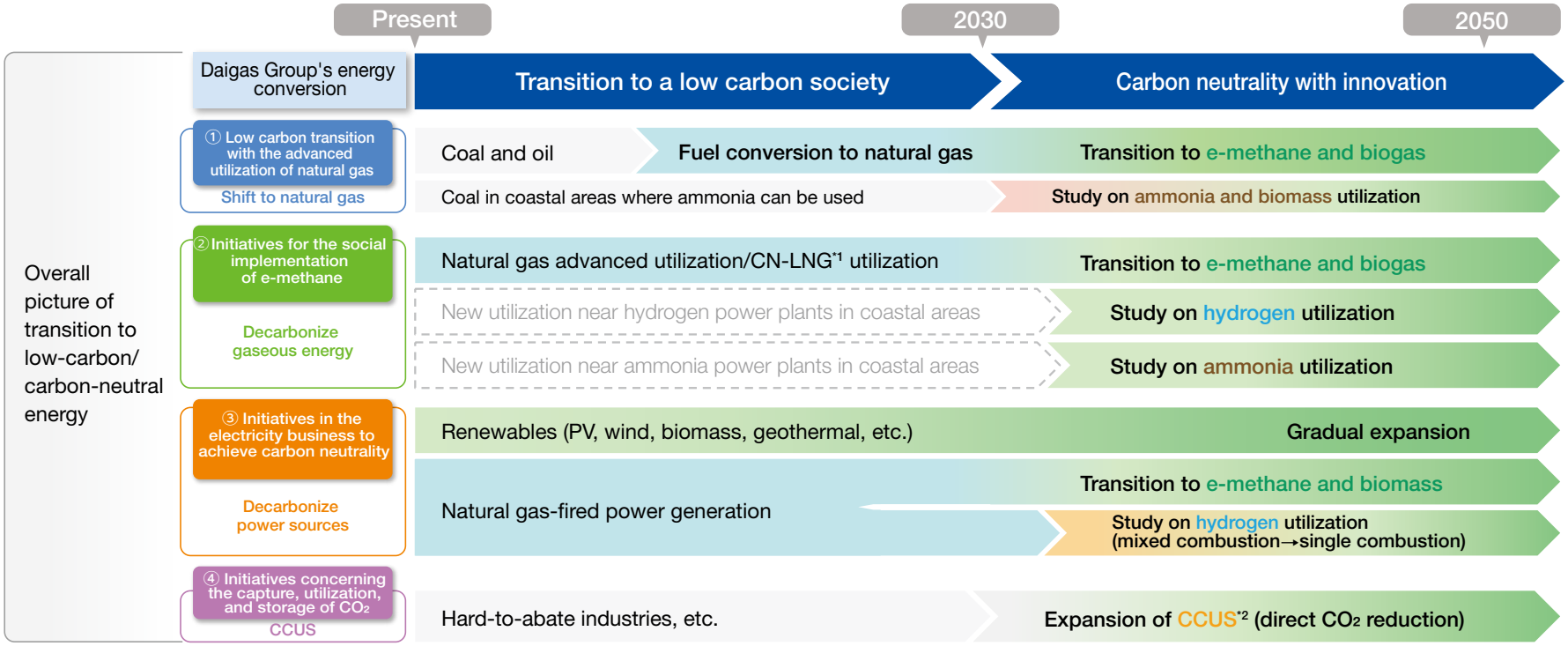
Achieving a low-carbon/carbon-neutral society

Energy Transition 2030

Under Energy Transition 2030 (ET2030), the Daigas Group outlines the overall picture of its transition to low-carbon and carbon-neutral energy.

