Research & Coordination Group

Members (As of Apr. 2025)

Group Leader, Chief Researcher Deputy Leader, Chief Researcher Deputy Leader Deputy Leader, Chief Researcher Associate Chief Researcher

Manager

Masato kannen Makoto Nomura Tatsuro Ide Naoki Oda Yoshinori Aoki Jun-ichi Shimizu Kin-ichiro Kusunose Takayuki Higashii Tokutaka Tani Tetsuya Deguchi (concurrent) Minehiro Takahashi Planning Manager Planning Manager Planning Manager Senior Researcher Senior Researcher Senior Researcher Vice Manager Vice Manager, Researcher Chief Sou Kuranaka Noritaka Mochizuki Sou Kuranaka Yumi Kobayashi Natsuko Yasumoto Hitoshi Nikaido Yuji Yamashita (concurrent) Yuka Matsugu Miho Matsuoka Nami Tatsumi Michiyo Kubo Mizuki Nagata

Toward a Carbon-Neutral Society ~ For people and the earth to live in harmony ~

1. Introduction

RITE is conducting R&D into global warming while keeping in mind the trends of the times and ensuring that people and the earth can live in harmony for many years to come.

The Research & Coordination Group has four major functions: 1) explore new R&D topics while looking at domestic and overseas policies and technology trends and propose and implement new research themes by taking advantage of the research potential of RITE; 2) support the government with regard to IPCC (Intergovernmental Panel on Climate Change) and facilitate collaboration with international organizations, such as ISO (International Organization for Standardization); 3) promote the dissemination of RITE's technologies and develop human resources for the future; and 4) promote the practical application of technologies through collaboration with the industry. We, together with research groups, have been actively working on policy support, technology development, and the creation of innovation in order to pursue both global environment protection and economic development¹⁾.

Here, we would like to first provide an overview of the Japanese government's actions taken toward carbon neutrality in fiscal year 2024 and then touch on the specific R&D being carried out by this group.

1.1. Trends surrounding Japan's global warming countermeasures in FY2024

Although fiscal 2024 saw events such as the U.S. withdrawing from the Paris Agreement, it can be said to have been a turning point for Japan's efforts to combat global warming.

Specifically, the Act on Carbon Dioxide Storage Businesses (CCS Business Act)²⁾ was enacted in May 2024, marking a major step forward toward the social implementation of CCS in Japan. In addition, the comprehensive 7th Strategic Energy Plan, the GX2040 Vision, and the Plan for Global Warming Countermeasures were approved by the Cabinet on February 18, 2025, providing momentum toward achieving carbon neutrality in the future.

Also on the same day, Japan submitted a new version of Japan's NDC (Nationally Determined Contribution) to the Secretariat of the United Nations Framework Convention on Climate Change. This aims to reduce greenhouse gas emissions by 60% and 73% in fiscal 2035 and 2040, respectively, from fiscal 2013 levels, as ambitious targets that are consistent with the global 1.5° C target and are on a direct path toward achieving net zero CO₂ emissions by 2050.

Here, we would like to explain the 7th Strategic Energy Plan, the GX2040 Vision, and the developments surrounding the CCS Business Act.

1.2. The 7th Strategic Energy Plan

The government has formulated the Strategic Energy Plan based on the Basic Act on Energy Policy in order to indicate the basic direction of its energy policy. The current 7th Strategic Energy Plan was first reviewed by the General Resources and Energy Research Committee of the Ministry of Economy, Trade and Industry (METI) in May 2024, with a draft presented on December 17 of the same year. After receiving public comments and other information, the plan was approved by the Cabinet in February 2025.

Specifically, taking into account changes in domestic and international circumstances, including the energy situation, since the formulation of the 6th Strategic Energy Plan in October 2021, the government has formulated the 7th Strategic Energy Plan in a manner consistent with the government's newly established target of a 73% reduction in greenhouse gas emissions by fiscal 2040. The government will implement this plan in conjunction with the GX2040 Vision and the Plan for Global Warming Countermeasures and will work to simultaneously achieve a stable energy supply, economic growth, and decarbonization.

<Overview>

With electricity demand expected to increase due to DX and GX, it is recognized that whether Japan can secure an appropriate amount of decarbonized power sources at a price that is internationally competitive will have a direct impact on its industrial competitiveness.

