

# CCS Project for Sustainable Society

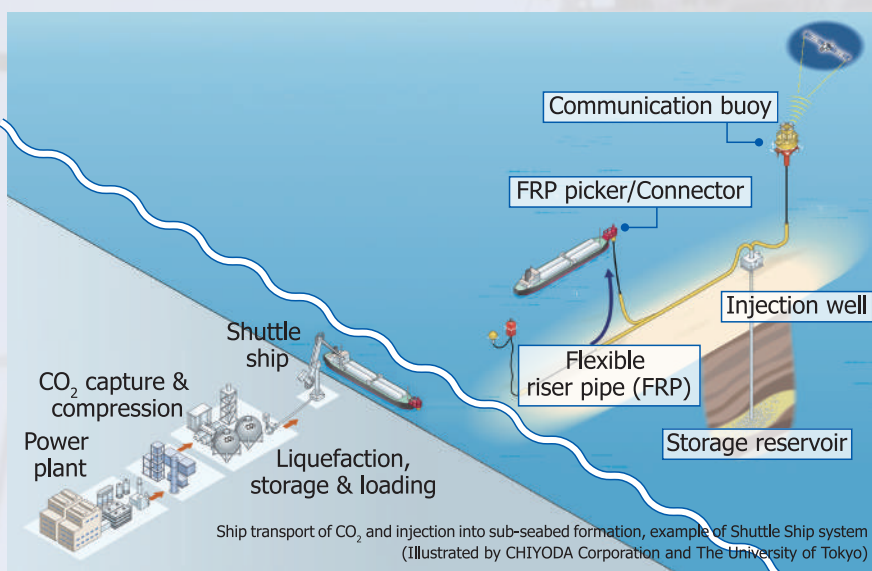
## Bridge towards a sustainable future



The Ministry of the Environment of Japan (MOEJ) is proceeding with a major five-year (FY2016-2020) CCS Project for a Sustainable Society, recognizing that carbon dioxide capture and storage (CCS) technology is indispensable to achieve the goal of long-term climate change mitigation. Led by a consortium of 18 organizations, the project consists of four tasks, including construction and operation of Japan's first large-scale facility for amine-based chemical absorption of CO<sub>2</sub> to capture the majority of emissions from a thermal power plant.

