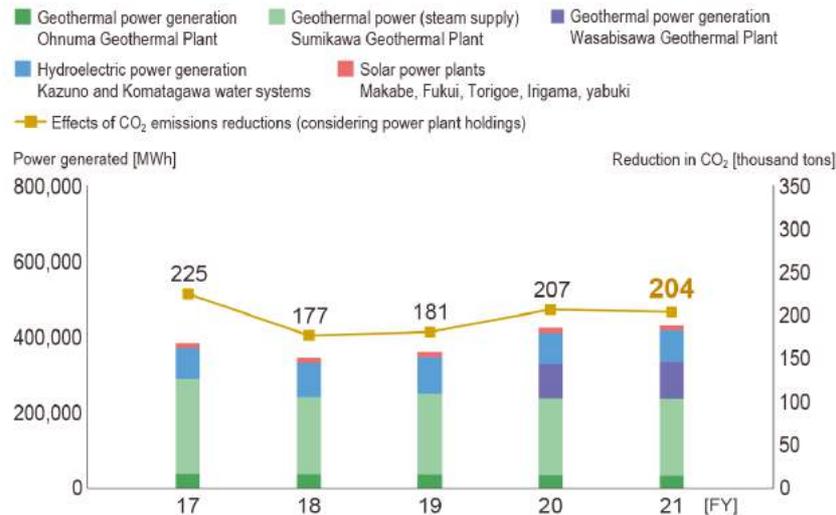
Having entered the solar power business in 2013, making effective use of idle group land, by 2017 we had built power plants in five locations as part of a joint venture with Mitsubishi UFJ Lease & Finance Company Limited. We are currently operating plants in Makabe (Ibaraki prefecture), Fukui (Fukui prefecture), Torigoe (Fukuoka prefecture), Irigama (Miyagi prefecture), and Yabuki (Fukushima prefecture). In fiscal 2021, the combined total of power generated by all five solar power plants was 29 GWh. The operation of these power plants effectively reduced CO₂ emissions, with a 10,000 ton reduction attributable to us, representing our share of the power plants.



Irigama Solar Power Station (Miyagi prefecture)
 Main business operator: LM Sun Power CO.,Ltd.
 Operation commenced in January 2015
 Output: 6,930kW

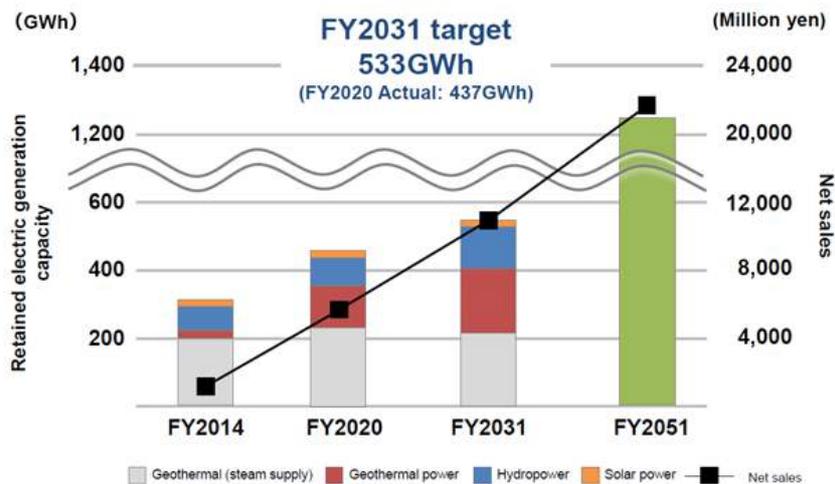
Renewable energy's effect on the reduction of CO₂ emissions

■ Reduction in CO₂ emissions using renewable energy (reflecting our equity in power plants)



* Recalculated based on the CO₂ emission factor for commercial electric power defined by METI

Renewable energy power generation targets and results



* Steam supply to geothermal power plants (steam sales converted by electric energy volume)

Ground Source Heat Pump Systems (GSHP)

Helping to Build of a Decarbonized Society by Promoting Ground Source Heat Utilization, Which is Renewable Heat.

In 2000, Mitsubishi Materials Techno Corporation entered the business of ground-source heat, which is heat from a renewable energy source, as a provider of total engineering solutions. The company has been providing services in the process from project proposal through investigation, design, construction, and maintenance.

