

JAPAN CARBON FRONTIER ORGANIZATION

*JAPAN **C**ARBON FRONTIER **O**RGANIZATION WITH INNOV**A**TIVE TECHNO**L**OGIES (JCOAL)*





http://www.jcoal.or.jp/eng

Our Vision

Coal energy is increasingly being reviewed anew from the perspective of ensuring a stable energy supply. Coal is one of the most abundant fossil energy resources in the world, and its large amount of reserves has ensured its price has remained low and stable, thereby supporting the very foundations of society across various fields. The Seventh Strategic Energy Plan (target of reducing greenhouse gases by 73% in 2040 compared to 2013) approved by the Cabinet in February 2025 also stipulates that coal is an important energy source that currently has excellent availability and economic efficiency, and that even as the amount of electricity generated (kWh) mainly with inefficient coal-fired thermal power generation decreases, the stable supply of coal remains important, and the independent development ratio of coal will remain at 60% in 2040.

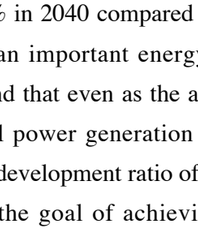
Along with the goal of achieving carbon neutrality by 2050, the GX (Green Transformation) Promotion Act was enacted in May 2023, and the CCS Business Law and the Hydrogen Society Promotion Act were enacted in May 2024. In response to these developments, support has been initiated through Green Transformation Economic Transition Bonds in an effort to promote GX.

Tackling climate change does not call for "getting rid of coal" but for promoting "low/zero CO_2 emissions from the use of coal." Our organization has long been involved in the development of advanced CCT, but has recently focused on projects contributing to carbon neutrality, such as the management and operation of the Carbon Recycling Demonstration Research Center and the research and development of sustainable aviation fuel (SAF) synthesis technology. In FY2026, we will closely monitor changes in the global energy landscape, and also promote international cooperation based on the principles of international frameworks such as AZEC, advocated by the Japanese government. We will also advance our initiatives together with our member companies while engaging in the framework of GX Economic Transition Bonds in accordance with the basic policies of the GX Promotion Act.

