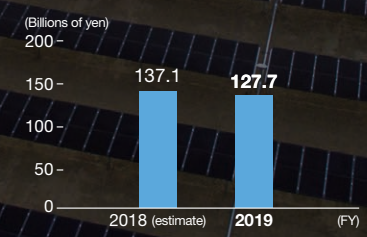
Power and Renewable Energy Segment

Review of Operations

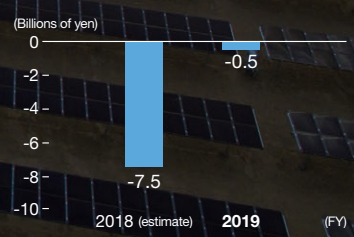
In the electric power business, we generate thermal power using highly efficient, environmentally friendly natural gas as well as byproduct gases and residues from oil refining conducted at our refineries. In addition, we operate renewable energy businesses, including solar, wind, and biomass power, in Japan and overseas. Furthermore, leveraging such in-house power sources, Idemitsu is involved in the electric power retail business in Japan, offering a wide range of electric power products and services to meet diversifying customer needs.

In the solar cell business, we are engaged in the R&D, production, and sale of CIS thin-film solar panels in collaboration with group company Solar Frontier K.K.

■ Net sales



■ Operating income + Equity earnings



Social Issues

- Energy security for Japan, which has a low energy self-sufficiency rate
- Global warming caused by increases in greenhouse gases from the consumption of fossil fuels
- Changes in the electric power supply and demand structure due to population decline, regional depopulation, and the growing use of renewable energy
- Increasing electric power demand in countries expected to see population growth
- Mass disposal of used solar modules expected from 2030 onward

Strengths

- Power source mix comprising diverse Company-owned power plants, including renewables, and accumulated operational know-how
- Accumulated solar power plant development expertise and know-how
- Integrated supply chain spanning from power generation to retail
- Diverse electric power retail products and services that meet the needs of both corporate and individual customers
- Accumulated R&D expertise and production know-how related to solar panels, including CIS thin-film solar cells

Risks

- Decline in business profitability due to policy and institutional changes in Japan and overseas
- Increasing competition in the domestic retail business
- Construction delays and rising connection costs due to high demand for transmission lines in regions suited to power source development
- Falling sales prices due to intensifying competition in the solar panel market
- Procurement risk arising from the globalization of supply chains for solar modules and their materials

Opportunities

- Growing needs for renewable energy and high-efficiency power generation reflecting responses to climate change
- Transition to renewable energy being facilitated by lower adoption costs due to technological innovation and government support
- Growing social needs for decentralized energy supply related to such areas as strengthening domestic energy supply, local production for local consumption, and in-house consumption
- Greater business opportunities created by changes in systems related to the domestic electric power business
- Growing electric power demand, mainly in emerging countries and Asia
- Growing recycling needs in line with the shift toward an advanced recycling-oriented society

Business Environment

In Japan, the business environment going forward is expected to be affected by government policy and the development of decarbonization and other technologies. Specifically, changes will include the formation of new markets, the shift toward renewables as primary power sources, and revisions to the feed-in tariff (FIT) for renewable energy. At the same time, intensifying competition related to solar panels due to the market entry of Chinese manufacturers remains a cause for concern.

Because of the decline in economic activity caused by the global spread of COVID-19 in early 2020, factory and office utilization fell, leading to a significant temporary decrease in electric power demand. While economic activity has recovered somewhat, going forward, some changes in patterns of such activity as well as in lifestyles and work styles are expected to be permanent, resulting in changes to the electric power demand structure.

Overseas, the further adoption of renewable energy and the economic development of emerging nations are expected to drive increases in electric power demand. However, as in Japan, the impacts of the COVID-19 pandemic are forecast to continue for some time.

Medium-term Management Plan

The Power and Renewable Energy Segment has designated as its mission meeting diversifying energy needs by developing and providing electric power solutions that only Idemitsu can in order to contribute to the creation of a sustainable society in and outside Japan. Our business is based on this mission.