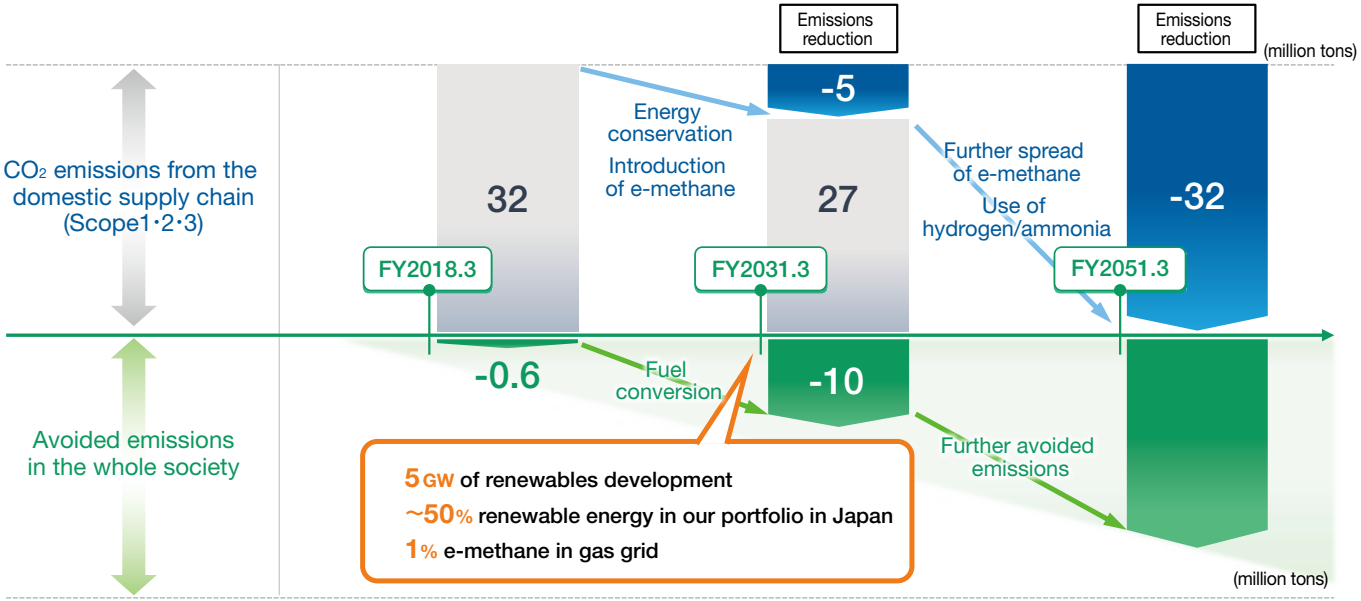
In order to achieve carbon neutrality, a steady transition to low-carbon energy is crucial, as a great deal of time and social cost will be required for technological innovation and the building of new supply chains. It is also important to choose optimal energies and supply methods to suit the customer's energy use characteristics, such as the balance of electricity and heat use and their location. Focusing on the transition to low-carbon energy by 2030 through a shift from coal and oil to natural gas, and the seamless transition to carbon-neutral energy with the introduction of e-methane and biogas in the future, we will continue to pursue the decarbonization of power sources in ways that meet customer needs. This will include the use of hydrogen and ammonia, the decarbonisation of power sources, such as renewable energy generation and zero-emission thermal power plants. The following pages present the Daigas Group's roadmap for CO_2 reduction, along with the background and approach to our major initiatives for decarbonization through ① Low carbon transition with the advanced utilization of natural gas, ② Initiatives for the social implementation of e-methane, ③ Initiatives in the electricity business to achieve carbon neutrality, and ④ Initiatives concerning the capture, utilization, and storage of CO_2.



*1 CN-LNG: Carbon Neutral LNG, which is considered to produce no CO_2 on a global basis when greenhouse gases emitted in the supply chain from natural gas production to combustion are offset by CO_2 absorbed and reduced in a separate process from the value chain.
*2 CCUS: Carbon dioxide Capture, Utilization and Storage

Daigas Group's CO_2 Emissions Reduction Roadmap

In Energy Transition 2030, we have declared targets for 2030 and 2050 regarding CO_2 emissions in our domestic supply chain and avoided emissions in the whole society, and presented a CO_2 emissions reduction roadmap. Through such measures as the 1% introduction of e-methane into existing infrastructure, we will aim to reduce the CO_2 emissions of the Daigas Group's supply chain in Japan by 5 million tons, and 10 million tons of avoided emissions in society as a whole in FY2031.3 through the Group's activities. After the introduction of e-methane in FY2031.3, we will pursue decarbonization through its wider use.