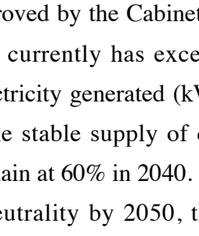
April 2026

Board of Directors

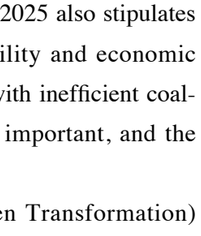
Chairperson
WATANABE Toshifumi



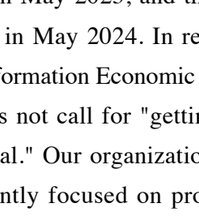
Vice Chairperson
NAKATANI Hiroshi



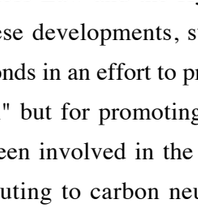
Vice Chairperson
SHIMOMURA Ikuo



President
TSUKAMOTO Osamu

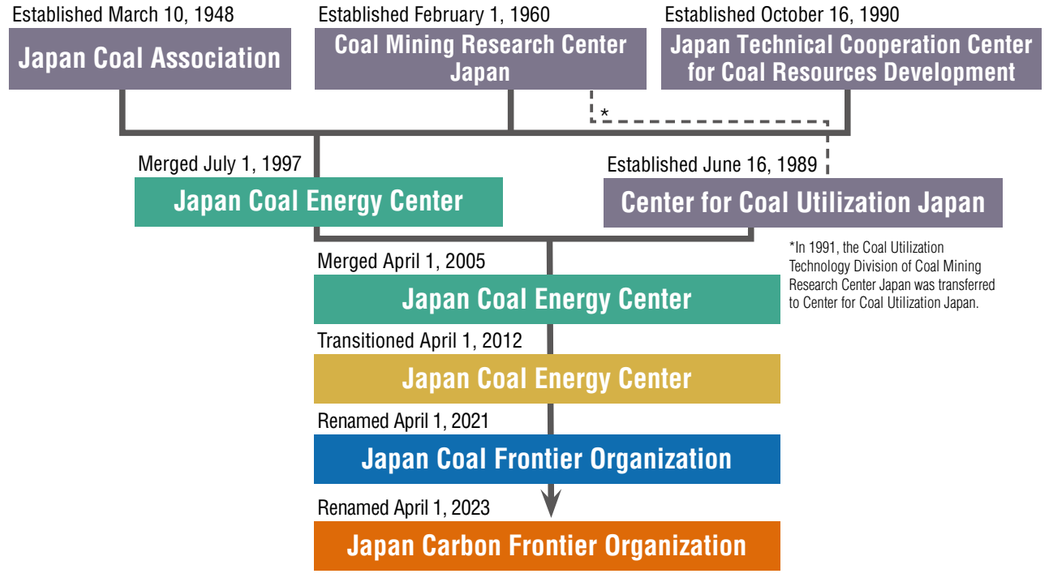


Senior Executive Director
TANI Akito

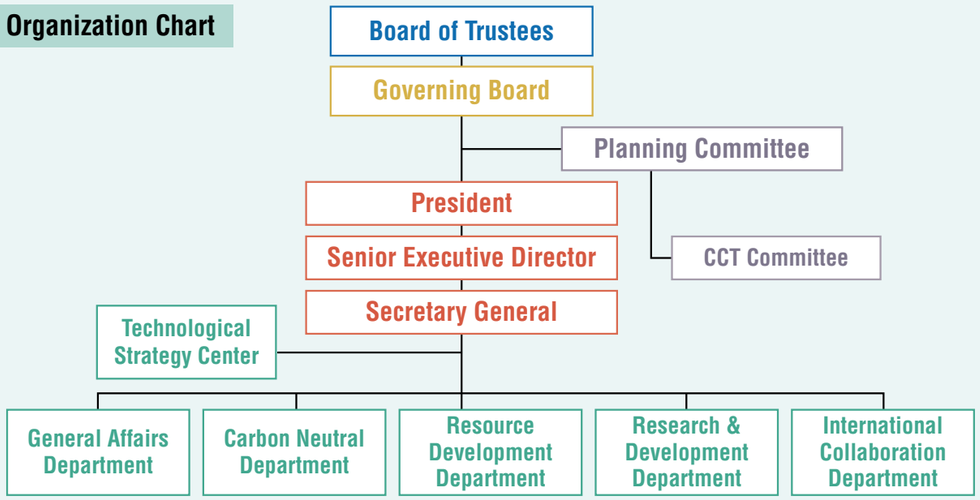


Organization Outline

History



Organization Chart



Various Committee Activities

The Planning Committee develops policy recommendations and proposals, conducts public relations activities, gathers coal-related information, and oversees the establishment, reorganization, and management of expert committees, with the aim of ensuring smooth business operations and providing valuable information to member companies.

The CCT Committee's activities include developing and revising roadmaps, and hosting seminars on specific technological themes, with the aim of promoting and supporting technological development toward carbon neutrality in the field of coal utilization.

(Reference: Topics of Recent Seminars)

- Role of coal-fired power generation in accommodating the large-scale roll-out of renewable energy
- Initiatives toward carbon neutrality utilizing biochar
- Japan's GX policy, and the outcomes and evaluation of COP30
- Carbon pricing (carbon credits, emissions trading, etc.)

Promotion of Carbon Recycling Activities

Operation and research support for the Carbon Recycling (CR) Demonstration Research Center at Osaki-kamijima, Hiroshima NEDO

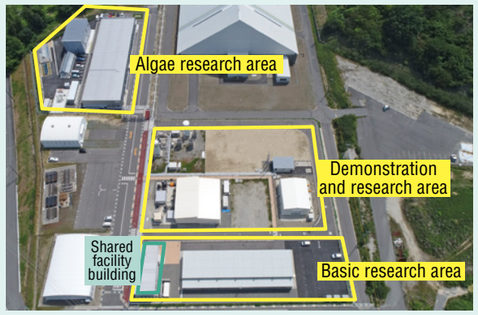
Implementation period: FY 2020-2027

At the Carbon Recycling (CR) Demonstration Research Center established by NEDO in 2022, CO_2 separated and captured at Osaki CoolGen is utilized to conduct four demonstration studies on the production of fuels, minerals, and chemicals, R&D on microalgae, and six elemental research projects. The center comprises a Demonstration Research Area, an Algae Research Area, and a Basic Research Area and the shared facility building provides various equipment and conference rooms required for research and development.