In order to achieve both a stable energy supply and decarbonization, the government will promote thorough energy conservation and fuel conversion in manufacturing while making maximum use of power sources that contribute to energy security and have a high decarbonization effect, such as renewable energy and nuclear power.

The plan also states the following about CCS and CDR (Carbon Dioxide Removal), which are closely related to RITE.

- Consider support systems to encourage investment in CCS projects, develop technologies to reduce CCS costs, and develop carbon storage sites.
- For CDR, work to improve the environment, create markets, and accelerate technological development since CDR is necessary as a means to offset residual emissions.

1.3. GX2040 Vision

Amid growing uncertainty about the future outlook, including the tense overseas situation and increased demand for electricity due to digital transformation and electrification, the above-mentioned vision has been formulated to indicate a longer-term direction in order to improve the predictability of investment for achieving GX.

Specifically, in order to realize a GX industrial structure, the vision aims to promote the social implementation of innovation and to leverage GX to promote the establishment of new industrial locations and the development of decarbonized power sources, leading to regional revitalization and economic growth.

<Growth-oriented carbon pricing initiative>

Based on the above-mentioned initiative to provide institutional support for these efforts, a bill to amend

the GX Promotion Act was submitted to the 2025 ordinary session of the Diet.

Specifically, the bill calls for the full-scale operation of an emissions trading scheme (from fiscal year 2026 onwards), which will require all companies with emissions above a certain level (direct emissions of 100,000 tons) to participate, regardless of industry, and for a fossil fuel surcharge to be introduced (from fiscal year 2028 onwards). Necessary measures will be put in place to ensure the smooth and reliable introduction and implementation of the initiative.

1.4. CCS Business Act

This act regarding CCS was enacted in May 2024, providing momentum toward the commercialization of CCS. We will go into more detail on this, including the latest trends, in Section 2.

2. Research activities

2.1. Introduction

The CCS business environment is gradually improving, with the selection of "Advanced CCS Projects"³⁾ in June 2023 and the promulgation of the CCS Business Act in May 2024. Additionally, detailed discussions have been underway since January 2025 regarding support measures for CCS projects⁴⁾. The basis for these efforts is the final summary on the CCS Long-Term Roadmap⁵⁾ published in March 2023. This article introduces the results of a survey on the status of consideration for the development of the domestic CCS business environment, which was conducted as part of the research activities of the Research & Coordination Group.

2.2. CCS Long-Term Roadmap⁵⁾

The final summary on the CCS Long-Term Roadmap, which serves as the basis for promoting the development of the CCS business environment in Japan, was published in March 2023. Its basic philosophy is to promote the sound development of CCS projects in our country while minimizing social costs by implementing CCS systematically and rationally, thereby contributing to economic and industrial development of our country, securing a stable energy supply, and achieving carbon neutrality.

This long-term roadmap aims to achieve an annual CO2 storage amount of approximately 120 to 240 million tons as of 2050 and, with a final investment decision (FID) of 2026 as a milestone, to establish a business environment (construct a business model, etc.) and launch CSS projects by around 2030 with a view to commencing full-fledged operations from 2030 and onwards.

The specific actions set out in the CCS Long-Term Roadmap to achieve this goal include (1) government support for CCS projects (advanced CCS projects, etc.), (2) initiatives to reduce CCS costs, (3) promotion of public understanding of CCS projects, (4) promotion of overseas CCS projects, (5) examination for the development of the CCS Business Act, and (6) development and review of the CCS Action Plan. The CCS Business Act, which was promulgated in May 2024, and the selection of Advanced CCS Projects, which began in fiscal year 2023, fall under (5) and (1) of the specific actions in the roadmap.

2.3. Status of consideration for the development of the CCS business environment and the development structure

(1) CCS Long-Term Roadmap Study Group⁵⁾

CCS is a key technology for achieving carbon neutrality by 2050. Meanwhile, in order to implement CCS in society, creating an environment conducive to commercialization remains an issue. For this reason, the 6th Strategic Energy Plan (October 2021) called for the formulation of a CCS long-term roadmap and for the public and private sectors to work together to address the issue. To make this a reality, the CCS Long-Term Roadmap Study Group (hereinafter referred to as the "Long-Term RM Study Group") was established in January 2022.