Decarbonize power	Low-carbon/carbon neutral power (renewables, e-methane, hydrogen, and CCUS)
Decarbonize gas	Low carbon transition with natural gas → Carbon neutrality with e-methane
Reduce in-house emissions	Net zero in our office buildings and vehicles
Investment valuation	Application of internal carbon pricing (ICP)

Introduction of ICP

Osaka Gas introduced the concept of "Environmental Management Efficiency" in 2003, which is used to quantify the environmental impact of business activities by converting environmental impacts per volume of gas produced into monetary values.

In addition, from FY2022.3, we have adopted internal carbon pricing (ICP) to identify the carbon impact of our invested projects.

From FY2024.3, we also reference ICP when making decisions on new investments in business fields that have a large carbon impact.

Joint investment in forest fund established by Sumitomo Forestry Group

In July 2023, Osaka Gas announced its joint investment, along with nine other Japanese companies, in the Eastwood Climate Smart Forestry Fund I ("the Fund") established by the Sumitomo Forestry Group.

The pooled capital amounts to approximately ¥60.0 billion and will be invested over 15 years. By 2027, the pooled capital will have been invested in the acquisition and management of 130 thousand hectares of forest, primarily in North America. With a target of sequestering an additional 1 million tons of carbon dioxide a year, the Fund will promote the production and trading of high-integrity carbon credits, which will contribute to the realization of a decarbonized society.

The Fund will deliver global climate benefits by supporting responsible forest management at a spatial and financial scale beyond that which individual companies could achieve on their own.

1 Low Carbon Transition with the Advanced Utilization of Natural Gas

The Daigas Group is proceeding with fuel conversion from coal and oil, etc. to natural gas, which emits less CO_2, and with the introduction of energy-saving technologies (cogeneration, etc.). The Group is thus contributing to CO_2 reduction in society as a whole. We are undertaking the fuel conversion not only in the Kansai area, but throughout other parts of Japan and in the Asian region, and will expand this activity even further going forward.

Contribution to low carbon transition with the introduction of gas cogeneration systems

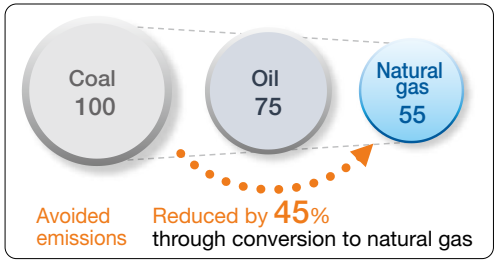
The Group is contributing to low carbon transition through the introduction of gas cogeneration systems to customers. Cogeneration systems generate power with city gas and use the waste heat generated for other applications such as cooling and heating, hot water supply, and steam, thus realizing high overall energy efficiency of 70-90%. Since the initial introduction in 1982, we have installed systems totaling 1.50 GW. In March 2022, we developed a new and improved gas cogeneration system that offers even higher power generation efficiency. This new system will also contribute to power security because gas can be used to generate power during blackout.

Approach to Avoided Emissions in Society

The following sums up our approach to avoided emissions in society. For example, we can reduce approximately 45% of CO_2 emissions with the switch from coal to natural gas. However, if we have supplied the natural gas, our gas sales volumes increase, which means an increase in Scope 3 CO_2 emissions according to the GHG Protocol*1 that is commonly used by companies to calculate their CO_2 emissions. For this reason, in the transition phase until 2030, our CO_2 emissions will increase by promoting fuel conversion from oil and coal to natural gas. On the other hand, by switching to natural gas, CO_2 emissions per the same calorific value will be reduced, which means that we can contribute to CO_2 emissions reduction in the whole society. However, under the current GHG Protocol, there is no way of evaluating the CO_2 reduction effect on society as a whole through contributions to other parties.

To steadily promote the transition to low-carbon/decarbonization together with our many customers, we believe that it is important to understand our progress with an indicator that shows the effect of CO_2 emissions reduction in the whole society (avoided emissions) and to obtain the understanding of our stakeholders.

