Summary of the 8th International Conference on Carbon Recycling 2026

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About the Conference

On October 9, 2026, the 8th International Conference on Carbon Recycling was held.

Carbon recycling refers to technologies that treat CO_2 as a resource and utilize it in the production of fuels, chemicals, minerals, construction materials, and other products. Since 2019, the International Conference on Carbon Recycling has brought together stakeholders from industry, academia, and government in Japan and around the world. The conference aims to accelerate the social implementation of carbon recycling by facilitating knowledge-sharing, showcasing the results of advanced technology development and demonstration projects, and strengthening international collaboration.

Against the backdrop of the current situation in the Middle East, uncertainty surrounding the global energy landscape has risen to an unprecedented level. Japan has taken every possible step to secure its immediate energy supply, including the release of crude oil from national reserves and public-private initiatives to secure alternative supplies via routes that bypass the Strait of Hormuz. At the same time, building a resilient energy system over the long term will require not only supply-side measures, but also reducing dependence on fossil fuels and fundamentally transforming the structure of energy demand itself.

In this context, carbon recycling is a key technology with the potential to contribute simultaneously to decarbonization and energy security by utilizing CO_2 as a feedstock for fuels, chemicals, and other products, thereby reducing fossil fuel consumption while maintaining industrial competitiveness. Realizing this potential will require further accelerating efforts toward social implementation, extending beyond technology development and demonstration to encompass commercialization and market creation.

Against this global backdrop, attendance at the conference reached approximately 1,000 participants from 26 countries, including around 450 in person and around 540 online. Representatives from governments, research institutions, companies, and startups delivered presentations under three themes: policy and international trends; advanced technologies supporting the CO_2 value chain; and industrial collaboration and market creation toward social implementation. The conference also featured a poster session, a startup event, and a student networking program, with a focus on the commercialization of technologies and the development of the next generation of professionals.

Thematic Sessions

The conference confirmed the following key points.

1. The Global Landscape of Carbon Recycling and Japan's Initiatives

Creating demand and developing markets are critically important for the social implementation of carbon recycling. Key measures include giving preferential consideration to carbon-recycled products in government procurement and providing institutional incentives for companies to adopt low-carbon products.

This session presented government initiatives in various countries aimed at advancing the social implementation of carbon recycling. Japan was represented by the Ministry of Economy, Trade and Industry (METI), the Ministry of the Environment (MOE), and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). METI emphasized that promoting Green Transformation (GX) investment requires greater policy consistency and predictability by setting out a long-term policy direction. It introduced the Growth-Oriented Carbon Pricing Concept, including the emissions trading system launched in April 2026. METI also presented initiatives to stimulate demand for GX products, including carbon-recycled products, by quantifying and clearly communicating their environmental value and actively promoting the adoption of GX products in public works projects. MOE presented a self-sustaining CCU/carbon recycling business model in which CO_2 emitted within a region is utilized locally through the use of regional resources, such as renewable energy, hydrogen, and infrastructure. MLIT introduced a new system requiring the calculation and reporting of emissions over the entire life cycle of large-scale buildings, with the aim of promoting decarbonization and innovation in the building sector.

Representatives from India and Sweden also participated in the session. In light of recent progress in Japan-India cooperation in the fields of green hydrogen and ammonia, further bilateral collaboration is also anticipated in CCUS and carbon recycling. Sweden, meanwhile, is pursuing advanced initiatives toward the social implementation of CCU technologies and the creation of associated markets, supported by government policies and funding under its broader climate policy framework. The presentation from India used initiatives at the Indian Institute of Technology Bombay (IIT Bombay) as an example to illustrate how research, demonstration, and collaboration with industry can contribute to the broader adoption of CCUS technologies, underscoring the importance of cooperation among government, academia, and industry. Sweden presented its frameworks for supporting industrial decarbonization and efforts to develop projects involving e-methane, e-SAF, and other products, while also expressing an interest in pursuing multilateral collaboration.

Other international developments were also discussed at the opening ceremony. Professor Sally Benson of Stanford University, drawing in part on examples from the United States, highlighted the importance of developing diverse technology pathways suited to each country’s resources, markets, and industrial structures; establishing carbon accounting methodologies to verify carbon intensity and circularity; creating markets and incentives that recognize environmental and energy security value; and identifying initial niche markets in which carbon recycling offers advantages in terms of performance, price, or energy security. From the perspective of ASEAN and East Asia, the Economic Research Institute for ASEAN and East Asia (ERIA) noted that, while consideration is being given to utilizing CO_2 as a feedstock for chemicals and other products in the region, technological risks, financing, and economic viability remain barriers to commercialization. ERIA emphasized the need for financing models that reduce early-stage investment risks, alongside improvements in catalysts and energy efficiency. It also noted that Japan’s Carbon Recycling Roadmap has become a reference for other countries and described ongoing cooperation with the National Institute of Advanced Industrial Science and Technology (AIST) and

research institutions in ASEAN countries to develop evaluation methodologies, including life cycle assessment (LCA). The International Energy Agency (IEA) reported that, although CCUS projects are expanding worldwide, many have experienced delays due to uncertainties surrounding permitting, construction, and markets. The IEA identified several key priorities for the future: transitioning from concept to execution; developing integrated value chains encompassing capture, transport, utilization, and storage; and creating reliable demand through policies, standards, and long-term offtake arrangements.