In Japan, we will maintain the safe and stable operation of our power plants while leveraging the strength provided by our diverse holdings in renewable energy plants to meet the various needs of customers in Japan as well as accelerating calls for decarbonization. Furthermore, leveraging distributed energy resources (such as in-house power generation facilities, renewable energy, storage batteries, and electric vehicles), we will build up our expertise and know-how through pilot testing and co-creation with municipalities and other companies with an eye to business development related to promising new business models, such as virtual power plants (VPPs) and peer-to-peer (P2P) power trading.

Overseas, by promoting the North American gas-fired thermal power generation business, we will not only secure revenue, but gain know-how in power plant operations and business in liberalized markets that we can then use to enhance the competitiveness of our domestic electric power business. Furthermore, mainly in North America and Southeast Asia, which offer favorable sunlight conditions and policy environments, we will advance the development of new solar power plants, aiming to expand our renewable energy sources and thereby bolster revenue.

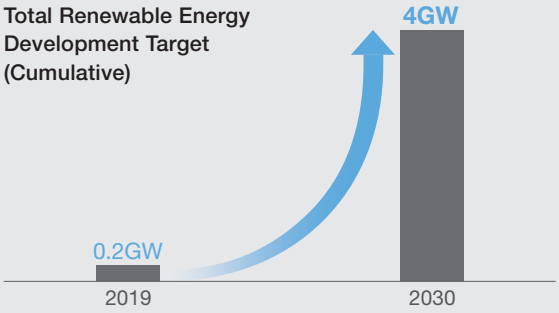
In terms of solar cell manufacturing and development, we will advance cutting-edge research into CIS thin-film solar cell technologies. At the same time, in sales, we will shift from sales of panels to package sales of power plants, aiming to grow our business while meeting needs for solar power plants in and outside Japan. Furthermore, we will advance R&D into recycling technologies to address the social issue of the mass disposal of solar panels, including crystalline silicon modules, expected from 2030 onward.

HIGHLIGHTS

Promoting Renewable Energy Development

We operate a diverse mix of power plants in and outside Japan with a total capacity of approximately 1.2 GW, of which approximately 0.2 GW is renewable energy. Going forward, we will continue to develop the power generation business worldwide. In renewables, specifically, we aim to reach 4 GW in cumulative total energy development by 2030, mainly through overseas solar power plants, an area of strength for the Company. By doing so, we will help reduce CO_2 emissions and contribute to communities.

Total Renewable Energy Development Target (Cumulative)



FY2020 Renewable Energy Development Plans
- Completion of solar power plant construction (California, United States) 210 MW
- Completion of solar power plant construction(California, United States) 50 MW
- Completion of solar power plant construction (Colorado, United States) 100 MW
- Beginning of biomass power plant construction (Tokuyama Complex, to begin operation in FY2022) 50 MW

■ Idemitsu Group's Power Generation Capacity (As of the end of October, 2020)

Power generation capacity*1	GW
Domestic solar power	0.11
Overseas solar power	0.05
Solar power (subtotal)*2	**0.16**
Biomass power	0.05
Wind power	0.02
Geothermal power*3	0.01
Renewable energy (subtotal)	**0.24**
Domestic thermal power	0.83
Overseas thermal power	0.11
Thermal power (subtotal)	**0.94**
Power generation capacity (total)	**1.18**

*1 Totals of Idemitsu's owned capacity
*2 Excludes the build-own-transfer (BOT) business (sales of power sources developed by Idemitsu)
*3 The geothermal power business is part of the Resources Segment

HIGHLIGHTS

Cutting-edge CIS Solar Cell R&D

We are engaged in the R&D, production, and sale of CIS thin-film solar cells. These solar cells are produced based on proprietary technology in which copper, indium, and selenium ("CIS") replace silicon as the key materials. We boast one of the largest CIS solar panel plants in the world, with an annual production capacity capable of producing enough cells to generate 0.9 GW.