CO_2 emissions per same calorific value*2



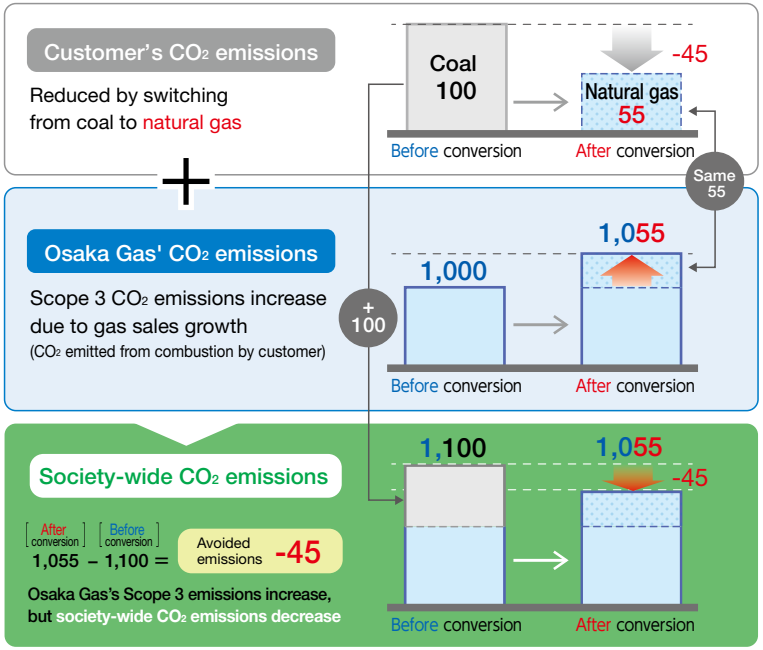
What is "avoided emissions"?

Quantified CO_2 emissions reduction through products and services provided to others

Calculated based on the "Guidelines for Quantifying GHG emission reductions of goods or services through Global Value Chain" (Ministry of Economy, Trade and Industry, March 2018)

Indicator of society-wide avoided emissions through contribution to other companies' emissions reduction

Avoided emissions calculation example



*1 International standard for calculating and reporting GHG emissions

*2 Prepared based on the "Ordinance Concerning Calculation of GHG Emissions from Business Activities of Specified Emitters" issued by METI and the Ministry of the Environment

② Initiatives for the Social Implementation of e-methane — Efforts for Transition toward 2030 —

The Daigas Group believes that e-methane, which is synthesized from hydrogen produced with renewable energy and CO_2, will be the key to realizing the carbon neutralization of city gas. The value offered by e-methane includes reducing additional social costs. The Group is implementing various initiatives*1 toward the social implementation of e-methane.

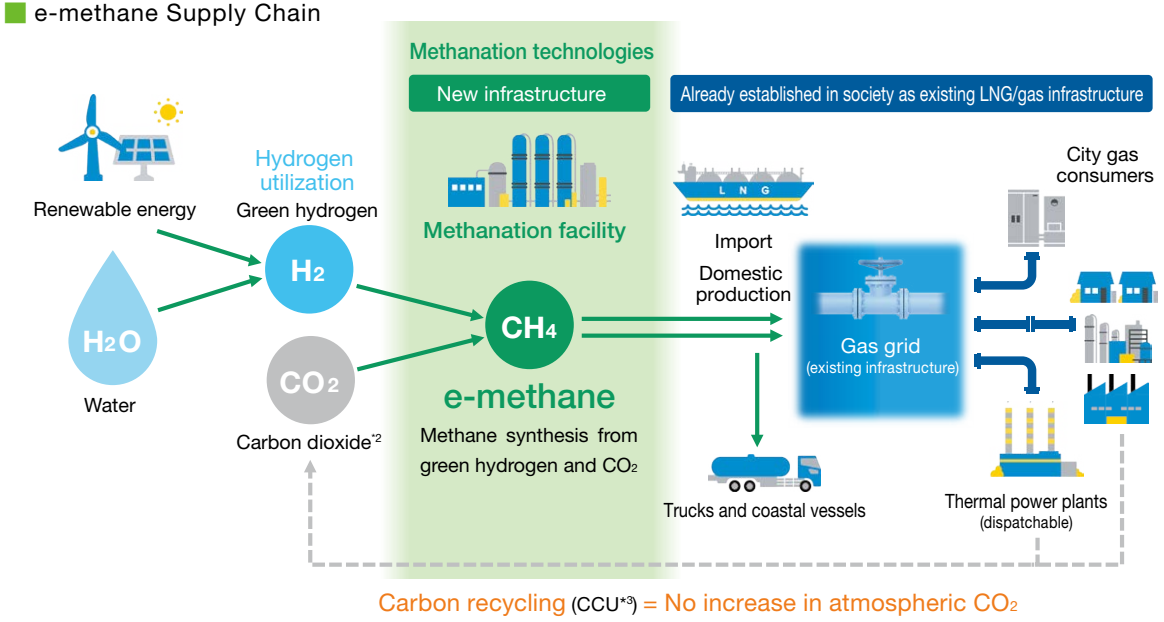
*1 Please see the next page for details of our initiatives toward the social implementation of e-methane.