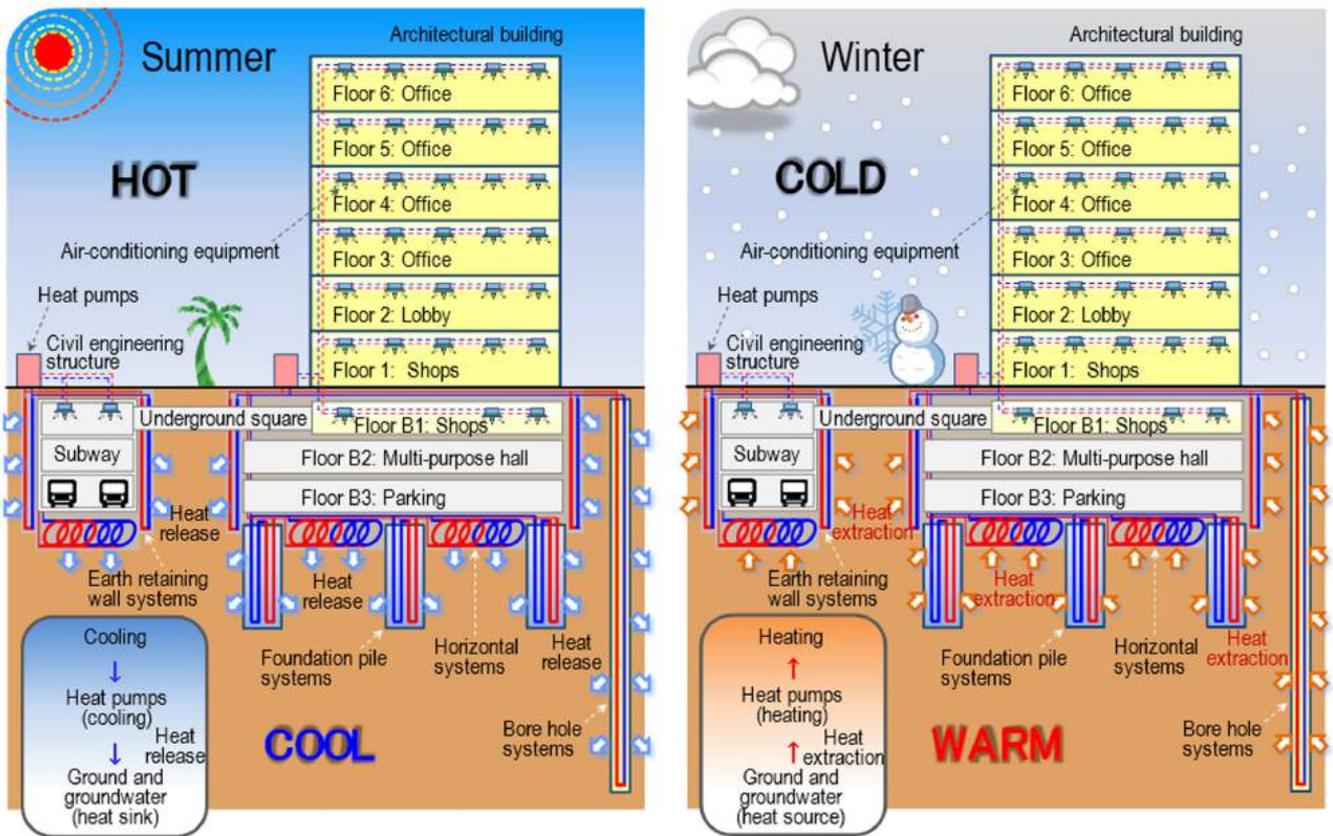
The company has continued its R&D efforts and acquired patented technologies through a project commissioned by NEDO and others, aiming to become the No.1 company in geothermal technologies. As a result, the company has succeeded in building infrastructure using ground-source heat by developing commercial systems with various heat exchange methods, including not only the common borehole method but also foundation pile, horizontal, and earth retaining wall methods. At present, Mitsubishi Materials Techno Corporation is promoting sales of these technologies as systems for using ground-source heat utilized through

urban infrastructure, aiming to contribute to smart cities in the future.

Approx. 130 systems from the company have been installed. In FY2020, the company completed one of the largest projects in Japan, which combines the borehole method (100 m in depth x 120 boreholes) and the horizontal method (nine approx. 100 m long trenches), at the construction site of the Nishine Hospital of Hachimantai City. It also completed one of the largest projects in the Tokyo metropolitan area, which applied the foundation pile method (66 cast-in-place piles) at the construction site of the new building of Yokohama City Hall. Through these and other projects, the use of ground-source heat is expanding. Moving forward, Mitsubishi Materials Techno Corporation plans to strengthen project proposals with the open loop method, with which groundwater is pumped up directly and used.

► [Geothermal Heat Pump System \(Mitsubishi Materials Techno Corporation\)](#) 

■ Overview of the system for using ground-source heat utilized through urban infrastructure



■ Heat exchange systems and examples of projects which adopted them

Bore hole systems	Foundation pile systems	Horizontal systems	Earth retaining wall systems
 <p>Heat supply to the Tokyo Skytree District Sonic drill method Japan's first district heating and cooling system (DHC)</p>	 <p>Adopted for use in more than 20 projects Compatible with cast-in-place piles, precast concrete piles, and steel pipe piles as well</p>	 <p>Patent No. 5624533/ 5859731 Quadruple tracking project of Odakyu Electric Railway The first adoption of this technology for a railway tunnel project in Japan Technological Development Projects for Global Warming Countermeasures Scheme by the Ministry of the Environment (FY2011 to FY2012, FY2012 to FY2014)</p>	 <p>Patent No. 5384058 NEDO project for developing technologies for using renewable energy (FY2016 to FY2019)</p>

For Capture and Storage and Effective Use of Carbon Dioxide

At the Mitsubishi Materials Group, we take approach to study how to reduce the CO₂ emissions from production activities, by putting to good use the outstanding technologies for assessing underground structures, which we have built up since our foundation, as well as our human resources.

■ Carbon dioxide Capture and Storage (CCS)

In May 2008, we invested in Japan CCS Co., Ltd., which was established under the leadership of the Ministry of Economy, Trade and Industry. Through Japan CCS, we are participating in the Large-scale CCS Demonstration Project in Tomakomai and Investigation of Potential Sites for CO₂ Storage.

■ <Recovering and using CO₂ emitted from plants -- A demonstration launched in Kyushu>