A key feature of this center is that it enables the integrated implementation of activities ranging from basic research to demonstration studies in an environment where coal-derived CO_2 can be utilized freely. And as an open innovation center facilitating collaboration between industry, academia, and government, it promotes the social implementation of carbon recycling technologies.

It also actively disseminates information by hosting facility tours, result reporting sessions, and inspection tours for visitors from Japan and overseas. With over 3,200 visitors as of FY2025, it also serves as a premier research center showcasing Japan's carbon recycling technologies.

JCOAL is responsible for the operation and management of the facility, and will contribute to enhancing the value and widespread adoption of CR projects by showcasing research outcomes.



Overview of the CR Demonstration and Research Center



Tour of the CR Demonstration and Research Center

Event Exhibits



Promotional content



Brochures



Booklets

Center website and videos



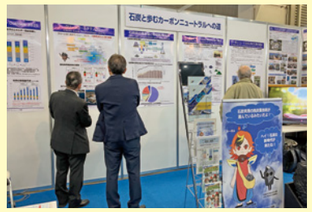


Introductory videos

Making policy proposa information, and prom Is, exchanging oting PR activities

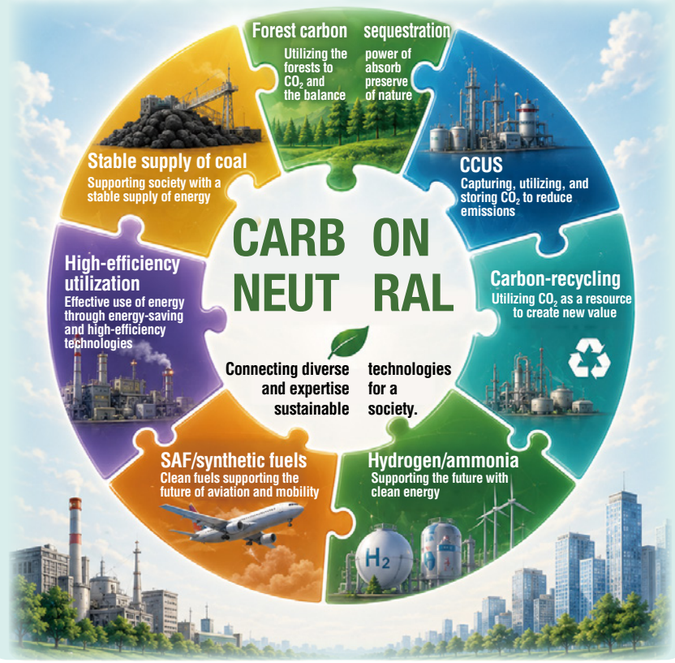


Coal experimentation classes



Zero Emission Thermal Power Generation EXPO

Together with Coal, Toward a Carbon -Neutral Future



Survey and technology development for decarbonization in ASEAN countries



Japan-China Joint Committee (November 2024, Tokyo)

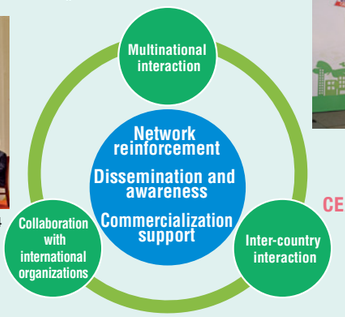
Multinational interaction

- **Clean Coal Day (CCD) International Symposium**
- **Southeast Asia CN (Carbon Neutrality) Seminar**

250 experts and policymakers from related organizations (in industrial sectors such as power, steel, cement, and chemicals) in eight Southeast Asian countries participated in the CN Seminar. The forum featured decarbonization technologies, such as CCUS/CR, from Japanese companies, that contribute to carbon neutrality, and promoted business matching.



ASEAN Energy Business Forum (AEBF)-24 (September 2024, Vientiane)



Inter-country interaction

- **Seminars, Invitation Programs, etc.**

Japan-China Joint Committee (China)

Established in 2008, this committee has been held continuously as a representative cooperation platform for the energy sector, backed with the support of the Japanese and Chinese governments. The committee also shared information on carbon neutrality.



CEA-JCOAL Workshop (December 2023, Delhi)

CEA-JCOAL Workshop (India)

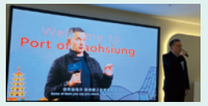
Workshop held under a long-term partnership with the Central Electricity Authority (CEA) of India under an MoU. It helped resolve key energy transition policy issues being addressed by the Indian electricity sector.