In our CIS thin-film solar cell R&D, in addition to efforts to increase conversion efficiency and otherwise enhance our existing technologies, we are also actively working to develop new CIS thin-film solar cell and recycling technologies.

• Building-integrated Solar Cells

Aiming to expand the use of our CIS thin-film solar cells in the Chinese market, in November 2019 we formed a memorandum of understanding with Triumph Science and Technology Group—a Chinese company with advanced technologies and significant market share in the fields of solar power and glass—regarding the development of building-integrated solar cells. We are currently advancing research related to product development.

Image of a building integrated panels

• Ultra-lightweight Film Modules and Solar Cells for Vehicles

We were selected by the New Energy and Industrial Technology Development Organization (NEDO) for a joint research project related to ultra-lightweight film modules and solar cells for vehicles over the five years from FY2020 to FY2024.

Ultra-lightweight film modules enable the installation of solar panels on rooftops and other structures where conventional panels are unusable due to weight restrictions. Accordingly, as the use of solar cells spreads going forward, the creation and expansion of markets for such modules is expected. Solar cells for vehicles are being developed with the goal of installing solar cells on electric vehicles, with an eye to widespread use by 2050.

Ultra-lightweight film modules prototype

• Establishing Solar Panel Recycling Technologies

We were selected by NEDO for a joint research project related to establishing solar panel recycling technologies over the four years from FY2020 to FY2023. The mass disposal of solar cell modules is expected from 2030 onward. To address this, we are developing CIS thin-film solar panel recycling technologies. Using these technologies, we have successfully separated the individual materials, recovering more than 90% of the rare metals (such as indium and selenium) contained in the solar cells. We are also applying this technology to the recycling of crystalline silicon solar panels. Solar Frontier K.K. is building a test plant within its solar cell factory with plans to perform testing aimed at realizing the continuous operation of these recycling technologies by FY2023.

HIGHLIGHTS

Developing Natural Gas Thermal Power Plants in North America

We are taking part in power generation projects in North America in order to gain insight into power plant operations and market trading in the United States, a leader in electric power market liberalization, and applying such insight to its businesses in Japan.

One such project in the United States is the Cricket Valley Natural Gas Thermal Power Plant (generation capacity: 1,100 MW; owned capacity: 110 MW). We hold a 10% stake in the operating company of the plant, which began commercial operation in April 2020. This high-efficiency, low-environmental impact gas-fired thermal power plant is one of the few large-scale, high-efficiency power sources in New York State, a mass consumption area. The power that the plant generates is sold through the state's wholesale energy market (NYISO), contributing to a stable power supply.

In the United States, construction is also advancing on a natural gas-fired thermal power plant (generation capacity: 1,182 MW; owned capacity: 160 MW) in Ohio. Operations are planned to start in 2021.

Cricket Valley Natural Gas Thermal Power Plant (generation capacity: 1,100 MW)

HIGHLIGHTS

Selected to Provide 100% Renewable Energy as the First Supplier for the "Tocho Electric Power Plan"

Our wholly owned subsidiary Idemitsu Green Power K.K. has been selected as the first power supplier for the Tocho Electric Power Plan which is being implemented by the Tokyo Metropolitan Government. Under this plan, Idemitsu Green Power will supply 100% renewable energy* to some facilities owned by the Tokyo Metropolitan Government. This renewable energy will include post-FIT power purchased from households in Tokyo in a scheme designed to prevent a decrease in the use of renewable energy after the FIT purchase period ends.

We will continue to contribute to the spread of renewable energy by leveraging its expertise in the sale of home-use power as well as its diverse range of power sources, including wind, geothermal, biomass, solar, and hydroelectric power.

* Power that will effectively be 100% renewable energy, comprising a combination of renewable energy, including that from the feed-in tariff (FIT) system, with non-fossil fuel energy certificates (from renewable energy) and post-FIT power