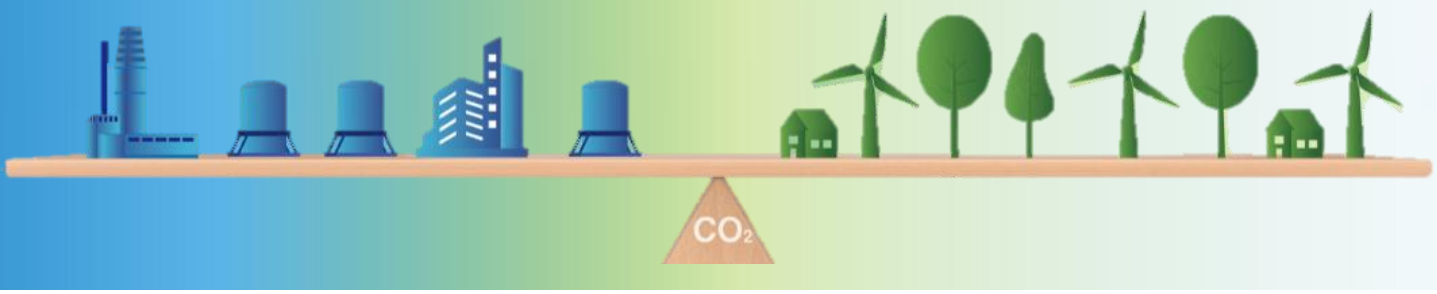
Carbon Recycling

7th International Conference on Carbon Recycling 2025

Summary of Results



METI
Ministry of Economy, Trade and Industry

NEDO
New Energy and Industrial Technology Development Organization

Carbon Recycling

7th International Conference on Carbon Recycling 2025

Summary of Results

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About the Conference

Event Overview

The International Conference on Carbon Recycling serves to reaffirm the commitment of various countries to the development and demonstration of carbon recycling technologies—key technologies for achieving carbon neutrality—and to enhance international collaboration toward their future social implementation.
In its seventh edition, the conference featured panel discussions on the following themes:

(1) Cooperation on Carbon Recycling to Contribute to CO_2 Reductions Across Industrial Society,
(2) Pathway of Carbon Recycling Technologies towards 2030, and
(3) Business Models for Forming the Carbon Recycling Market.

During the conference, participants reaffirmed the importance of promoting technological development in carbon recycling to create markets through cost reduction and the visualization of environmental value. They also highlighted the need to establish systems for appropriately assessing environmental value, as well as the significance of sharing and collaborating on technologies, funding, and expertise among countries. Furthermore, as concrete measures for cost reduction, expanding production scale, lowering the procurement costs of CO_2 feedstock, and improving efficiency throughout the supply chain were discussed. It was emphasized that reducing initial investment and operational costs is essential for building sustainable business models, which in turn is crucial for the social implementation of carbon recycling.
Additionally, as a side event of the conference, an exchange of views meeting was held between Japanese university students and overseas experts to foster the next generation of leaders in carbon recycling. A poster exhibition was also organized to showcase Japan's industry-academia-government initiatives in carbon recycling, thereby sharing Japan's CCU (Carbon Capture Utilization) and carbon recycling technologies and activities with the world.
Going forward, efforts to strengthen international cooperation will be further accelerated to realize the social implementation of carbon recycling, which is indispensable for achieving carbon neutrality.

7th International Conference on Carbon Recycling 2025

Schedule & Location

Friday, October 10, 2025
Hilton Osaka (Hybrid event with online participation)
*Site visit: Osaka-Kansai Expo on October 11

Organizer

METI Ministry of Economy, Trade and Industry

NEDO New Energy and Industrial Technology Development Organization

Participants

Approximately 650 people (approximately 250 on-site, approximately 400 online | 38 exhibitors)

Official Website

https://carbon-recycling2025.nedo.go.jp/

Program

10:00-11:30 **Exchange of Views for Students**

13:00-13:30 **Opening Ceremony**

13:40-14:30 **Panel A | Cooperation on Carbon Recycling to Contribute to CO_2 Reductions Across Industrial Society**

14:40-15:40 **Panel B | Pathway of Carbon Recycling Technologies towards 2030**

15:50-16:40 **Panel C | Business Models for Forming the Carbon Recycling Market**

16:50-17:00 **Closing Ceremony**

17:00-18:00 **Networking Event**

Opening Session 1/3

Mr. Kihara Shinichi
Director General for Energy and Environmental Policy, Ministry of Economy, Trade and Industry