International institution interaction

- **International Energy Agency (IEA)**
- **FutureCoal Global Alliance (FutureCoal)**
- **ASEAN Centre for Energy (ACE)**
- **Economic Research Institute for ASEAN and East Asia (ERIA), etc.**

Japan-Taiwan Industry and Technology Cooperation Forum on Decarbonization and CCUS

A forum was held to share policy and technology trends related to decarbonization and CCUS between Japan and Taiwan. We are aiming for future collaboration in technology development with Taiwan.



Briefing by a representative of the Kaohsiung Port Authority (May 2026, Kaohsiung City)

CEFIA Flagship Project

- **CEFIA Biomass Flagship Project**

CEFIA is a public-private initiative that aims to promote clean energy and decarbonization technologies in the ASEAN region. Since September 2025, JCOAL, as the lead organization for the Biomass Flagship project under CEFIA, has been supporting the public relations, dissemination, and commercialization of Japanese technologies contributing to decarbonization efforts in ASEAN countries.



Japan-Indonesia Environmental Week CEFIA Seminar (May 2026, Jakarta)

Promoting Carbon Recycling Technology Implementation Through Inter-Industry Cooperation

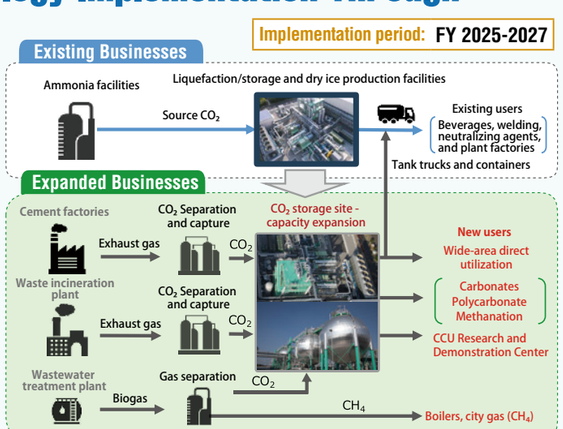
Study on establishing a distributed CO_2 supply chain through inter-industry cooperation NEDO

Implementation period: FY 2025-2027

Multiple industries are operating at industrial complexes in Japan, producing a variety of products.

This study focuses on specific industrial complexes characterized by distributed small and medium-sized industries. By establishing a CO_2 supply chain that connects multiple CO_2 suppliers and users located within these complexes, we will evaluate business profitability and CO_2 emission reduction effects achieved through engineering and CO_2 management business studies. We will also formulate a business development action plan that contributes to the local community and promote the implementation of this project.

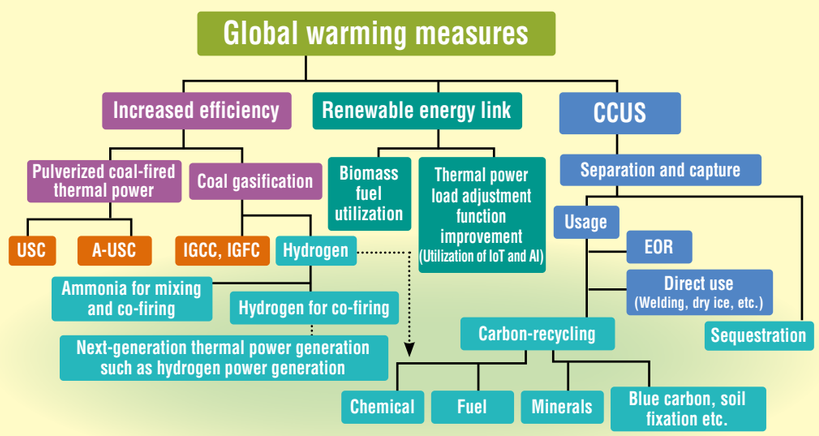
(Joint implementation with companies located in the applicable industrial complex)



Innovative CCT

To achieve carbon neutrality, industry, academia, and government collaboration is crucial for advancing CO_2 emission reductions in the field of coal utilization and the development of technologies such as CCUS and carbon recycling. JCOAL is working to develop "innovative CCT" that aims to achieve innovation in fields such as CCUS and carbon recycling, while simultaneously reducing the costs associated with CO_2 emission control.

*CCT used to be the abbreviation for Clean Coal Technology, but is now used as a general term for "technologies for carbon neutrality in the field of coal utilization" due to recent changes in initiatives.