Through this session and the opening ceremony, developments across key regions were shared, covering Japan, the United States, ASEAN and East Asia, South Asia, Europe, and the world as a whole. The discussions confirmed the importance of advancing carbon recycling in a manner tailored to the resources, industrial structures, and policy environments of each region, while also reaffirming the importance of international collaboration.

2. Advanced Carbon Recycling Technologies for CO_2 Value Chain Development

Promoting the development of innovative technologies capable of substantially reducing costs is essential for the social implementation of carbon recycling. In particular, technologies must be advanced at every stage, from CO_2 separation and capture to its conversion into and utilization as fuels, chemicals, minerals, construction materials, and other products. These technologies must also be integrated in ways that take into account actual emission sources, existing facilities, and downstream applications, thereby facilitating the transition from demonstration to commercialization.

The session presented a case involving the construction of a methanation facility on one of the world's largest scales and the injection of synthetic methane produced at the facility into a city gas pipeline. It also provided an update on progress toward the practical application of a technology for producing silicon carbide (SiC), a material used in power semiconductors, from CO_2. Another presentation covered a high-performance membrane for separating and capturing CO_2 from low-concentration, low-pressure industrial flue gas, including operational testing with actual flue gas and the development of technologies for the mass production of membranes. In catalyst-based fuel and chemical production, work is under way to develop processes designed for the recycling of unreacted CO_2 and other materials, as well as for continuous operation. For ethylene production through CO_2 electrolysis, electrolyzers are being scaled up in stages with the objective of achieving quality and cost comparable to those of existing products. Carbon-fixing construction materials produced through mineralization are also progressing toward integration into existing construction-material manufacturing processes, customer evaluation for multiple applications, certification for use as construction materials, and the development of commercial-scale plants. Although these technologies are at different levels of maturity, the examples demonstrated that development has moved beyond laboratory-scale performance improvements and has entered a stage in which the specific conditions required for commercialization are being validated, including operation in real-world environments, the development of mass-production technologies, integration with existing facilities, product certification, and customer evaluation.

At the same time, a value chain cannot be established through improvements in individual technologies alone. Going forward, CO_2 concentration and quality, renewable energy and hydrogen supply, downstream process specifications, integration with existing facilities, continuous operation, certification, customer evaluation, and mass-production costs must all be addressed across the value chain as a whole to ensure its viability. To enable deployment in other regions, it will also be important to distinguish between elements that can be standardized and those that must be designed in accordance with regional conditions.

As a special lecture, Distinguished Professor Susumu Kitagawa of the Kyoto University Institute for Advanced Study, recipient of the 2025 Nobel Prize in Chemistry, delivered a video presentation titled "From an Extractive Civilization to a Separation Civilization: The Third Chemical Revolution Enabled by the Design of Molecular Space." Professor Kitagawa noted that an extractive civilization based on "extracting, burning, and emitting" underground resources faces structural limitations, including geopolitical risks arising from the uneven distribution of resources and environmental burdens. He then advocated a transition to a "separation civilization" in which CO_2 and other substances are separated and captured from air, which is available everywhere, and reused in a circular manner as resources. As technologies central to this transition, he introduced porous materials such as metal-organic frameworks (MOFs), which can separate, store, and convert gas molecules at ambient temperature and with low energy consumption. He further stated that Japan could draw on its accumulated scientific and technological capabilities, as well as its human resources, in separation, adsorption, catalysis, and related fields to pioneer the development of a new circular civilization. Achieving this vision, he emphasized, will require industry, academia, and government to share a vision extending 20, 30, and 50 years into the future and for Japan to pursue this goal through a concerted national effort.

3. Industrial Collaboration and Market Development for Carbon Recycling Deployment

To advance the full-scale social implementation of carbon recycling, it is essential to move beyond the development and demonstration of individual technologies and achieve commercialization across the entire value chain. It is equally important to create sustainable markets by ensuring performance and quality comparable to those of existing products, while appropriately evaluating and communicating their environmental value. Accordingly, the session presented examples from different industries to highlight the industrial collaboration and market creation needed to facilitate the transition from technology demonstration to commercialization. Specifically, initiatives involving green methanol, concrete, consumer products, and synthetic fuels were presented.