First of all, I would like to express my heartfelt gratitude to everyone participating in this conference, especially to those who have come from overseas, as well as to all those who have contributed to making this event possible.
Japan is promoting GX (Green Transformation), aiming to achieve a stable energy supply, economic growth, and decarbonization simultaneously in order to realize carbon neutrality by 2050. In February of this year, we also set new and ambitious greenhouse gas emissions reduction targets that are consistent with the global 1.5°C goal: to reduce emissions by 60% by fiscal year 2035 and by 73% by fiscal year 2040, both compared to fiscal year 2013 levels. Achieving these goals is extremely challenging, and decarbonization of hard-to-abate sectors such as steel, chemicals, and cement is essential.
In this context, carbon recycling (CR) technologies, which contribute to emissions reduction by reusing CO_2 as materials or fuels, are considered indispensable for GX, as they also support decarbonization in hard-to-abate sectors.
In Japan, we are promoting the development and demonstration of new CO_2 separation and capture methods that can reduce costs, as well as technologies for stably fixing CO_2 recovered from factories into concrete. Some of these CR technologies are currently being showcased and demonstrated at the Osaka-Kansai Expo.
To create a market for CR products, it is also necessary to make their environmental value visible and to establish mechanisms that encourage demand-side preference for products with high environmental value. In Japan, we are developing rules for counting emissions reductions from CR in reporting greenhouse gas emissions under the law, and the government is actively procuring high-environmental-value CR products through public procurement. We hope that such initiatives will also progress in other countries, leading to the creation of a global market for CR products.
Through this conference, I hope that experts from industry, academia, and government around the world will exchange advanced knowledge and ideas for the social implementation of CR, and that the outcomes will contribute to a safe and sustainable energy future worldwide. With these expectations, I would like to conclude my opening remarks.

Mr. Saito Tamotsu
Chairman,
New Energy and Industrial Technology Development Organization (NEDO)

This conference has been held six times to date with the aim of promoting international discussion and collaboration across industry, academia, and government on CR, which is a crucial technology for achieving carbon neutrality. I would like to express my sincere gratitude to all participants for joining this seventh edition of the conference.
This year, Japan's Cabinet approved the 7th Strategic Energy Plan, in which CR, as part of CCUS (Carbon Capture, Utilization, and Storage), is expected to be a key technology for realizing a carbon-neutral society by 2050, since it can reduce CO_2 emissions to the atmosphere throughout the entire supply chain of products compared to conventional methods. NEDO is promoting research and development based on the government's "Carbon Recycling Roadmap." Including initiatives at the R&D and demonstration base for CR at Osaki-kamijima Island in Hiroshima Prefecture and exhibitions at the Osaka-Kansai Expo, NEDO's CR demonstration projects are being conducted across Japan.
In response to climate change, countries around the world are working on technology development, demonstration projects, and rule-making, as they seek pathways toward social implementation. Against this backdrop I hope that this conference will serve as a platform to broaden and deepen understanding of the significance and role of CR, and to further strengthen international cooperation.
Lastly, I would like to mention that Professor Susumu Kitagawa of Kyoto University, who has been involved in NEDO projects, was awarded the Nobel Prize in Chemistry for his research on porous metal complexes that can separate and store CO_2 and other gases. I hope that this remarkable achievement will serve as a catalyst to further advance CR technologies and to mark a new step toward a sustainable future. With these wishes, I would like to conclude my remarks.

Opening Session 2/3

Dr. Nuki Agya Utama

Director for Energy Policy & Head of Asia Zero Emission Center (AZEC), ERIA, Former Executive Director, ASEAN Centre for Energy (ACE)

Last year, we discussed how CR is one of the most promising pathways for transforming waste into resources and promoting a circular carbon economy. Since then, momentum in the CR sector has continued to grow, with an increasing number of pilot projects, policy developments, and the establishment of business models by the private sector worldwide. However, further scaling up is necessary, and cooperation among all of us is essential.

In ASEAN, where fossil fuels remain predominant, combining CR with CCS can open up realistic and region-specific pathways to decarbonization. ERIA is committed to supporting this transition, and at the 5th Asia CCUS Network Forum, we discussed that CR should be seen not only as a technological solution, but also as an economic opportunity. Nonetheless, challenges such as technological maturity, financing, and regulatory frameworks remain, making international cooperation indispensable. Clear regulatory frameworks, harmonized standards, and coordinated investments are needed to move CR from concept to implementation.

Among these, financing is a critical factor that will determine progress. ERIA's research indicates that voluntary carbon credit markets have the potential to drive regional decarbonization. By recognizing CR as a legitimate carbon removal activity, it is possible to generate high-quality credits, promote economies of scale as a new source of revenue, and attract private investment. In other words, carbon credits serve as a bridge between technology and commercial viability.

Dr. Timur Gül

Chief Energy Technology Officer, International Energy Agency (IEA)

Japan recognized the importance of CR at an early stage and has demonstrated international leadership in the CCUS field through the formulation of the "Green Growth Strategy" and the "Carbon Recycling Roadmap." Japan is actively advancing concrete initiatives such as legal development and liquefied CO_2 transport technologies, and is also engaged in international cooperation, including bilateral consultations on cross-border projects.

Globally, CCUS-related projects are on the rise, with several groundbreaking examples such as the introduction of CCS (Carbon Capture and Storage) at natural gas power plants and Indonesia's first large-scale CCUS project. The industry is increasingly focusing on steady progress in existing projects rather than announcing new ones, and further expansion into hydrogen production and other industrial sectors is anticipated.