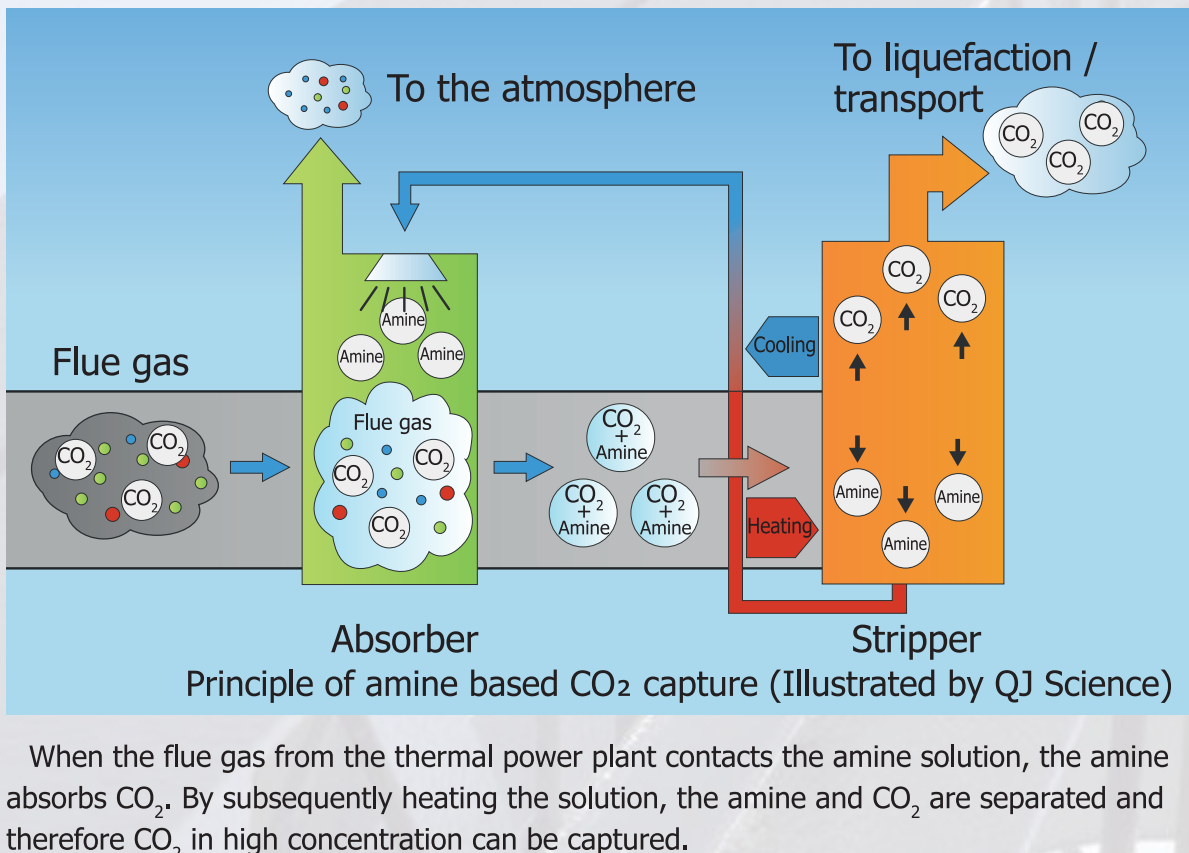
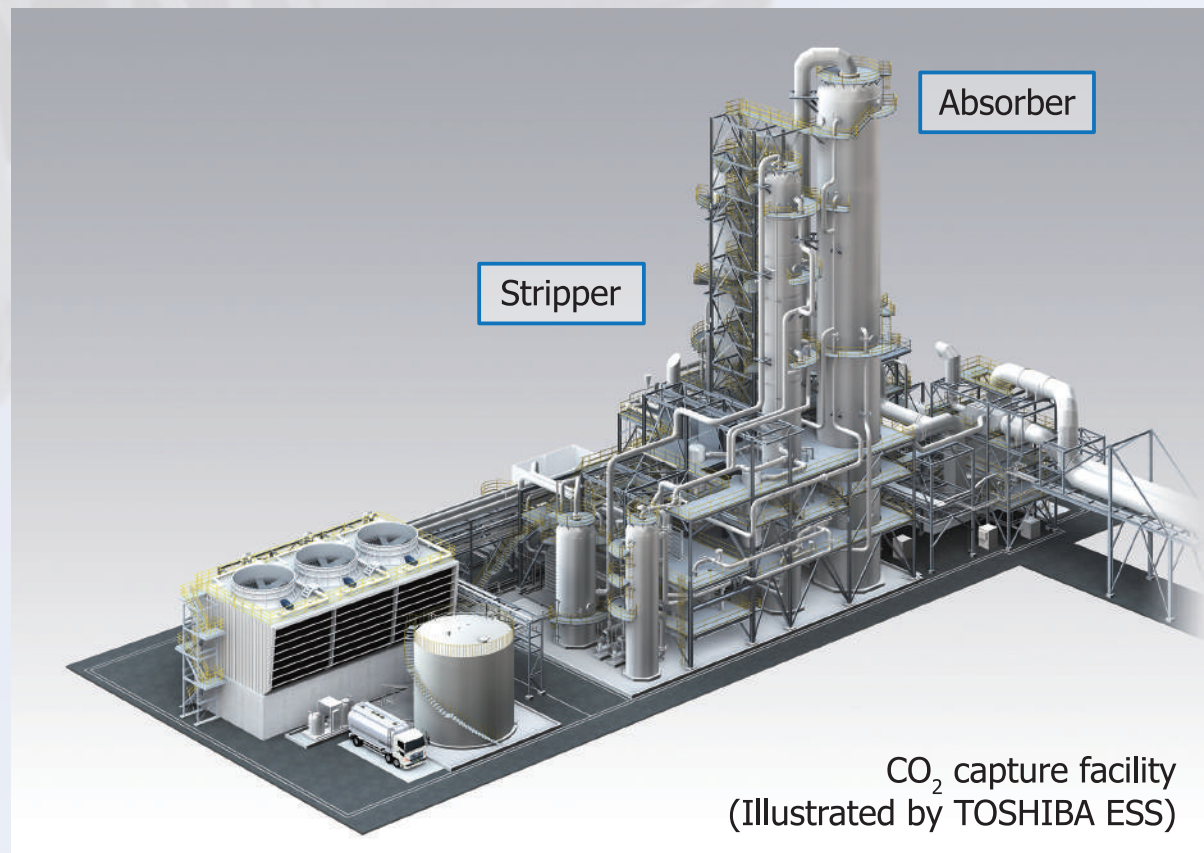
### Preliminary research

Potential CO<sub>2</sub> storage sites in Japan are distributed in marine areas. Therefore, in the preliminary phase from FY2014 to FY2015, pre-feasibility studies on ship-based CO<sub>2</sub> transport and offshore storage was conducted. A research on the emissions and environmental impact of the amine-based CO<sub>2</sub> capture process was carried out using Toshiba's pilot facility at Mikawa Power Plant of Sigma Power Ariake (Omura City, Fukuoka Prefecture). The results have led to a conceptual design of a large scale capture plant to be used in the integrated CCS demonstration. Based on these results, a demonstration project plan was also prepared.



