



## Our Response to Climate Change

### Basic Stance

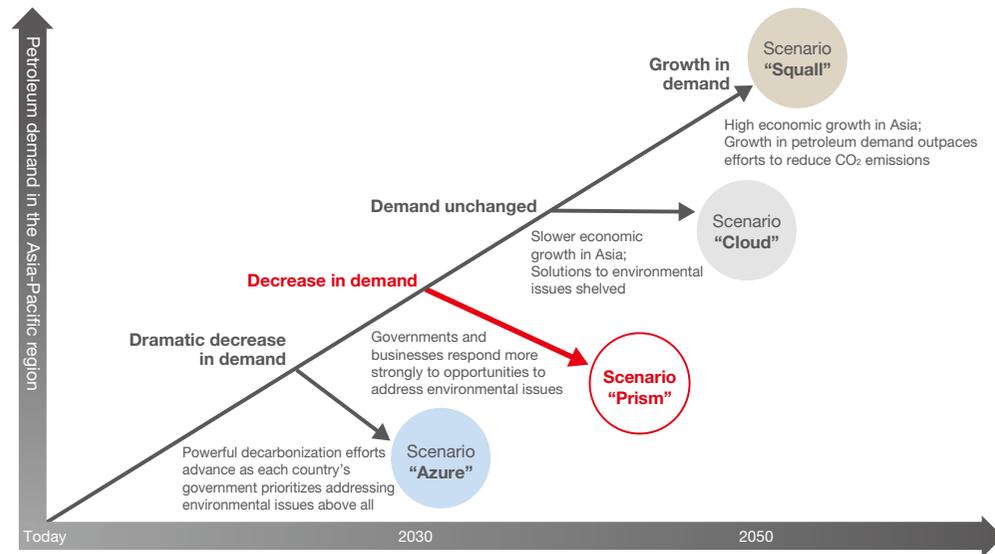
Recognizing that responding to climate change is one of the most important issues that must be addressed on a global scale, the Idemitsu Group works to tackle this issue through both “mitigation” and “adaptation” by making maximum use of our resources.

Specifically, by examining a range of possible future business environments based on the analysis of multiple scenarios, we identify risks and opportunities and reflect them in our strategies and initiatives.

### Scenario Analysis

With regard to risks and opportunities associated with climate change, we use scenario analysis to explore possible energy transition pathways resulting from decarbonization, the development of environmental technologies, and social change as well as to examine their impacts on our company. This scenario analysis is designed to identify energy demand and the effects of climate change in the Asia-Pacific region, assuming business environments in 2050 as follows. We prepared four scenarios. Of these, one scenario assumes an increase in energy demand that exceeds the trend toward low-carbon emissions due to high economic growth across Asia, while another assumes that the targets of the Paris Agreement have been achieved. (See the diagram below.) Currently, we are examining specific priority issues in a way that is particularly conscious of the “Prism” scenario, in which our group is expected to take stronger environmental measures. This scenario assumes that, in 2030, domestic petroleum demand will decrease 30% compared with the 2017 level. As an energy supplier, we are acutely aware that significant risk could emerge under this scenario. Accordingly, we actively engage in deliberating priority issues based on this analysis.

#### ■ Long-term Scenarios for Conditions of the Energy Business in the Run-up to 2050



### Risks and Opportunities

Based on the results of this scenario analysis, we are examining the risks and opportunities we face. As for transitional risk, we have identified a possible decline in fuel oil demand in step with the popularization of electric vehicles (EVs) and changes in consumer awareness, in addition to a risk of deterioration in the overall reputation of the fossil fuel sector. On the other hand, given the increasing demand for renewable energy and environmentally friendly products, we are aware of opportunities to contribute to the realization of a low-carbon society and to expand our businesses.