The Long-Term RM Study Group held a total of five discussions between January and May 2022 and published an interim summary in May. Subsequently, in September 2022, two working groups, the CCS Business Domestic Law Review Working Group and the CCS Business Cost and Implementation Scheme Review Working Group, were established to delve deeper into issues such as "issues for establishing domestic legislation for CCS projects" and "current costs and future cost targets across the entire CCS value chain and the form of government support." Four meetings were held in each working group to discuss the issues by December 2022. Based on the results of discussions at these working groups, the 6th Long-Term RM Study Group meeting was held in January 2023, and the final summary on the CCS Long-Term Roadmap was compiled.

(2) Carbon Management Subcommittee⁶⁾

Based on the content of the final summary on the CCS Long-Term Roadmap, the Carbon Management Subcommittee (hereinafter referred to as the "CM Subcommittee") was established in September 2023 under the General Resources and Energy Research Committee and the Resources and Fuel Subcommittee to more specifically consider the form of government support and the development of the CCS Business Act toward the commercialization of CCS and to promote carbon management using CCUS technology by companies.

Regarding the form of institutional measures related to CCS, the CM Subcommittee held a total of four discussions between September and December 2023 in collaboration with the Industrial Structure Council, the Security and Consumer Product Safety Subcommittee, and the Basic Industrial Security System Subcommittee, and it published an interim summary (on the form of institutional measures related to CCS) in January 2024.

In addition, discussions to consider a support framework for CCS projects have resumed since September 2024. Four discussions were held by December, and the Discussion on the Draft of the CCS Support System, presented at the eighth CM Subcommittee meeting (December 2024), stated that an interim summary on the CCS support system would be compiled by mid-2025. (3) Carbon Dioxide Storage Business Safety Subcommittee⁷⁾

Discussions on the form of institutional measures related to CCS had been held jointly with the Basic Industrial Security System Subcommittee. However, following the promulgation of the CCS Business Act (May 2024), the Carbon Dioxide Storage Business Safety Subcommittee was established in August 2024 under the Industrial Structure Council and the Security and Consumer Product Safety Subcommittee as a forum for discussing and examining the drafting of safety regulations for CCS projects and their enforcement status. Three discussions have been held so far, and deliberations are underway on laws and regulations related to exploratory drilling, pipeline transportation, and storage.

(4) Working Group on Support Measures for CCS Projects⁴⁾

As mentioned above, the eighth CM Subcommittee meeting presented a draft of a support system for CCS projects. Going forward, the detailed design of the support system for CCS projects will be considered at the working level, with an interim summary scheduled to be compiled by mid-2025. Accordingly, in February 2025, the Working Group on Support Measures for CCS Projects (hereinafter referred to as the "Support Measures WG") was established under the CM Subcommittee. The Support Measures WG is expected to meet approximately once a month until May 2025.

(5) Others^{8) 9)}

The LCO₂ Shipping Value Chain Standardization

Council was established in September 2024 to standardize specifications for CO₂ shipping and reduce associated shipping costs. Moreover, the Carbon Dioxide Geological Storage Assessment Committee was established in December 2024 to provide the technical advice necessary to properly advance exploratory drilling and storage projects in accordance with the Act on Carbon Dioxide Storage Businesses.

An organizational chart of the councils and other bodies described in (2) to (5) is shown below.



Figure 1 Organizational chart of the councils and other bodies

2.4. CCS Business Act and related government and ministerial ordinances¹⁰⁾

The CCS Business Act was enacted on May 17, 2024 and promulgated on May 24. Of the provisions of this act, the provisions regarding exploration came into effect on August 5, within a period not exceeding three months from the date of promulgation of the act, and the provisions regarding exploratory drilling came into effect on November 18, within a period not exceeding six months. The provisions regarding storage and pipeline transportation projects will be in effect for no more than two years (by May 23, 2026). Other related government and ministerial ordinances are also being enacted one after another.

The CCS Business Act is a regulatory law that creates a business environment for CCS in Japan, based on which the following systems have been established.

i. A licensing system for exploratory drilling and storage projects has been established, under which the Minister of Economy, Trade and Industry would designate specific areas and grant licenses to businesses, and under which specific implementation plans for exploratory drilling and storage projects would be subject to approval by the Minister of Economy, Trade and Industry.