### Task 1: Demonstration of CO<sub>2</sub> capture technologies

Construction of a large-scale demonstration facility is underway that can capture more than 500 tons of CO<sub>2</sub> per day, which represents 50% of the CO<sub>2</sub> emission from the Mikawa Power Plant. In addition to verifying the performance and operability of this facility integrated with the power plant, technological issues will be identified and costs associated with installation of the CO<sub>2</sub> capture facility at a thermal power plant will be assessed. In parallel with the construction work, research activities on the emissions and environmental impact of the amine-based CO<sub>2</sub> capture process have been carried out. Such activities include examination of environmental impact assessment methodology, engineering studies to minimize the environmental burden associated with the operation of a larger scale CO<sub>2</sub> capture facility, and verification that there will be almost no environmental impact associated with the demonstration facility.



### World's first biomass power plant equipped with a CO<sub>2</sub> capture facility

The Mikawa Power Plant has already installed an advanced circulation-type fluidized bed boiler that can burn not only coal but also biomass for power generation. The power plant will become the world's first biomass power plant fitted with a CO<sub>2</sub> capture facility, and the construction work will be completed in early FY2020. This facility is innovative as it captures CO<sub>2</sub> that has been absorbed from the atmosphere by plants and will lead the way to Bioenergy with carbon dioxide capture and storage (BECCS) that can reduce the CO<sub>2</sub> concentration in the atmosphere.

### Task 2: Study on ship transport of CO<sub>2</sub> and injection into a sub-seabed geological formation

In Japan, potential areas for CO<sub>2</sub> storage are unevenly distributed in marine areas. Accordingly, a key issue for a large-scale deployment of CCS is to use such storage sites as efficiently as possible by rationally matching them with the large-scale CO<sub>2</sub> emission sources that are widely distributed across the country. Accordingly, this project aims to create technology for ship transport and sub-seabed injection of captured CO<sub>2</sub>, that is widely compatible with a range of distances between CO<sub>2</sub> emission sources and storage sites as well as a variety of water depths at the CO<sub>2</sub> storage sites.



### Task 3: Study of stable undersea CO<sub>2</sub> storage

In order to know exactly how much CO<sub>2</sub> can be stored in our country, we need to judge appropriately whether we can store CO<sub>2</sub> in offshore areas, in addition to coastal regions. For this reason, we are making efforts to identify issues related to stable undersea CO<sub>2</sub> storage, including the potential for leakage of stored CO<sub>2</sub> as well as monitoring methods and leak repair methods. We are also studying and organizing leakage mitigation measures.