Currently, the main applications of CR are in the fertilizer industry and enhanced oil recovery, but new uses for synthetic fuels, chemicals, and building materials are rapidly accelerating. It is expected that CO_2 captured by 2030 will be primarily used for synthetic fuel production, though even greater scale will be required to achieve net zero. CCUS and CR are indispensable for reducing emissions in industrial sectors that cannot be addressed by renewable energy and efficiency measures alone, and they will contribute to maritime and aviation sectors through the supply of low-emission hydrogen and sustainable fuels. The use of sustainable fuels has the potential to increase dramatically through national policies and demand creation initiatives.

In addition to technological development, it is essential to promote investment, establish viable business models, and strengthen international cooperation. Governments have a role to play in creating markets for CO_2-derived products, developing infrastructure, and harmonizing international standards and policies. Japan is contributing to the global spread of CCUS not only through technological innovation, but also through international platforms and cooperative frameworks. Through such public-private partnerships and international collaboration, it is possible to achieve both climate change mitigation and new economic opportunities.

Opening Session 3/3

Dr. Naser Odeh

Principal Fellow,
King Abdullah Petroleum Studies and Research Center (KAPSARC)

The King Abdullah Petroleum Studies and Research Center (KAPSARC) is a think tank that provides advisory services on low-carbon technologies and conducts research in six areas related to sustainability.
Saudi Arabia has adopted a Circular Carbon Economy (CCE) approach, treating CO_2 not as waste but as a valuable resource. This approach uses a framework of Reduce, Recycle, Reuse, and Remove. The goal is to reduce CO_2 emissions while promoting economic development. For example, in the "Reduce" category, Saudi Arabia has set targets of 9 million tons of CCS by 2028 and 44 million tons by 2035.
For "Recycle," KAPSARC evaluates promising uses of recycled CO_2 based on criteria such as technology maturity, scalability, market demand, and life cycle assessment (LCA). Of particular importance is the removal potential, and it has been shown that the use of CO_2 in building materials—such as concrete curing and aggregates—has high potential. Since the prioritization of these applications varies by country, it is necessary for each country to carry out analyses from various perspectives like these. Recycling should be considered not as a single technology, but as a portfolio of various utilization technologies. To facilitate social implementation, appropriate policies, partnerships, R&D investments, and demonstration support must be indicated.

Mr. Mitsuoka Tsugio

Chairperson,
Carbon Recycling Fund Institute

The Carbon Recycling Fund (CRF) is a private-sector-led organization established in August 2019. Together with approximately 250 members—including companies from various industries, academia, and local governments—CRF has been engaged in activities such as providing research grants (including support for startups), organizing seminars, and making policy recommendations. In its annual call for research proposals in May, CRF has selected 22 research themes for this fiscal year and has supported around 100 research projects to date, including international joint research. In October, CRF participated in the Cleaner Energy Future Initiative for ASEAN (CEFIA) Forum, and we hope to further promote collaboration in the ASEAN region going forward.
CRF believes that, when considering CR, it is important to fully leverage the inherent functions of nature. Building on this, the separation, capture, and transport of CO_2, the formation of markets to promote its utilization, and the expansion of demand through visualization are all essential for circulating CO_2 as a resource. By broadening the value chain and increasing collaboration, we believe that the value of CO_2 as a resource can be enhanced.
Additionally, CRF recognizes the importance of green and blue carbon sinks for sequestering CO_2 and has begun discussions with a diverse range of stakeholders. We aim to quantitatively evaluate their effectiveness and contribute to the development of international rules. We also hope to see these initiatives gaining momentum internationally.

Panel Discussion

Panel A — Cooperation on Carbon Recycling to Contribute to CO_2 Reductions Across Industrial Society

In this session, drawing on examples of international collaboration in the field of CR, participants discussed what kinds of partnerships could be effective for creating CR markets and what roles each country and business entity should play in the future.

During the panel session, Mr. Hasegawa from Japan's Ministry of Economy, Trade and Industry pointed out that, at present, it is difficult for private businesses alone to make investment decisions for cost reduction of CR products. He emphasized the need for systems that evaluate environmental value to stimulate demand for CR products during the transition period, and indicated that the government intends to proactively procure high-environmental-value products to create an early-stage market.

Dr. Stephenson from the UK government referred to challenges such as cost reduction, securing raw materials, and frameworks for verifying environmental value, and argued that government support is necessary for establishing standards related to CR and for creating credit markets.

From a business perspective, Mr. Tanaka of Idemitsu Kosan emphasized that in order to create demand and promote the widespread adoption of CR products with added environmental value, it is necessary to hold collaborative discussions not only at the private sector level but also at the government level. He also highlighted the importance of utilizing international frameworks such as AZEC. Similarly, Ms. Fitriani from Pertamina remarked, from the viewpoint of developing countries, that reducing CAPEX and OPEX costs for promoting CR requires further international cooperation.