Taking these factors into account, we aim to reform our business portfolio in order to become a group of resilient companies by responding to these risks and strengthening our business initiatives to capture opportunities. (Quantitative Targets for Business Portfolio ⇒ P.9)

Classification	Matters to be evaluated	Responses and initiatives
Transition risks	Decline in demand for petroleum products due to the spread of EVs and changes in consumer awareness	Market monitoring and the establishment of optimal production, supply and sales systems Departure from the business portfolio depending on fossil fuel
	Decline in energy prices due to technological advances	Strengthening of the competitiveness of the entire supply chain
	Possibility of divestment of the coal business	Development of black pellets and biomass co-firing technology
	Decline in the reputation of the oil and coal businesses	Strengthening of external engagement
Physical risks	Introduction of carbon pricing	Internal discussions of carbon pricing
	Suspension of equipment operation and production sites damage due to abnormal rainfall and others	Reinforcement of equipment maintenance and strengthening of the supply chain
	Impact of sea-level rise on manufacturing and distribution bases	Measures such as reinforced seawall and relocation of control rooms
Opportunities	Expanding demand for renewable energy	Development of renewable energy sources in Japan and overseas
	Strengthening of IMO (International Maritime Organization) regulations	Efficiency improvement and reinforcement of refinery facilities
	Increasing demand for environmentally friendly products with low environmental impact	R&D and overseas expansion of lubricants for electric vehicle units, advanced greases, and biological pesticides
	Increasing demand for energy-saving materials	Development of applications for next-generation materials and commercialization of all solid state lithium-ion battery materials
	Development of distributed energy resource systems	Development of and entry into VPP (Virtual Power Plant) control services
	Development of the circular economy	Development of recycling technologies for waste plastics, solar panels, carbon, etc.
	Advent of the MaaS (Mobility as a Service) society	Development leveraging the existing refueling network and entry into ultra-compact EVs
Development of natural gas resources	Shifting focus from oil to gas	

### Risk Management

Climate change-related risks identified via our analyses are handled by the Safety & Environmental Protection Headquarters and departments in charge of corporate planning. These risks are also reported to the Management Committee. Furthermore, the Management Committee assesses and evaluates the magnitude of each risk and reports its conclusions to the Board of Directors through the President and Representative Director. We are also developing a comprehensive risk management system that incorporates ESG elements into our internal control system. Issues recognized in the course of identifying risks and opportunities are referred to departments specializing in relevant areas to enable them to fully discuss and address each risk in a way that employs input from outside experts.



## Our Response to Climate Change

### Internal Carbon Pricing

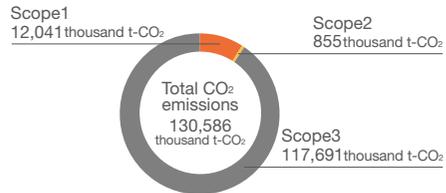
In recent years, businesses have increasingly been called on to step up their response to climate change. We expect this trend will put our company in a position where we face both risks and opportunities. With this in mind, we are nurturing active internal discussion on how to decarbonize our businesses. To this end, we have established internal carbon pricing of investments related to new projects and decided to carry out trial-basis investment studies that reference the economic impact of carbon dioxide (CO<sub>2</sub>) emissions.

### Concept on How to Mitigate the Impact of Climate Change

Looking at the composition of greenhouse gas (GHG) emissions associated with our group's operations, emissions arising from the consumption of our products (Scope 3) far exceed emissions from our refineries, complexes, and plants (Scope 1) and emissions mainly attributable to purchased energy (Scope 2). Scope 3 emissions constitute the overwhelming majority of our emissions (see the graph below). This is why we prioritize reducing GHG emissions across value chains. Accordingly, our reduction efforts not only aim to curb Scope 1 and 2 emissions, but also target Scope 3 emissions. In doing so, we are placing the utmost priority on reducing CO<sub>2</sub> emissions, which account for more than 90% of Japan's GHG emissions.

Value chains related to Idemitsu Group operations are diverse. Therefore, we are better placed to help reduce CO<sub>2</sub> emissions from value chains in a range of areas. Looking ahead, we will strengthen our efforts in these areas and contribute to a reduction in CO<sub>2</sub> emissions.

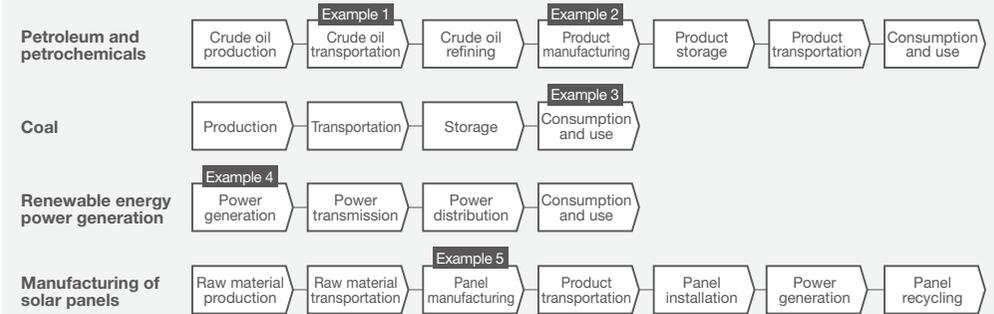
#### ■ Our Group's CO<sub>2</sub> Emissions by Scope (FY2019)