### Task 4: Comprehensive study of social environment for CCS suited to Japan

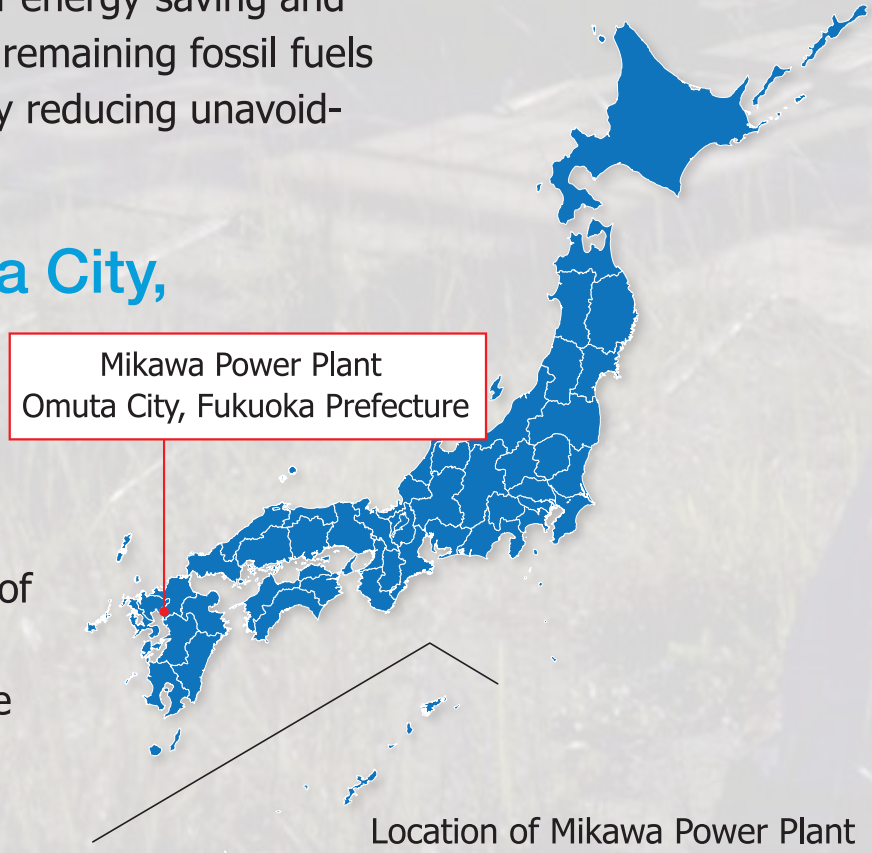
In this project, in addition to demonstration and technical research, detailed study is being conducted on the development of strategies and associated tools to facilitate the introduction of CCS in Japan. Activities of this task include: studies on policies and measures to create enabling environment, development of strategies for consensus building and related tools, study on a full-chain CCS system suitable to Japan, development of a roadmap and action plans for a large-scale deployment of CCS. In addition knowledge sharing and management platform has been developed to support integrating the whole range of tasks in the project.

## Technology acting as a bridge to a "Decarbonized Society" as the ultimate goal and aiming to accomplish it ambitiously as early as possible in the second half of this century

The world is heading toward a "Decarbonized Society" by promoting widespread use of energy-saving and renewable energy technologies. For the time being, however, we are likely to depend on remaining fossil fuels to a certain extent. CCS is a technology acting as a bridge to a "Decarbonized Society" by reducing unavoidable CO<sub>2</sub> emissions associated with the use of fossil fuels.

### CO<sub>2</sub> capture demonstration project has started in Omura City, where once flourished with the coal mining industry

Home to the CO<sub>2</sub> capture demonstration of this project, Mikawa Power Plant is located in Omura City, Fukuoka Prefecture, which flourished with the coal mining industry between Meiji and Showa eras. To commemorate this, Miike Coal Mine, Miyahara Pit, and Miike Port were registered on the UNESCO World Heritage List in 2015 as the "Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining". A "revolutionary" CO<sub>2</sub> capture demonstration project which leads to BECCS as an ultimate measure against climate change was launched in this historic city.