According to Dr. Fajardy from the IEA, the key areas of government support for promoting international collaboration are: (1) international harmonization of definitions, standards, and methodologies; (2) cooperation in research and development; (3) collaboration in establishing international infrastructure; and (4) encouraging investment in emerging economies. She also highlighted that, given the significant economic challenges in emerging economies, it is important to expand support from the private sector and international financial institutions, as well as to share expertise.

Moderator

Mr./ Prof. Sakamoto Toshiyuki
Board Member, Director, The Institute of Energy Economics

Panelist

Mr. Hasegawa Hiroshi
Director, International Strategy on Energy Resources Office, METI

Ms. Rachma Fitriani
Senior Researcher in New & Renewable Energy at Pertamina

Dr. Mathilde Fajardy
Energy Technology & Policy Analyst, International Energy Agency（IEA）

Mr. Tanaka Hiroshi
Executive Officer, General Manager of Carbon Neutral Transformation Department, Idemitsu Kosan Co.

Dr. Anna Stephenson
The Deputy Director for Engineering and Research at the UK Government Department for Energy Security and Net Zero

Panel Discussion

Panel B Pathway of Carbon Recycling Technologies towards 2030

This session focused on development of CR technologies, introducing the current level of technological progress and maturity in the field, and discussing technological challenges and future prospects for social implementation.
In the chemicals sector, Dr. Ohishi from NEDO presented examples of technology development for producing various chemicals from CO_2, such as paraxylene, formic acid, and ethylene. He emphasized that the technology for methanol production, a key raw material, is particularly important, and highlighted the need to advance R&D to improve catalyst performance.
In the minerals sector, Dr. Zhou from Greenore, Mr. Kozakai from Sumitomo Osaka Cement, and Mr. Dawe from MCi Carbon introduced technologies for producing concrete and artificial limestone from steel slag and carbonates. Mr. Kozakai noted that mineralization does not require energy for CO_2 fixation, and CO_2 capture is unnecessary in cases of high alkalinity, which makes early social implementation promising. On the other hand, he pointed out the challenge of securing a stable supply of raw materials for scaling up, while Mr. Dawe mentioned the need to establish new product standards. Dr. Zhou also indicated that successful overseas scale-up requires securing engineering skills and understanding the cost and market characteristics of each country and region. Thus, the panelists reaffirmed their shared understanding that efforts from both the public and private sectors are essential.
In the fuels sector, Dr. Ohnishi from Osaka Gas introduced their innovative e-methane technologies such as SOEC methanation. Due to its high efficiency, low electricity requirements, and the potential to utilize existing LNG supply chain and facilities, he said that this technology has high cost reduction potential. He also indicated that there are plans to further promote the development of scale-up technologies going forward.

Moderator

Dr. Kondoh Motohiro
Professor, Research Institute for Industrial Technology, Aichi Institute of Technology

Panelist

Dr. Ohishi Yoshihiko
Director in the Circular Economy Department at the New Energy and Industrial Technology Development Organization (NEDO)

Mr. Kozakai Noriyuki
Managing Executive Officer, Sumitomo Osaka Cement Co.,Ltd.

Dr. Xiaozhou Zhou
CEO of Greenore

Dr. Ohnishi Hisao
Executive Fellow, OSAKA GAS Co., Ltd.

Mr. Marcus Dawe
Founder & CEO of MCi Carbon

Panel Discussion

Panel C — Business Models for Forming the Carbon Recycling Market

To achieve commercial success in projects utilizing CR technologies, it is essential to ensure economic viability by expanding production scale, reducing procurement costs for raw materials such as CO_2 and hydrogen, and lowering initial investment and operational costs through supply chain optimization. In this session, the discussion centered on new business models in the CR sector, with a particular focus on introducing advanced cases of cross-industry collaboration for building supply chains from CO_2 emitters to end users, and examining specific actions that governments, companies, international organizations, and other stakeholders should take.

During the discussions, Mr. Boltze from thyssenkrupp highlighted key challenges in building supply chains for CR products, such as sourcing affordable green hydrogen, the willingness of end users to accept higher prices, methods for allocating environmental value, and differences in regulations and interests among industries. He also emphasized the need for policy support from governments.

Dr. Maeda from Saga City spoke about the importance of leveraging the position of local governments to thoroughly listen to the concerns of various stakeholders—from CO_2 emitters to end users—and to build projects on the foundation of existing CO_2 utilization businesses.

Dr. Ukai from Aisin stressed the need for efficient CO_2 transport systems and quality management that aligns supply-side and demand-side requirements (such as CO_2 purity) to reduce costs. He also pointed out that expanding the supply chain requires building stakeholder networks and Aisin is actively working, in cooperation with Aichi Prefecture and other partners, to promote initiatives such as evaluating emissions across the entire supply chain, defining the role of project coordinators, and establishing frameworks to ensure environmental value.

Dr. Kofler from K1-MET stated that, beyond the development of individual technologies, it is crucial to build an integrated, cross-industry ecosystem. Project managers need to foster a shared understanding of goals, timelines, and success criteria among stakeholders, while managing governance and risk. She also noted that the current lack of transport infrastructure for hydrogen and CO_2 and the associated high costs are significant challenges, highlighting the necessity of long-term policy support.