Notes: 1. Scope of calculation: Idemitsu Kosan and consolidated subsidiaries  
2. Data regarding GHG emissions (CO<sub>2</sub> equivalent) is featured on "ESG Data" (P.74).

In conjunction with business integration in 2019, we found differences of calculation methods used by the two pre-merger companies for measuring CO<sub>2</sub> emissions. The differences are outside of the scope of the relevant domestic regulations requiring disclosure. In response, we partially revised and otherwise upgraded our calculation methods with reference to the globally accepted disclosure standards.

#### ■ Business value chains and efforts to reduce CO<sub>2</sub> emissions



#### Reducing CO<sub>2</sub> emissions in value chains

- Example 1** Reducing fuel consumption by improving the operational efficiency of crude oil carriers
- Example 2** Reducing fuel consumption by promoting energy-saving at refineries
- Example 3** Reducing coal consumption by introducing a high-efficiency combustion system for coal-fired boilers
- Example 4** Reducing dependence on fossil fuel power generation by expanding renewable energy power generation
- Example 5** Expanding renewable energy power generation by manufacturing and supplying solar panels



## Our Response to Climate Change

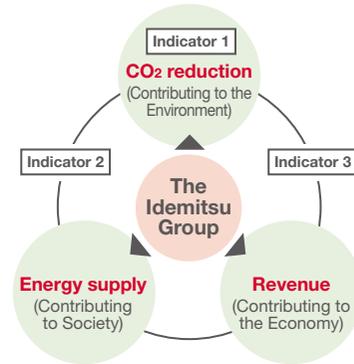
### CO<sub>2</sub> Reduction Targets and Monitoring Indicators

We recognize that an environmental contribution consisting only of a reduction in our CO<sub>2</sub> emissions is not enough to secure corporate sustainability. Along with these reduction efforts, we need to contribute to society by providing low-carbon energy with a view to transitioning to a low-carbon society in the future. Moreover, we also aim to contribute economically by generating constantly robust profits even as we shift our business portfolio. We consider all of these endeavors to be matters of equal importance.

In addition to our fossil fuel business, we conduct business related to the development of renewable energy and environmentally friendly products, as well as research aimed at solving social issues. These activities contribute to the reduction of CO<sub>2</sub> emissions on a global scale throughout our value chain. We recognize that this concept will become even more important in the future along with the reduction of CO<sub>2</sub> emissions by the Group.

Based on this recognition, in 2019 the Group established three indices to accelerate its efforts to reduce CO<sub>2</sub> emissions.

In light of the Japanese government's declaration of achieving carbon neutrality by 2050, we aim to contribute to the reduction of CO<sub>2</sub> emissions through the supply of low-carbon energy.



#### Target value

##### Indicator 1 Reduction of the Group's Scope 1 + 2 emissions

(An indicator of the extent to which "Scope 1 + 2 emissions" have been reduced through the promotion of energy conservation activities at refineries, complexes, and plants, etc.)

**2030 Target: Cut levels by 2 million ton-CO<sub>2</sub>** (compared to 2017 levels)

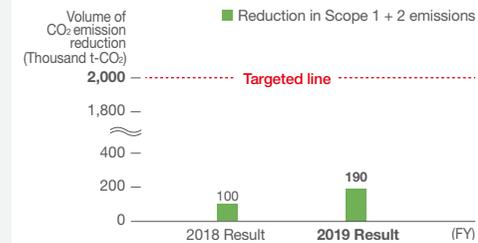
(Calculation formula) = CO<sub>2</sub> emissions in target year (Scope 1 + 2) – CO<sub>2</sub> emissions in base year (Scope 1 + 2)

**FY2019 Results: down 1.3 million ton-CO<sub>2</sub>**

(reduction activities: down 0.19 million tons; other: down 1.11 million tons)

In fiscal 2019, the progress of energy conservation activities at refineries and plants was ahead of schedule, and the Company's CO<sub>2</sub> reduction activities are steadily contributing to progress toward the target (see the graph on the right). It should be noted that, due to a long-term unplanned suspension caused by malfunctioning equipment at a refinery, the lower CO<sub>2</sub> emissions from the reduced operations dovetailed nicely with our deliberate efforts to cut emissions, resulting in a larger than expected reduction.