Innovative CCT (innovative CCT aiming for zero emissions)

Introduction of Initiatives

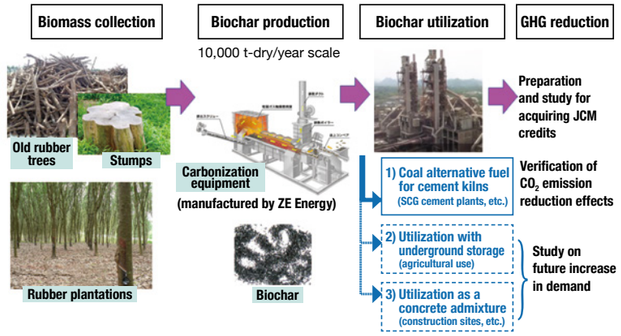
Technological development for the realization of carbon neutrality

1 Biochar Production and Utilization Technology Demonstration Project for GHG Reduction in the Cement Industry (Thailand) NEDO

Implementation period: FY 2025-2026

Promotion of low-carbon technologies utilizing the joint crediting mechanism (JCM) and other schemes

This project aims to produce biochar from unused biomass that is available in abundant quantities in Thailand (such as stumps of old rubber trees) with the use of Japanese carbonization technology. By utilizing this biochar as an alternative to coal fuel in the cement kilns of the Siam Cement Group (SCG), the largest cement company in Thailand, the project seeks to verify the CO_2 emission reduction effects and aim for the issuance of JCM credits. We will also explore the potential for multipurpose utilization, such as underground storage in agricultural lands and use as a concrete admixture (jointly implemented with ZE Energy and Sinanen), with an eye toward future commercialization.
Following the completion of a one-year "Demonstration Design Project", the feasibility of commercialization and development of a JCM methodology will be assessed in Thailand.



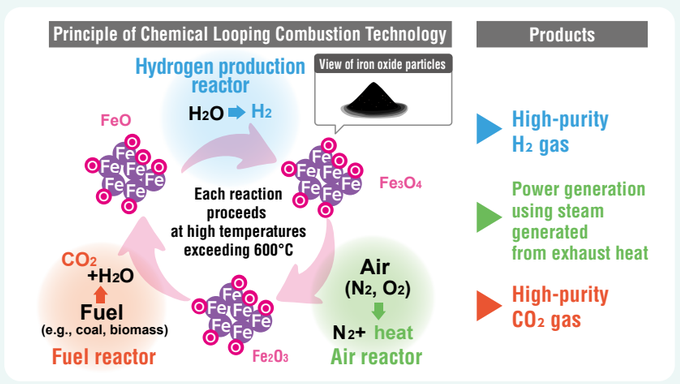
Source: Overview diagram of NEDO demonstration project (prepared by JCOAL)

2 Development of Chemical Looping Combustion Polygeneration Technology NEDO

Implementation period: FY 2025-2027

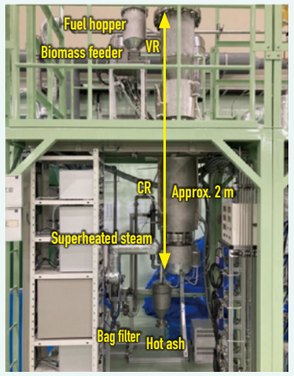
Production of green power and green hydrogen with the application of biomass fuel

Chemical looping combustion technology utilizes the oxidation-reduction of carrier particles comprising metal oxides. The process burns biomass and unused organic matter using oxygen within the carrier, generating heat to drive a steam turbine for power generation. Adding steam to the reduced carrier generates hydrogen, thereby enabling the production of both green power and green hydrogen. It also incorporates a CO_2 separation and capture function, allowing for the generation of high-purity CO_2.
We will undertake the construction and demonstration testing of a 300 kWth-class demonstration unit under a subsidized project from FY2025 to FY2027, with the view of achieving commercialization. JCOAL will conduct complementary research for the 300 kWth-class demonstration unit, focusing on operational tests of the two-stage fluidized bed reactor and the carrier circulation wear test unit at Institute of Science Tokyo.