Moderator

Ms. Yoko Chivers
Senior Vice President, Sustainable Planning Dep at Sumitomo Mitsui Financial Group (SMFG)
General Manager, Sustainable Planning Dep at Sumitomo Mitsui Banking Corportaion (SMBC)

Panelist

Dr. Maeda Shuji
Director of Policy Promotion, GX Promotion Division, Saga City

Mr. Nikolaus Boltze
thyssenkrupp AG / Country Representative

Dr. Ukai Kenji
Senior Specialist, the Energy VC Company of AISIN Corporation

Dr. Irmela Kofler
Head of Research Area "Decarbonisation and Sectorcoupling", K1-MET GmbH

Closing Session

Mr. Matsumoto Shintaro

Executive Director,
New Energy and Industrial
Technology Development
Organization (NEDO)

I would like to thank all the participants of this international conference for your vigorous and candid discussions. My gratitude also goes out to everyone who supported the successful, well-attended poster session.
NEDO is vigorously supporting the development of CR-related technologies by utilizing the Green Innovation Fund, which totals approximately 2.75 trillion yen. Technologies resulting from these efforts, such as environmentally friendly concrete and synthetic methane, are being showcased at the Osaka-Kansai Expo, and I feel that outreach to end users and interest in these technologies are steadily growing.
To summarize the discussions at the conference: In Panel A, it was reaffirmed that expanding regional initiatives requires international collaboration while leveraging the technologies of each country. In Panel B, we recognized the challenges of scaling up CR technologies from the laboratory to the commercialization level while involving even end users in the process. Panel C highlighted the need to explore profit-sharing mechanisms among multiple players and to establish the appropriate regulatory frameworks for CR market formation.
Through today's conference, we were able to discuss the necessity and future outlook of CR and once again confirm the importance of strengthening international cooperation. NEDO will continue to focus our efforts on technological development, outreach activities, and international collaboration to promote the social implementation of CR technologies.
Finally, I would like to conclude my remarks by expressing my hope that this conference will serve as a catalyst for the social implementation of CR , and will contribute to the realization of a carbon-neutral society as soon as possible.

Networking Event/Poster Session

After the conclusion of the conference, a networking event was held as a side event for those who attended in person. The purpose of this event was to deepen exchanges among conference participants, and it began with a toast by Mr. Fukunaga Shigekazu, Director General of the Circular Economy Department at NEDO. The networking event took place in the poster session venue, where various industry, academia, and government participants engaged in the field of carbon recycling were able to interact and build relationships through poster exhibitions and discussions.
At the end of the networking event, closing remarks were delivered by Mr. Hashiguchi Masamichi, Senior Executive Director of the Carbon Recycling Fund Institute. In his speech, Mr. Hashiguchi expressed a strong commitment to promoting the advancement of the CR field through collaboration among industry, academia, and government in order to achieve net zero by 2050. With this, the event came to a successful close.

Exchange of Views for Students

The International Conference on CR serves as a valuable opportunity for experts from industry, academia, and government both in Japan and abroad to gather and discuss CR, one of the key technologies for achieving carbon neutrality, with the aim of strengthening international collaboration and partnerships. Seizing this opportunity, we organize an annual student networking event aimed at university students who will lead the next generation of research and technological development. This event is designed to foster interest in the CR field and provide opportunities for students to become involved in CR, through networking and international exchange among university students nationwide.

This year, the event consisted of two parts: a lecture segment featuring guest speakers from overseas and a discussion segment with group discussions and presentations by students.

In the lecture segment, we welcomed Dr. Naser Odeh from KAPSARC and Mr. Haryo Satriya Oktaviano from Pertamina as guest speakers. Dr. Odeh introduced four areas of CR technology (construction material-based, waste management-based, fuel-based, and chemical-based), noting that construction material-based concrete curing is expected to be the most widely adopted due to its high technological maturity (TRL 8-9), low initial retrofit investment, and permanent CO_2 fixation capacity. He also emphasized that in the chemical sector, the decarbonization benefits are limited since CO_2 is eventually released. Mr. Oktaviano highlighted that promoting low-carbon energy businesses requires three essential elements: CO_2, clean hydrogen, and clean electricity. He stressed the importance of collaboration among diverse stakeholders in building these value chains and introduced Pertamina's technology development examples, such as fuel cells and SOEC water electrolysis systems.

In the discussion segment, students discussed the challenges and solutions related to nurturing talent capable of promoting CR technologies internationally. Key issues identified included: "Compared to overseas, the value of a doctoral degree is lower in Japan, and financial and career prospects are uncertain," and "Researchers themselves do not fully understand how their individual research contributes to decarbonization." Proposed solutions included: "Expanding government support systems for human resource development beyond research funding, such as support for overseas internships," "Increasing the number of scholarship grants," "Attracting international researchers to shape global career paths," "Creating opportunities for industry to communicate the importance of technology to students," and "Establishing research frameworks through consortia involving industry, academia, and government."