### Schedule of this project

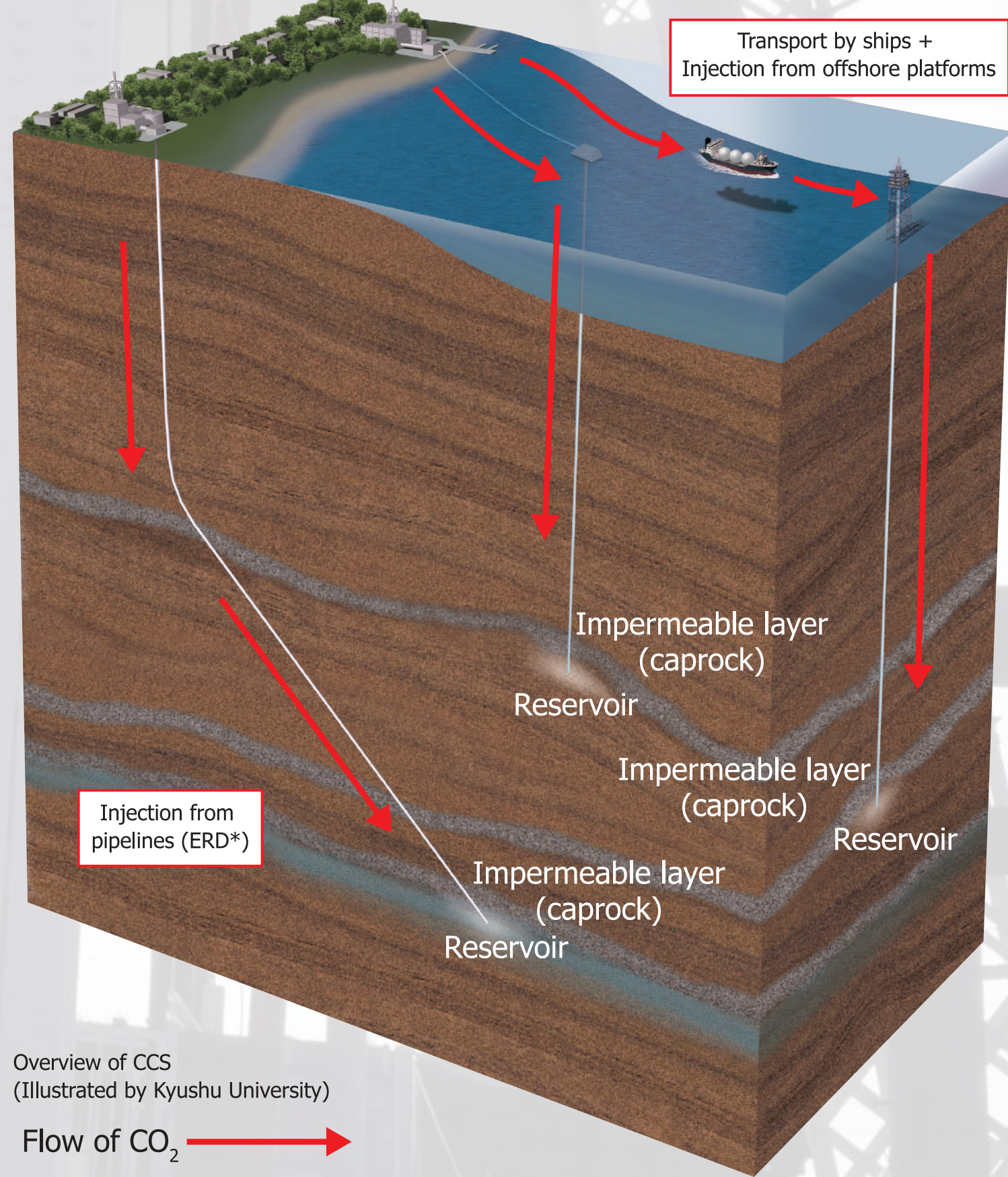
| FY2014               | FY2015 | FY2016                                                                              | FY2017 | FY2018 | FY2019 | FY2020 |
|----------------------|--------|-------------------------------------------------------------------------------------|--------|--------|--------|--------|
| Preliminary research |        | Demonstration of CO <sub>2</sub> capture technologies                               |        |        |        |        |
|                      |        | Study of CO <sub>2</sub> transport by sea and injection into a geological formation |        |        |        |        |
|                      |        | Study of stable undersea CO <sub>2</sub> storage                                    |        |        |        |        |
|                      |        | Comprehensive study of social environment for CCS suited to Japan                   |        |        |        |        |

### The Long-term Strategy under the Paris Agreement (Cabinet decision, June 11, 2019)

Japan proclaims a "decarbonized society" as its ultimate goal and aims to accomplish it ambitiously as early as possible in the second half of this century. Toward that end, Japan has set a long-term temperature goal of reducing GHG emissions by 80% by 2050, and will boldly take measures towards its realization (*Chapter 1: Basic Concepts, 2. Japan's Long-term Vision, p.15*). It is also necessary to identify concrete targets in terms of costs and efficiencies in the key areas for decarbonization such as hydrogen, carbon dioxide capture and storage (CCS), carbon dioxide capture and utilization (CCU), renewable energy, storage batteries and nuclear energy, as well as challenges and systems including collaboration both in Japan and overseas (*Chapter 1: Basic Concepts, 3. Basic Principles in Policy towards the Long-term Vision, p.16*).

### What is CO<sub>2</sub> Capture and Storage (CCS)?

While the impacts of climate change has become widely recognized through experiencing a series of heavy rains and an increasing number of extremely hot days, the "Paris Agreement" came into effect in November 2016. On such a background, the global community is working to achieve the goal to limit global warming to well below 2°C and aiming for 1.5°C above pre-industrial level by the end of the century. CCS is a technology consisting of 1) capturing CO<sub>2</sub> from large emission sources such as thermal power plants or manufacturing facilities, 2) transporting it via pipeline or ships to storage sites and 3) injecting it into an underground reservoir. CO<sub>2</sub> is then confined by an overlying impermeable layer (also called a caprock) that prevents leakage into the atmosphere. CCS has been recognized as an indispensable tool along with other technologies such as renewables and energy conservation to meet the objectives mentioned above by many international bodies such as IPCC and IEA.



\* ERD: Extended Reach Drilling is highly deviated drilling starting from the land area to an undersea reservoir.

CCS = Carbon dioxide Capture and Storage

### Project members