Regarding the development of business and safety regulations related to CO₂ pipeline transportation projects, a notification system to the Minister of Economy, Trade and Industry has been established.

For more details, please see the METI website (Policies > Resources and Fuels > CCS Policy > CCS Business Act) (in Japanese).

2.5. Trends in support for CCS projects⁴⁾

CCS projects as a measure against global warming are not necessarily highly predictable because financial mechanisms for generating business revenues have not been established. For this reason, Europe and the U.S. are taking measures to provide support that focuses on the cost difference between the costs required for CCS and the costs of CO₂ countermeasures and to offer relatively high subsidy rates. In Japan, by commercializing CCS projects ahead of other projects with government support, it will be possible to make the CCS business self-sufficient and build a cost-competitive CCS value chain. To this end, as described in 2.3.(4), the Support Measures WG has been established under the CM Subcommittee, and discussions are underway to compile an interim summary on the CCS support system, scheduled for around summer 2025 (the results of which will be reported to the parent committee, the Carbon Management Subcommittee). Since the establishment of the Support Measures WG, three discussions had been held by the end of March 2025. Meetings are scheduled to be held once a month from April onwards. The main direction is for support to focus on the cost difference between the costs required for CCS and the costs of CO₂ countermeasures. In addition, a direction has also been indicated that will promote making the CCS business self-sufficient.

For the time being, priority will be given to support measures for the domestic pipeline case. For the ship transport case, an interim summary is scheduled to be issued, after which a review will be conducted and a final summary will be reported.



Source: 1st Working Group on Support Measures for CCS Pro-jects (February 5, 2025)

https://www.meti.go.jp/shingikai/enecho/shigen_nenryo/carbon_management/ccs_wg/pdf/001_06_00.pdf (in Japa-

nese)

3. Promotion of international partnership

3.1. IPCC (Intergovernmental Panel on Climate Change)

The IPCC has been established in 1988 with a view to conducting a comprehensive assessment from scientific, technical, and socio-economic perspectives on climate change, impact, adaptation and mitigation measures by anthropogenic sources, jointly by the United Nations Environment Program (UNEP) and by the World Meteorological Organization (WMO). The IPCC examines scientific knowledge on global warming and makes the reports prepared by three WGs, - Physical Science Basis (WG1), Impacts and Adaptation, and Vulnerability (WG2), and Mitigation Measures (WG3).

In the IPCC, the experts chosen among each country

make the reports, based on the literature or the scientific observation data and evaluate / examine the scientific analysis, social economic influence and countermeasures to control climate change. This outcome is to have a high influence on international negotiations since the scientific basis is also given to the policies of each country.

RITE plays the central role of domestic support secretariat of mitigation measures (WG 3) (Figure 2). The IPCC began its Seventh Assessment Cycle (AR7) in July 2023, and is currently preparing a Special Report on Climate Change and Cities and a Methodology Report on Short-Lived Climate Forcers (SLCF). The outlines of each Working Group report were adopted at the 62nd Session of the IPCC in February 2025, and after the selection of authors, the writing process starts. It has also been decided to produce a Methodology Report on Carbon Dioxide Removal Technologies (CDR) and Carbon Capture Utilization and Storage (CCUS). RITE has also been supporting METI through information gathering, analysis, report, advise, etc.



Figure 2 Committee structure and RITE

3.2. ISO

ISO (International Standard Organization) is an organization composed of 173 standardization bodies of various countries that gives the common standards and promotes global trade. It can provide safe, reliable, and high-quality products/service by utilizing ISO standards. In the world, a number of CCS verification projects on a commercial scale are implemented, and inter-national collaboration is under way. International standardization of CCS can contribute to the wide-spread of safe and appropriate CCS as it can ensure internationally agreed knowledge on safety and environmental aspects.

RITE is a domestic deliberation organization on ISO / TC 265 (Carbon dioxide capture, transportation, and geological storage) and is in charge of a secretariat of WG 1 (capture). Through these activities, we are actively involved in the international standardization on design, construction, operation, environmental planning and management, risk management, quantification, monitoring and verification, and related activities in the CCS field (Figure 3).