Post-event surveys revealed high levels of satisfaction, with comments such as "The lectures from international experts were very informative" and "Interacting with students from different research fields was stimulating." In fact, 90% of respondents indicated that the event was "very helpful" or "helpful" for their career development, demonstrating its positive contribution to both career formation and heightened interest in the CR field among students.

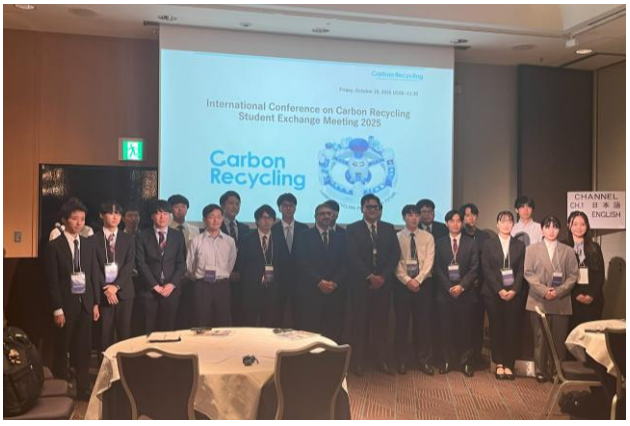
Guest speaker

Dr. Naser Odeh

Principal Fellow,
King Abdullah Petroleum Studies and Research Center (KAPSARC)

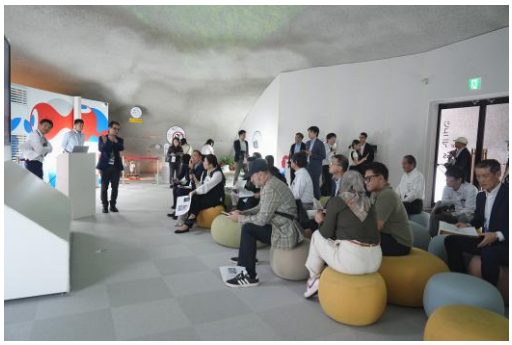
Mr. Haryo Satriya Oktaviano

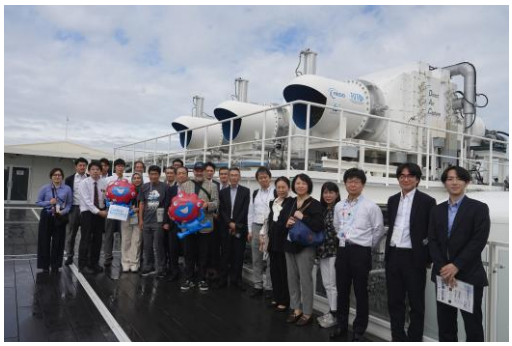
Sr. Specialist II Downstream Research, PT Pertamina (Persero)



Site Visit

The day after the international conference, a site visit to the Osaka-Kansai EXPO was organized for experts who had participated as speakers at the conference. During this visit, participants toured demonstration facilities related to CR within the expo, such as “Sustainadome” and “Carbon Recycling Factory”.
The first stop was the “Sustainadome”. Representatives of the facility explained the design methods of the dome, which utilizes the environmentally friendly concrete “CUCO-SUICOM” developed by Kajima Corporation and others as part of NEDO’s Green Innovation Fund, as well as the method for injecting CO_2. By using this concrete, a 70% reduction in CO_2 emissions has been achieved, though the cost is about three times higher than that of conventional concrete. Participants raised questions, particularly regarding the challenges of cost reduction and future prospects. The representatives pointed out the current challenges that the high price of CO_2 and the concrete’s vulnerability to carbonation—which lowers its ability to protect rebar—currently limit its use mainly to interior applications of buildings.
Next, the group visited the “Carbon Recycling Factory,” where cutting-edge CR demonstration facilities of the Research Institute of Innovative Technology for the Earth (RITE), Osaka Gas, and AIR WATER are located. The tour began with Osaka Gas’s methanation demonstration facility, “Bakeru LABO.” Here, CO_2 is derived from the biogas produced by fermenting the food waste collected from the Expo site. The CO_2 is combined with hydrogen produced using renewable energy to synthesize methane, the main component of natural gas. Two methanation methods, the Sabatier catalytic reaction and biomethanation (utilizing microorganisms), are used to compare their feedstock supply, operating conditions, and efficiency. The facility receives a renewable electricity supply from Kansai Electric Power and produces 20 Nm^3 of green hydrogen at 100 kW. The facility produces methane equivalent to the consumption of about 170 households at a concentration of 97%.
The next stop was AIR WATER’s “Nature’s Blessings Station.” This facility demonstrates CO_2 recovery and liquefaction from boiler exhaust gas for use as dry ice. The recovery technology utilizes a Na-Fe-based oxide CO_2 absorbent developed through the Green Innovation Fund project, achieving a recovery rate of 0.3 tons per day. The absorbed CO_2 can be released by heating the absorbent; this heat is derived from the exhaust gas itself, which improves energy efficiency. The recovered CO_2 is used not only for dry ice production but also as a feedstock for methanation at the aforementioned Osaka Gas facility.
Finally, the group visited the “Future Forest,” where they saw demonstrations of negative emission technologies, including DAC (Direct Air Capture) facilities developed by RITE, Nagoya University, and Kyushu University. Here, a DAC system efficiently captures low-concentration CO_2 (about 0.04%) using adsorbents specially developed by RITE (such as amines). The CO_2 is then recovered at a concentration of 95% and is utilized for applications such as methanol synthesis by Mitsubishi Gas Chemical in Niigata Prefecture. The group also observed Nagoya University’s CO_2 recovery technology (Cryo-DAC), as well as Kyushu University’s ultra-thin membrane CO_2 recovery technology and its application in dining areas (DAC-U device).
The site visit concluded with a tour of the Grand Ring, a symbolic structure of the Osaka-Kansai Expo, thus bringing this year’s site visit to a close.