Supply Chain and Cost Benefits of the Social Implementation of e-methane

"e-methane" is considered as a carbon-neutral energy because it is produced by recycling CO_2 emitted into the atmosphere and synthesizing it with hydrogen, and does not increase atmospheric CO_2 even when combusted.

Furthermore, since "e-methane" has almost the same composition as city gas, existing city gas infrastructure and customers' combustion equipment can be used without modification, enabling seamless decarbonization from the transition period. This has the advantage of reducing social implementation costs.

■ e-methane Supply Chain



Carbon recycling (CCU*3) = No increase in atmospheric CO_2

*2 Biogenic CO_2 and possibly CO_2 derived from DAC (Direct Air Capture: a technology used to capture and remove CO_2 directly from the atmosphere) might be utilized in the future

*3 Carbon dioxide Capture and Utilization

Four Value Propositions of e-methane

"e-methane" offers four value propositions that contribute to customers and society. Based on these values, the Group aims to introduce "e-methane" accounting for 1% of the Group's gas sales as of FY2031.3.

■ Four value propositions

Value proposition ① Decarbonized heat demand	Decarbonizing heat demand, which accounts for 60% of the energy including high-temperature heat that cannot be generated by electricity
Value proposition ② Lower social costs	Significantly reducing social costs by using the existing gas infrastructure and customers' equipment without replacement
Value proposition ③ Enhanced energy security	Mitigating geopolitical risks through diversified sources of e-methane produced in various locations in Japan and overseas
Value proposition ④ Carbon neutral Asia	Exporting competitive Japanese industries and contributing to environment conservation and economic growth in Asia and Japan

2 Initiatives for the Social Implementation of e-methane — Efforts for Transition toward 2030 —

e-methane Supply Chain Development in Japan and Overseas

For the full-scale introduction of e-methane in 2030, the Daigas Group will consider establishing diverse methanation technologies, developing renewable energy sources, and building a supply chain both in Japan and overseas, including the procurement of hydrogen and CO_2 in collaboration with customers.

We will study the introduction of e-methane primarily in the city gas supply area in the Kansai region and comprehensively verify necessary elemental technologies and feasibility of the supply chain, in our aim to establish the optimal supply model for e-methane. In addition to supply chain development in Japan, we view the building of a supply chain overseas as another promising option for the introduction of e-methane. In collaboration with business operators both in Japan and overseas, we are conducting several feasibility studies and basic design work regarding the building of such a global supply chain. For stable procurement in the future, we are identifying locations suitable for e-methane production, focusing our consideration on North America, South America, Australia, the Middle East, and Southeast Asia, where existing natural gas and LNG facilities can be used. We will also promote more widespread use of e-methane in Asia as a new location of use.

e-methane Supply Chain Development

Methanation technology development

1. Sabatier methanation*1 (existing technology)
   Scaled up and implemented in society at an early stage
2. Biomethanation*2 (innovative technology)
   Produce and use energy locally for local consumption
3. SOEC methanation*3 (Innovative technology)
   Reduce cost by enhancing energy efficiency

Supply Chain Development Overseas

The United States

- A joint study is underway on the production of e-methane using biomass-derived CO_2 from a bioethanol plant and blue hydrogen derived from natural gas through the reforming process.
  (Main operators: Osaka Gas USA Corporation, Tallgrass MLP Operations, LLC, Green Plains Inc.)
- A joint study is underway on the production of e-methane near the Cameron LNG facility.
  (Main operator: Osaka Gas, Tokyo Gas Co., Ltd., Toho Gas Co., Ltd., Mitsubishi Corporation)

Australia

- A joint study is underway on the production of e-methane using CO_2 captured from exhaust gas in industrial areas and natural gas liquefaction plants and green hydrogen generated through water electrolysis powered by renewable energy.
  (Main operator: Osaka Gas Australia Pty. Ltd., Santos Ltd)