##### Results of our reduction efforts targeting Scope 1 + 2 emissions



#### Monitoring indicator

##### Indicator 2 Low carbon level of supplied energy

(Indicator of the extent to which an energy company can reduce the "CO<sub>2</sub> emissions per unit of energy" supplied to society)

**2050 Indicator Level: down 30%** (compared to 2017 levels)

(Calculation formula) =  $\frac{\text{CO}_2 \text{ emissions (Scope 1 + 2 + 3)} - \text{CO}_2 \text{ avoided emission}^*}{\text{Amount of energy supplied to society}}$

**FY2019 results: down 0.8%**

\* CO<sub>2</sub> reduction contribution throughout the entire value chain

(We intend to revise this target from time to time in light of social trends)

##### Indicator 3 Degree of carbon exit from corporate earnings

(Indicator of how the "Revenue level per unit of CO<sub>2</sub>" emitted by the Company as a whole is being raised)

(Calculation formula) =  $\frac{\text{Revenue}}{\text{CO}_2 \text{ emissions (Scope 1 + 2 + 3)} - \text{CO}_2 \text{ avoided emissions}^*}$

We have not currently established a target for this indicator and use it for internal purposes only.

\* CO<sub>2</sub> reduction contribution throughout the entire value chain



## Our Response to Climate Change

### Reducing CO<sub>2</sub> Emissions Throughout Entire Value Chains

We are committed to reducing CO<sub>2</sub> emissions globally along the entirety of our value chains. We will promote the reduction of CO<sub>2</sub> emissions through our business activities in the following five areas.

- (1) Promoting Energy Conservation and Zero-Emission Electric Power Consumption
- (2) Provision of environmentally friendly products and services
- (3) Expansion of renewable energy power generation
- (4) Expansion of Biomass Fuel Supply
- (5) Development and social implementation of innovative technologies

#### Promoting Energy Conservation and Zero-Emission Electric Power Consumption

We are working to reduce direct and indirect CO<sub>2</sub> emissions attributable to our refineries, complexes, and plants. Staff at our main manufacturing sites hold monthly meetings to monitor progress in energy conservation activities while sharing best practices in a way that transcends departmental boundaries.

##### ● Modification of resid hydrodesulfurization unit raises efficiency

In May 2020, the Chiba Complex modified its resid hydrodesulfurization unit to raise its efficiency. This project was intended to secure our responsiveness to regulations enforced by the International Maritime Organization (IMO) with regard to the limitation of sulfur content in marine vessel fuel.

##### ● Construction of a highly efficient naphtha cracker

Currently, a construction project is under way at the Tokuyama Complex to introduce a highly efficient naphtha cracker, with plans calling for completing the introduction by the end of FY2020. The project involves the suspension of two naphtha crackers, old models that have been part of our ethylene manufacturing facility. These naphtha crackers will be replaced with a single new, high-efficiency model capable of performing the thermal decomposition of raw materials in less time. Thanks to this feature, the new cracker will help us raise the yield ratio of resulting ethylene while improving the thermal efficiency of production process. Accordingly, we anticipate the new ethylene production process will achieve roughly a 30% drop in energy consumption from the level prior to the upgrade.

##### ■ Construction of a highly efficient naphtha cracker (Tokuyama Complex)



Reducing energy consumption via fresh capital expenditure

##### ● Promoting the use of renewable energy sources

We decided to begin powering our 15 domestic oil depots with renewable energy provided by Idemitsu Green Power K.K. Under contract, this group company will supply a total of 2,200 kW from FY2020.

##### ● Initiating development of floating offshore wind power turbines that directly connect to oil and gas production facilities

Group company Idemitsu Snorre Oil Development Co., Ltd. has received permission from the Norwegian government for its development project to install floating offshore wind power turbines at the Snorre Oilfield, in which it owns a stake, through its local subsidiary Idemitsu Petroleum Norge AS. Aiming to start operations at the end of 2022, the company initiated construction of the floating offshore wind power equipment in October 2020. Plans call for assembling it in the Gulen municipality of western Norway, and then installing it offshore. The world's first project of its kind, this development project is aimed at establishing a large-scale offshore wind farm (the Hywind Tampen floating wind farm) approximately 200 kilometers off the coast of Bergen City, the western part of Norway, and directly feeding its output to oil and gas production facilities. The completed wind farm will consist of 11 turbines, each with a rated power output of 8,000 kW, or a combined total of 88,000 kW.