Summary Document by the Organizers 1/2

Overview

On October 10, 2025, the 7th International Conference on Carbon Recycling 2025 was held at the Hilton Osaka, bringing together representatives from academia, industry, and government worldwide. The International Conference on Carbon Recycling is an international forum aimed at reaffirming the commitment of participating countries to the development and demonstration of carbon recycling technologies, which are recognized as key to achieving net-zero emissions, with a view to their future social implementation, and at strengthening cooperative relationships among countries.
This year's conference saw the participation of approximately 650 people from 20 countries, with around 250 attending in person and about 400 joining online. EXPO 2025 OSAKA, KANSAI, held from April 2025, showcased a wide range of carbon recycling technologies developed by Japanese companies. This year's conference was held in Osaka to coordinate with these initiatives at EXPO.
At this seventh conference, panel discussions were held on the following themes: [i] cooperation on carbon recycling to contribute to CO_2 reductions across industrial society, [ii] pathways of carbon recycling technologies towards 2030, and [iii] business models for forming the carbon recycling market. In addition, an exchange event between students and experts was also held with the aim of fostering the next generation of talent.

Panel Discussion

①Cooperation on Carbon Recycling to Contribute to CO_2 Reductions Across Industrial Society
At the G7 Summit held in Hiroshima in 2023, it was acknowledged that CCUS/carbon recycling technologies can be an important part of decarbonization solutions to reduce emissions from industrial sources that cannot be avoided by other means. The application of carbon recycling requires government efforts to create a favorable business environment, including financial support. Furthermore, as carbon recycling technologies become more widely adopted globally and CO_2 supply chains extend across borders, international coordination of regulations will be necessary.
In Session 1, discussions were held on potential future collaborations and the roles that countries and businesses should play towards establishing a carbon recycling market., using examples of international cooperation in this field. During the panel session, it was noted that while technological development is essential for reducing the costs of carbon recycling products, current uncertainties—such as rising energy prices and the expected increase in energy demand from AI and other sources—make investment decisions difficult for private companies. Therefore, government support for technological development during the transition period is crucial. It was also discussed that establishing systems to evaluate the environmental value of carbon recycling products is necessary to stimulate demand, and that proactive government procurement of environmentally valuable products can lead to the early creation of markets.
Additionally, the importance of international cooperation was emphasized, including joint research and development, infrastructure development, partnerships between companies, and the role of emerging economies as regional hubs. On the other hand, challenges such as high costs and securing stable demand remain, and particularly in emerging economies, international cooperation in technology, funding, and expertise was highlighted as indispensable.

Summary Document by the Organizers 2/2

Panel Discussion

②Pathway of Carbon Recycling Technologies towards 2030

According to the IEA's "ETP Clean Energy Technology Guide," co-electrolysis of CO_2 and H_2O for the production of CO_2-derived synthetic fuels in the hydrocarbon fuel sector has reached Technology Readiness Level 6 (TRL6), indicating significant progress in fuel-related carbon recycling technologies. In addition to the fuel sector, the potential applications of carbon recycling technologies are expanding in the fields of minerals and chemicals. For example, technologies for producing calcium carbonate and environmentally friendly concrete or cement from CO_2 have the potential to contribute to decarbonization in the construction and manufacturing industries. In the chemical sector, research and development of polymers and chemical products using CO_2 as a feedstock are underway, and these products are expected to enhance sustainability in the chemical industry.

Against this backdrop, Session 2 focused on the development of carbon recycling technologies, introducing the current technological progress and maturity in this field, and discussing technical challenges and prospects for future societal implementation. During the panel session, the latest carbon-recycling technologies in each field were presented, including environmentally friendly concrete utilizing steel slag and carbonates (minerals), catalytic processes for producing various basic chemicals from CO_2 (chemicals), and SOEC methanation (fuels). These presentations demonstrated the steady progress toward the practical application of carbon recycling technologies.

Participants confirmed a shared understanding of the importance of scaling up for cost reduction and the necessity of efforts by both public and private sectors to achieve this, including stable and diversified procurement of raw materials and regulatory frameworks for handling large volumes of CO_2. Furthermore, it was pointed out that scaling up overseas projects will require securing engineering expertise and understanding the cost structures and market characteristics specific to each country and region.