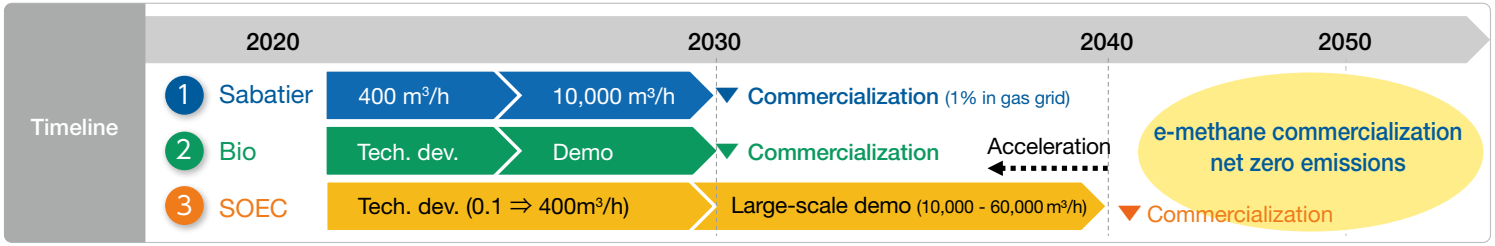
Southeast Asia

- A joint study is underway in Malaysia on the production of e-methane that is not affected by renewable electricity prices, using methanation by converting biomass, such as unutilized forest resources, into gas.
  (Main operator: Osaka Gas, IHI Corporation, PETRONAS Global Technical Solutions Sdn. Bhd.)

South America

- A joint study is underway at PERU LNG's plant on the production of e-methane using green hydrogen produced through water electrolysis using renewable energy and CO_2.
  (Main operator: Osaka Gas, Marubeni Corporation, PERU LNG S.R.L.)

Roadmap for Social Implementation of Methanation Technology



*1 CO_2 conversion by a catalytic reaction with hydrogen derived from renewable energy, etc. to synthesize methane.
*2 Technology that uses biological reactions to synthesize methane from CO_2 and hydrogen
*3 Use of SOEC equipment to electrolyze water and CO_2 into hydrogen and carbon monoxide using renewable energy, etc., and then synthesize methane by catalytic reaction of the hydrogen and carbon monoxide.

3 Carbon Neutral Initiatives in the Electricity Business
— Efforts for Energy Transition toward 2030 —

Low-Carbon/Carbon-Neutral Transition of Power Sources

We are promoting the development of a wide range of renewable energy sources such as wind, solar, and biomass together with various partners nationwide, aiming for 5 GW of renewable energy development contribution,*1 one of our targets for FY2031.3.

We are also working on initiatives for storage batteries and VPP utilization, as well as the low-carbon/carbon-neutral transition of thermal power plants needed as dispatchable sources.

*1 Including power sources under the feed-in tariff (FIT) system.

Energy conservation and grid stabilization with VPP

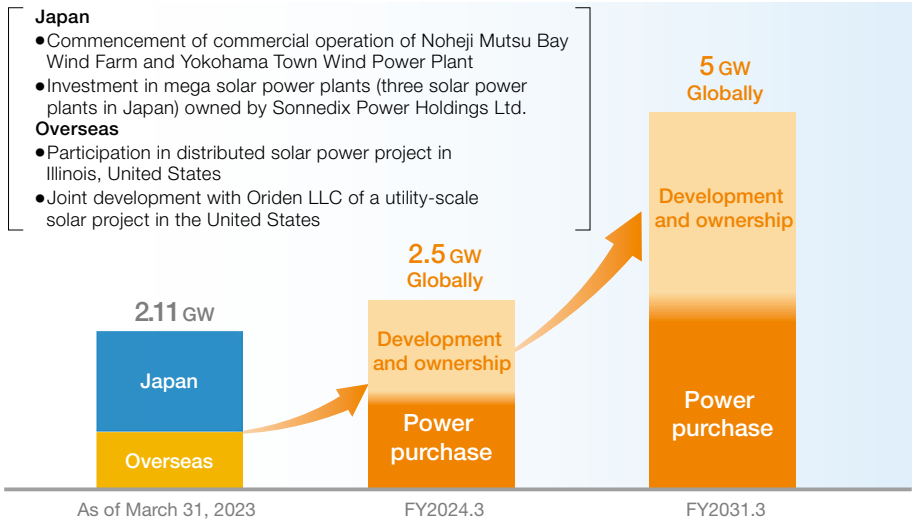
A VPP is a system that uses IoT-based energy management technology to control distributed energy resources remotely and in an integrated manner, thereby adjusting the supply-demand balance of electricity like a single virtual power plant.