Looking ahead, our company will proactively incorporate advanced technologies to advocate for the reduction of environmental burden in the course of our resource business.

##### ■ Floating wind turbines feeding renewable energy to an offshore oil field



Idemitsu acts as a co-participant in the project in tandem with Equinor and other partners.

## Our Response to Climate Change

### Provision of Environmentally Friendly Products and Services

We provide products and services designed to help reduce CO<sub>2</sub> emissions. By doing so, we contribute to the CO<sub>2</sub> emissions reduction efforts of not only Idemitsu Group entities but those of other companies.

#### ● Cumulative solar panel shipments worldwide surpass 6GW milestone

Solar Frontier K.K. is a Group company specializing in solar panel production and sales. As of the end of FY2019, its cumulative production and shipments of panels hit a milestone of 6GW. This accomplishment is proof of solid customer trust, which Solar Frontier has earned by supplying panels that, thanks to CIS thin-film solar cell technologies, deliver superior energy yield in actual operational settings that extend to environment with high-temperature or limited sun exposure. Other factors contributing to this record include stable product quality supported by the company's fully domestic production process and robust after-sales services, including a 20-year product guarantee.

#### ● Marketing of ULTY-V plus™ coal boiler control optimization system

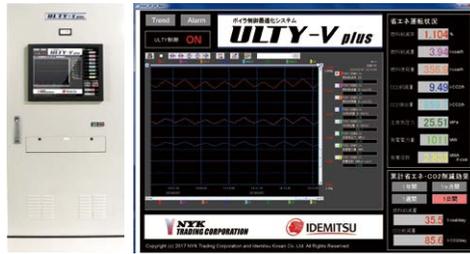
We developed the ULTY-V plus™ coal boiler control optimization system in tandem with the NYK Group. Once introduced, this system enables our customers to reduce coal consumption approximately 1%, thus helping them improve economic efficiency and reduce CO<sub>2</sub> emissions. In March 2019, we also established NYK IDEMITSU Green Solutions Co., Ltd., a fifty-fifty joint venture, in tandem with the NYK Group. The new company will work to step up solution proposals aimed at marketing the system. In FY2020, we signed a supply contract with Formosa Plastics Corporation headquartered in Taipei, Taiwan, with the aim of delivering six ULTY-V plus™ units. Although approximately 100 units are already in operation in Japan, the aforementioned contract is the first deal of its kind with an overseas customer.

#### ■ Production of Japan-made solar panels (Kunitomi Plant, Solar Frontier K.K.)



Japan's largest facilities of this kind in terms of production capacity

#### ■ Sale of ULTY-V plus™ coal boiler control optimization system



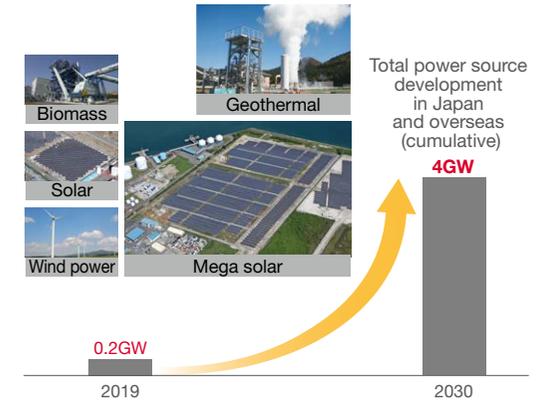
Helping to curb coal consumption through optimal operational control

We also promote the development of environmentally friendly products in growth business fields, including those listed below.