As of the end of March, 2025, fifteen standards related to the CCS have been published from ISO / TC265 and five documents are currently under development. The launch of a new project is also being considered, and TC265 has become more active in recent years. In particular, CO₂ ship transportation is attracting attention as a powerful means of transportation from emission sources to CO₂ storage site and technical report related to CO₂ ship transportation was published in 2024. Currently, a new technical report on the interface between ships and onshore facilities is being proposed by Japan.





4. Public awareness promotion / Human resources development and industry collaboration

4.1. Public awareness promotion / Human resources development

RITE is conducting various activities to promote public awareness and develop human resources with the aim of nurturing the next generation of researchers. Here, we will explain our activities separately for elementary, junior high, and high school students and university/graduate students.

<Elementary, junior high, and high school students>

Believing that educating the next generation about global warming issues is important, RITE accepts elementary, junior high, and high school students for field trips to its laboratories and visits schools to give lectures. In fiscal 2024, RITE focused on CCS technology from among its research projects and explained to 227 students from seven schools the mechanism of global warming and that even if CO2, a major greenhouse gas, is stored underground, there is a low possibility of leakage due to the clay layer (shielding layer). Based on our learning cycle, we then deepened their understanding through reflection and exchange of opinions.(Figure 4).



Figure 4 Human resource development by RITE (Elementary, Junior and high school students)

<University & Postgraduate student>

As part of efforts to develop human resources who will support next-generation research and technology, RITE promotes educational partner-ships with universities and graduate schools. We are developing education at universities and re-search guidance at research institutes (Figure 5). For example, Nara Institute of Science and Technology (NAIST) has set up a university-collaborated laboratory in the bio-science field at RITE. We are promoting research and education aimed at realizing are cycling-oriented and low-carbon society using renewable resources. In addition, we have established a collaborative laboratory with the materials creation science area of the NAIST, and are promoting research and education on CO₂ separation and recovery technology.



(University & Post graduate students)

4.2. Intellectual property and industry collaboration

RITE strategically and efficiently acquires and manages intellectual property rights such as pa-tents and know-how regarding the results of re-search and development, etc., and actively utilizes them for the public interest. The aim is to advance and improve industrial technology that contributes to the conservation of the global environment.

The acquisition of such research results as intellectual property creates opportunities for industrial collaboration with companies, etc., and through joint research and joint applications, further intellectual property is generated through a virtuous cycle that contributes to society. At RITE, we focus on the di-verse functions of intellectual property rights and strategically promote intellectual property activities while taking into consideration the market and other research and development trends.

As part of the promotion of intellectual property strategies, the "Patent Deliberation Committee" was established with RITE executives as members and the public relations and industry collaboration team as the secretariat. The main agenda is the acquisition and management of intellectual property such as patent applications and examination requests, patent right maintenance, and intellectual property strategies such as approval of license agreements.

As of the end of March 2025, of the patents for which RITE is the sole or joint applicant, 21 domestic applications and 12 foreign applications are pending patent applications, and the registered rights are maintained. It holds 63 domestic patents (including 3 under license to companies) and 40 foreign patents (3 of which are licensed to companies).



collaboration

5. Conclusion

Toward the realization of carbon neutrality by 2050,

the government has started the issuance of GX economy transition bonds and various GX promotion measures. With the enactment of the CCS Business Act, in addition, efforts have just been commenced to develop a business environment in which private companies are able to launch CCS business by around 2030. However, it is never easy to achieve carbon neutrality. To achieve this, RITE is required to play an active role in the social implementation of innovative environmental technologies. For practical application of CCS and other new technologies, it is essential to enhance public understanding. Taking advantage of the opportunity to display its DACCS (Direct Air Capture and Storage) technology at Expo 2025 Osaka, Kansai, Japan, RITE will make active efforts to enhance public understanding of the need to achieve carbon neutrality and the importance of CCS.

We at the Research & Coordination Group will also actively collect information on domestic and overseas policies and technology trends. With an eye toward realizing carbon neutrality by 2050, we, together with research groups, will actively implement and promote technology development and PR activities as well as industry-university cooperation activities. We believe that through RITE's concerted efforts to promote the social implementation of innovative environmental technologies, we will be able to contribute to carrying out RITE's mission: "to achieve the balance between the global environmental protection and economic growth."

Reference

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