The Daigas Group is pursuing initiatives to contribute to gird stabilization in a society with the mass introduction of renewable energy. In June 2022, we launched a verification project to build a VPP using our residential fuel cell, ENE-FARM.

Major initiatives to develop and spread renewable energy sources

Japan
- Commencement of commercial operation of Noheji Mutsu Bay Wind Farm and Yokohama Town Wind Power Plant
- Investment in mega solar power plants (three solar power plants in Japan) owned by Sonnedix Power Holdings Ltd.

Overseas
- Participation in distributed solar power project in Illinois, United States
- Joint development with Oriden LLC of a utility-scale solar project in the United States

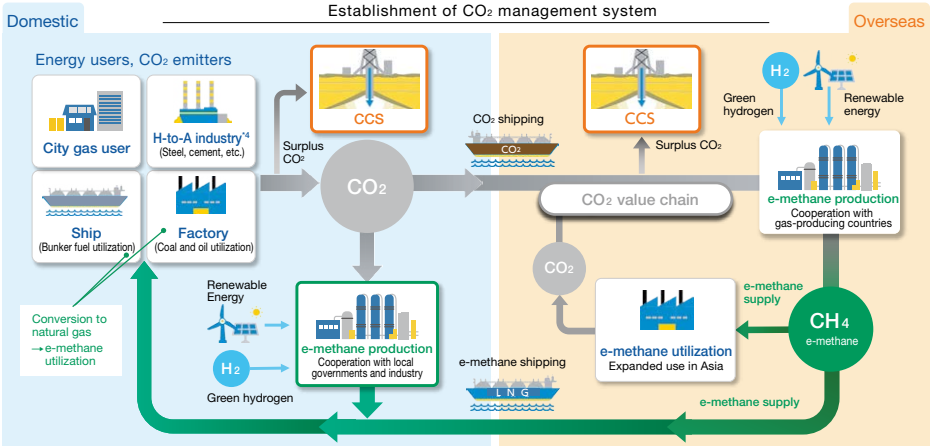


4 Initiatives Concerning CO_2 Capture, Utilization, and Storage

The Daigas Group aims at contributing to a circular society that reduces customers' CO_2 emissions and environmental burdens by reusing emitted CO_2 in the atmosphere (CCU*2) and supplying e-methane produced by methanation. We are also pursuing initiatives such as joint studies in Japan and overseas on establishing a CO_2 value chain and injecting and storing surplus CO_2 deep underground by CCS.*3

*2 CCU: Carbon dioxide Capture and Utilization *3 CCS: Carbon dioxide Capture and Storage

Conceptual Diagram of CO_2 Value Chain



*4 H-to-A industries: Industries. where CO_2 emissions reduction is difficult (hard-to-abate)

Initiatives for CO_2 Value Chain Development

To develop a CO_2 value chain, Daigas Group commenced a joint study on the capture, transport, utilization, and storage of CO_2 emitted from domestic plants and factories in hard-to-abate industries, such as steel, cement, and chemicals.

A joint study on CO_2 value chain development

Osaka Gas and Mitsubishi Heavy Industries, Ltd. (MHI) have entered into an agreement to conduct a feasibility study on the development of an efficient CO_2 value chain, leveraging Osaka Gas's expertise in e-methane production and CO_2 storage and MHI's expertise in CO_2 capture, vessel transport of liquefied CO_2, and CO_2 management.

A joint study on CCS value chain development with Shell

Osaka Gas and Shell Singapore Pte. Ltd. have commenced a joint study on the development of a CCS value chain, in which CO_2 is captured from emissions by industrial facilities in Japan and injected into underground storage overseas.

A joint study on the capture and utilization of CO_2 emissions from the Senboku Industrial Complex

Osaka Gas and Mitsui Chemicals, Inc. have commenced a joint study on a project to capture and utilize CO_2 emitted from the Senboku Industrial Complex.