- Products compatible with EVs (high-performance lubricants and grease)
- Development of all-solid-state lithium-ion battery materials
- Next-next-generation high-performance (e.g., ultra-high-efficiency) solar panels
- Advanced greases (the utilization of cellulose nanofiber, a biodegradable and safe material derived from wood pulp for use in food processing machinery)

### Expansion of Renewable Energy Power Generation

In line with our aim to promote the supply of energy from sources with lower carbon footprints, we operate a number of renewable energy power plants at home and abroad. As of the end of October 2020, our network of plants encompassed solar, geothermal, biomass, and wind power plants in Niigata, Oita, Kanagawa, and elsewhere in Japan as well as in Vietnam. Going forward, we will significantly expand the use of renewable energy sources in Japan and overseas toward 2030 by leveraging our accumulated operational know-how.

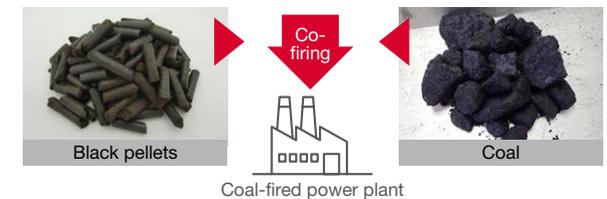


#### FY2019 Initiatives

- Completed a 49.5MW mega solar plant in Vietnam
- Decided to commercialize biomass power generation at the Tokuyama Complex
- Initiated a 100MW solar power generation project in Colorado, the United States
- Initiated a 50.5MW solar power generation project in California, the United States
- Participated in an 80.9MW solar power generation project in the Philippines
- Initiated environmental assessments in connection with a geothermal power generation project in the Oyasu district of Akita Prefecture

### Expansion of Biomass Fuel Supply

Even as we strive to promote renewable energy generation projects, we are engaged in biomass fuel-related operations as part of our efforts to supply energy from sources with lower carbon footprints. Specifically, we are developing black pellets, a biomass fuel that can be co-fired with coal at coal-fired power stations to reduce CO<sub>2</sub> emissions.



Black pellets are made by pulverizing, drying, and roasting wood to semi-carbonize it. Compared with conventional white pellets, black pellets boast superior properties, including water resistance, and are easier to crush. Along with these features, they can be handled in the same way as coal. This makes it possible to reduce coal consumption without modifying existing power generation facilities while increasing the use of renewable energy sources in the form of black pellets. Proving this point, Idemitsu's Tokuyama Complex has successfully used a feed of 20% black pellets in combustion trials at its coal boilers. In 2020, in addition to the existing demonstration plant in Thailand, we built a sample production plant in Vietnam. Going forward, we will advance preparations to commence commercial production.

Furthermore, using idle land at the Ensham Coal Mine in Australia, we have begun test cultivation of sorghum and test production of black pellets using this crop. Going forward, we plan to advance demonstration tests aimed at the commercial export of biomass fuels leveraging our mine infrastructure.

## Our Response to Climate Change

### Development and Social Implementation of Innovative Technologies

Technological innovation is indispensable to achieving the goals of the Paris Agreement, which is an international framework related to climate change. With this in mind, we will carry out demonstration testing and otherwise strive to advance such promising technologies as carbon dioxide capture and storage (CCS), carbon dioxide capture and utilization (CCU), and hydrogen energy, which is completely free of CO<sub>2</sub> emissions. Taking a proactive approach, we aim to achieve much-anticipated breakthroughs in these fields and to commercialize solutions that promote the transition to a low-carbon society.

#### ■ Participation in “Challenge Zero,” Keidanren initiative

We are a participant in “Challenge Zero,” an initiative sponsored by the Keidanren (Japan Business Federation) in collaboration with the Japanese government, with the aim of contributing to the realization of a decarbonized society, the long-term goal defined by the Paris Agreement—an international framework for climate change countermeasures. To this end, participants in “Challenge Zero” are acting as strong advocates of decarbonization efforts at home and abroad, as well as encouraging other businesses and organizations to take action and tackle the challenge of achieving innovation.

A dedicated website for the Keidanren Challenge Zero initiative <https://www.challenge-zero.jp/en/member/27>  
(Articles describing innovation achieved by Idemitsu are featured.)



#### ■ Cooperation in the CCS demonstration project

We have been cooperating in a CCS demonstration project run by Japan CCS Co., Ltd. The project is being executed in Tomakomai, Hokkaido Prefecture and is commissioned by the Ministry of Economy, Trade and Industry (METI) and New Energy and Industrial Technology Development Organization (NEDO). In this case, CCS refers to a technology that absorbs CO<sub>2</sub> from gaseous power plant emissions before it can be released into the atmosphere, pumping it deep underground to sequester it. Since April 2016, our role in the project has been to supply the gas containing CO<sub>2</sub> from the Hokkaido Refinery for use in the demonstration project. As of November 22, 2019, the project achieved a cumulative total of 300,000 tons of CO<sub>2</sub> sequestration, meeting the initial target. Having ceased sequestration, the project is currently in the monitoring phase to confirm whether there are any leaks or other abnormalities.