For green methanol, a concept was presented for producing green methanol in India using renewable energy and supplying it to international markets, including Japan. Projects involving investment in large-scale production facilities and international transportation must secure long-term demand before production begins to enhance the predictability of investment. The presentation therefore emphasized the importance of using offtake agreements with customers as the starting point for collaboration among stakeholders responsible for production, transportation, and certification, thereby establishing a cross-border supply framework. In the concrete sector, an example of CO_2-fixing technology being applied to actual structures was introduced. In addition to ensuring material performance and durability, the presentation stressed the importance of integrating the entire process, from CO_2 capture and supply to manufacturing, design and construction, and end use, into existing construction processes. For consumer products, an initiative to incorporate materials derived from captured CO_2 into high-performance footwear was introduced. The example demonstrated that the involvement of a consumer-facing brand from the development stage can help verify both the performance and quality of the material for use in footwear and the compatibility of CO_2-derived materials with existing manufacturing processes. It also highlighted the potential to stimulate demand by communicating the product's contribution to reducing CO_2 emissions. For synthetic fuels, an initiative was presented to produce fuels from captured CO_2 and green hydrogen that can be used in existing equipment. The approach involves validating performance and interchangeability with conventional fuels in sectors such as aviation and motorsports, thereby building user confidence and establishing a track record that can facilitate the expansion of both production capacity and applications.

These examples demonstrated that the social implementation of carbon recycling requires more than the development of individual technologies. Companies, public authorities, and other stakeholders

must work together across the entire business process, from the procurement of feedstocks and energy to manufacturing, logistics, certification, financing, product sales, and end use, to establish a framework under which the overall business can operate on a self-sustaining and sustainable basis. In doing so, it is important to consider the design of products and businesses with the needs of end users as the starting point. Requirements include not only product performance and quality, but also the traceability of feedstocks and manufacturing processes, CO_2 emissions reductions across the entire life cycle, price competitiveness, compatibility with existing equipment and production processes, and the accumulation of a proven track record that enables users to make adoption decisions with confidence.

The session also affirmed that demonstration projects should be designed not merely to confirm that a technology works, but to serve as a "bridge to commercialization" by generating operational data, building customer confidence, establishing standards and certifications, and demonstrating the economic viability of the subsequent stage. It also highlighted the importance of clearly communicating the environmental value of products to consumers alongside their performance.

Concurrent Events

1. Poster Session

Building on the previous year's event, a poster exhibition was again held as Concurrent Events to promote interaction among participants and deepen their understanding of technologies and initiatives related to carbon recycling.

This year, a total of 62 organizations, including co-exhibitors, showcased their work across 39 booths. A broad range of stakeholders from industry, academia, and government presented their initiatives related to technology development, research, commercialization, and other areas. The exhibition provided an opportunity for the participating organizations to widely share their achievements and expertise, while fostering lively exchanges between exhibitors and visitors and facilitating the creation of new partnerships and networks.

2. Startup Event

Carbon recycling technologies are gradually transitioning from technology development and demonstration to commercialization and social implementation, with efforts under way to scale up demonstration projects, establish mass-production capabilities, and develop markets and customers. Further progress in the social implementation of carbon recycling will require the acceleration of technology demonstration and commercialization through collaboration among diverse stakeholders, including startups and large corporations, as well as Japanese and international companies. The session was held to enable overseas startups to share their pathways to commercialization and partnership needs, and to create tangible opportunities for collaboration with Japanese companies and relevant organizations.

The presentations introduced CO_2 capture and conversion technologies, direct air capture (DAC) technologies, and their respective business strategies. With regard to CO_2 capture and conversion, an integrated process was presented that converts CO_2 captured from industrial flue gas or ambient air into valuable products, such as precipitated calcium carbonate. A phased approach was presented, progressing from feasibility studies and pilot demonstrations to facility scale-up and eventual deployment at commercial facilities. With regard to DAC, the presentation introduced a technology that uses electricity to capture CO_2 from the atmosphere without requiring an external heat source, together with examples of the utilization of captured CO_2 in the production of sustainable aviation fuel (SAF) and

construction materials, as well as for geological storage. The presentation indicated that reducing costs and achieving large-scale deployment will require the development of regional supply chains, integration with renewable energy, the creation of demand for captured CO_2, and sustained partnerships that support the entire process, from the deployment of first-of-a-kind facilities to mass production and large-scale rollout. The session also emphasized that translating startup technologies into social implementation requires more than investment in the technology itself. It is important to bring together demonstration sites, customers, engineering expertise, financing, and policy support at an early stage, thereby enabling the whole process from technology development and commercialization to be pursued in an integrated manner.

3. CR Exchange of Views for Students

This program has been held regularly for undergraduate and graduate students from universities across Japan who are expected to play a leading role in the next generation of research and technology development. It aims to provide opportunities for networking among students and international exchange, foster interest in carbon recycling, and encourage participants to consider pursuing future involvement in the field.

This year, students were divided into groups to discuss the theme: “Promoting Awareness and Adoption of Carbon Recycling Technology-Based Products on University Campuses.” Each group presented the outcomes of its discussions regarding products and services with the potential for widespread adoption on campus, the roles to be played by students and universities, and ways to develop initiatives at universities in Japan into collaborative efforts with universities overseas. Through a lecture and comments by an international expert on carbon recycling and career development, participants also gained a shared understanding that the social implementation of these technologies requires awareness and adoption among younger generations. They also recognized the importance of domestic and international collaboration centered on universities.