③Business models for forming the Carbon Recycling Market

To achieve commercial success in projects utilizing carbon recycling technologies, it is essential to ensure economic viability by scaling up production, reducing procurement costs for raw materials such as CO_2 and hydrogen, lowering initial and operational costs through supply chain optimization, and establishing financing mechanisms including carbon credits. Additionally, visualizing the environmental value of products manufactured using recovered CO_2—such as concrete, fuels, and chemicals—can facilitate appropriate price transfer, thereby supporting the formation of a sustainable market based on carbon recycling technologies and products and accelerating their full-scale societal implementation.

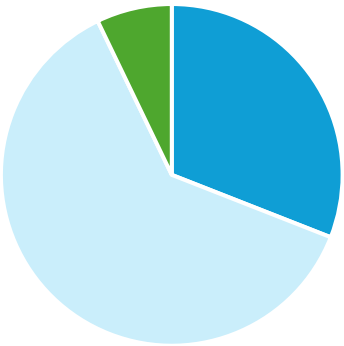
In Session 3, discussions centered on new business models for the carbon recycling sector, particularly from the perspectives of industry and market players, focusing on the measures needed to expand business activities. Advanced case studies that promote inter-industry collaboration to build value chains from CO_2 emitters to end users were examined to identify specific actions that should be taken by stakeholders such as governments, companies, and international organizations. The panel session featured examples of pioneering inter-industry cooperation both in Japan and overseas.

Through these discussions, the importance of visualizing and clarifying the requirements and interests of stakeholders—such as regulatory frameworks, cost tolerance, and the value of CO_2 emission reduction—on both the supply and demand sides of CO_2, as well as matching and facilitating communication between them, was highlighted as critical for building efficient CO_2 supply chains. The role of project management and governance was also emphasized. Furthermore, it was pointed out that establishing systems to visualize and allocate the value of CO_2 emission reduction is necessary to further promote inter-industry collaboration.

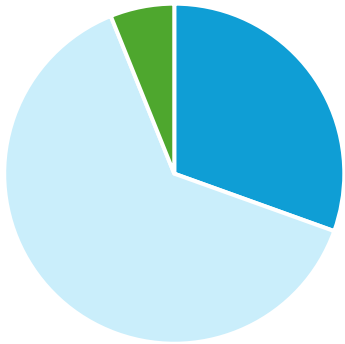
Feedback from the Participants

Survey Results (Main Events)

Satisfaction with the main events?



Satisfaction with the poster session?

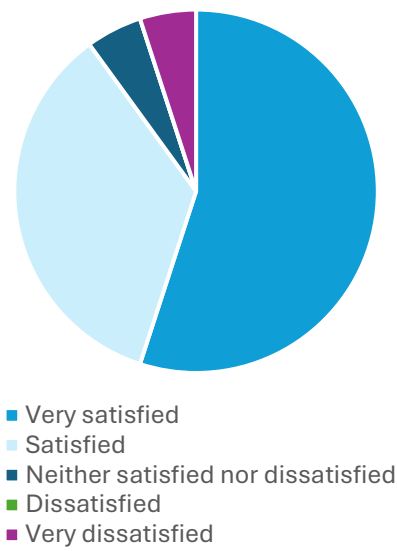


Main Opinions (Excerpts)

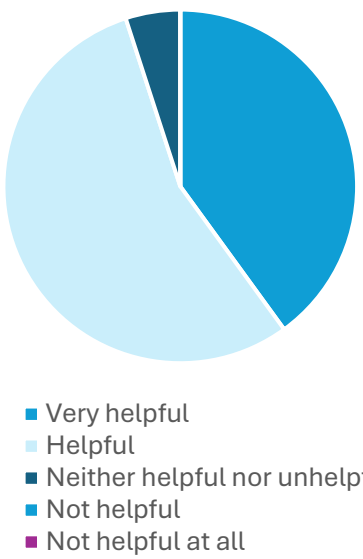
- It was a valuable opportunity to hear the latest trends and government perspectives on CR technology and social implementation from various countries, including those overseas.
- It was good that a long time was allocated for the panel discussion. In addition to answering the facilitator's questions, allowing panelists to engage in Q&A with each other would further energize the discussion.
- During the poster session, I was able to communicate closely with various people.

Survey Results (Exchange of Views for Students)

Overall satisfaction with the event?



Was it helpful for career development?



Main Opinions (Excerpts)

- It was very stimulating to be able to discuss with students from diverse backgrounds. It was a great opportunity to think about CR from perspectives I hadn't considered before.
- I was able to learn about CR technology from a business perspective, which is something I don't often encounter in graduate school, where the focus is mainly on basic research. It was a meaningful experience.

Carbon Recycling

7th International Conference on Carbon Recycling 2025

METI
Ministry of Economy, Trade and Industry

NEDO
New Energy and Industrial Technology Development Organization