#### ■ Participation in the Working Group on the Roadmap for Carbon Recycling Technologies

We participated in the Working Group on the Roadmap for Carbon Recycling Technologies established by the METI. The Working Group was established to promote an effective and rapid development of carbon recycling technologies. The roadmap was compiled in June 2019.

#### ■ Cooperation in the Hydrogen Supply Chain Demonstration Project

We have been cooperating in the world's first international hydrogen supply chain demonstration project promoted by the Advanced Hydrogen Energy Chain Association for Technology Development (AHEAD) supported by NEDO. This project will contribute to the utilization of hydrogen, which does not emit CO<sub>2</sub> during combustion, in large-scale power generation. In this project, hydrogen is separated from liquid (methylcyclohexane), which is transported from Brunei Darussalam, by a demonstration plant newly constructed by AHEAD on the premises of Keihin Refinery of TOA Oil Co., Ltd., an Idemitsu Group company. The plant was brought on line at the Keihin Refinery in April 2020 and is supplying hydrogen for use by TOA Oil's thermal power generators as fuel and other applications. In addition to cooperating in plant construction, we are assisting this project from the aspect of demonstration testing. Specifically, we dispatch human resources and carry out other project-related tasks while assuming the role of a hydrogen consumer.

#### ■ Conceptual drawing of the dehydrogenation plant



#### ■ Participation in the “Hydrogen Utilization Study Group in Chubu”

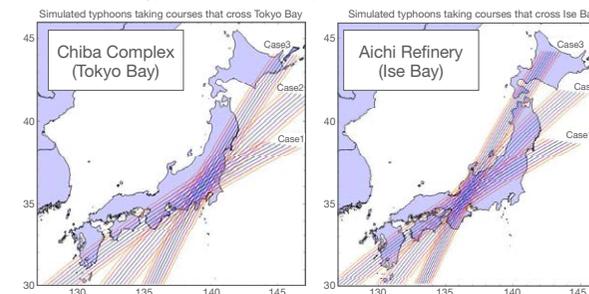
In tandem with nine other private-sector companies that are taking on the challenge of promoting hydrogen utilization, we launched a study group aimed at discussing the possibility of hydrogen utilization on an industrial scale. The study group is looking to build a hydrogen supply chain in the Chubu area to help stimulate demand growth and ensure stable utilization, to this end engaging in a feasibility study aimed at assessing such factors as the potential of hydrogen energy as well as the costs arising from its introduction.

### Concept on Climate Change Adaptation

With an increasing frequency of ever more severe natural disasters striking Japan, it is extremely important to identify possible disaster risks via the development of diverse scenarios. We assume earthquakes, flooding, high tides and other emergencies so that we can minimize damage to our refineries and complexes and ensure that operations at these facilities can be promptly restored. To strengthen our ability to ensure safety, we will therefore direct capital expenditure to upgrade facilities, while enhancing operational procedures and human resource capabilities, to mitigate damage even in the event of a disaster with unprecedented severity. By doing so, we will continue to fulfill our mission as an energy supplier.

In recent years, a growing number of typhoons have passed through a large part of the Japanese archipelago while remaining at full strength. This phenomenon is believed to be due in part to climate change. As these typhoons often induce high tides, our refineries and complexes located in coastal areas are facing a growing risk of flooding. In response, we have conducted risk analysis associated with the impact of flooding due to high tides based on the simulation of typhoons of the largest-possible scale taking courses that directly cross these facilities' sites. Based on the results of this analysis, we are considering the reinforcement of facility structures via, for example, the installation of flood walls to safeguard seawater pump rooms in addition to the enhancement of disaster response manuals and other procedures designed to provide our staff with guidance on how to mitigate disaster damage.

#### ■ The course of typhoons assumed to provide a basis for the estimation of damage on refineries



#### ■ Illustration of damage from high tides

A surge in water level

$$= \text{inverse barometer effect} + \text{rise in average sea level due to breaking waves} + \text{wind surge}$$