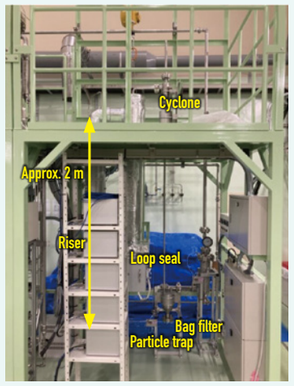


Principle of chemical looping combustion (CLC) technology
(Osaka Gas Co., Ltd. Website: https://www.daigasgroup.com/rd/topic/1310192_53539.html)

New Test Unit Setup



Two-stage fluidized bed reactor
(@ Institute of Science Tokyo)



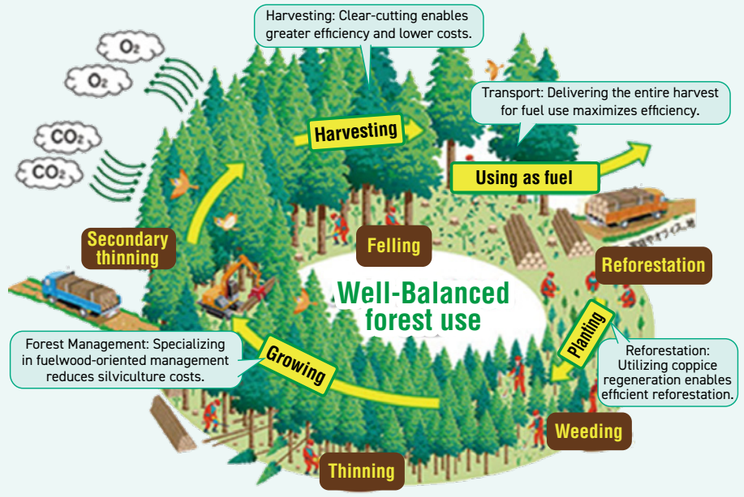
Carrier circulation wear test unit
(@ Institute of Science Tokyo)

3 Highly efficient production system for woody biomass fuel using fast-growing trees NEDO

Implementation period: FY 2021-2024, FY 2025-2027

Contributing to regional development through the local production and consumption of biomass

The challenges faced by domestic biomass power generation are ensuring a stable supply of biomass and reducing procurement costs.
We are developing a highly efficient production system in Iwaki City, Fukushima Prefecture, aimed at ensuring a stable supply of domestic woody biomass fuel from fast-growing trees (such as Chinese fir) and creating an "Energy Forest." By replacing existing Japanese cedar forests with fast-growing trees and applying GIS (Geographic Information System) and cloning technologies for superior seedlings, we are developing a clear-cutting and regrowing system for fast-growing trees dedicated to fuel production. This will contribute to the revitalization of local economies through the local production and consumption of biomass fuel.
(Jointly implemented with Tohno Kosan and Furukawa Ringyo)



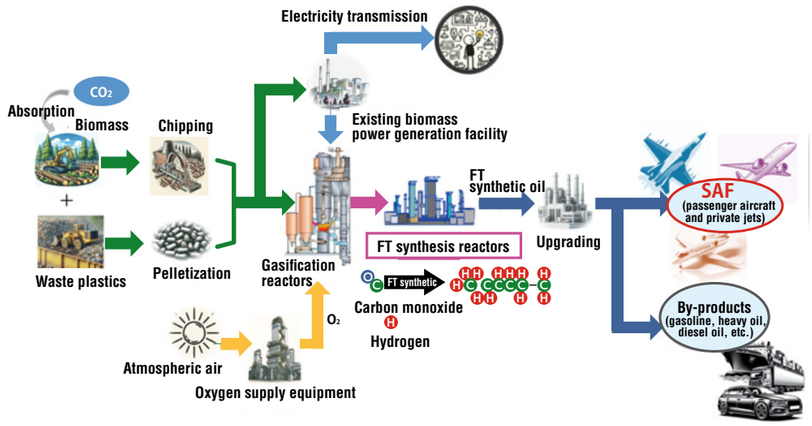
Modified from figure in the Forestry Agency “FY2015 Annual Report on Forest and Forestry in Japan”
(Source: NEDO's illustration of the creation of “Energy Forests”)

4 Small-scale Distributed SAF Production Technology using Biomass Gasification and FT Synthesis

Implementation period: FY 2025-2028

Production of SAF (Sustainable Aviation Fuel) from regional biomass using small-scale gasification and FT synthesis reactors

There has been active international development of SAF (Sustainable Aviation Fuel) produced from low-carbon sources such as algae and biomass in recent years. Given the recent energy situation, rather than relying solely on overseas sources, technologies need to be developed for a broad range of SAF procurement that also utilizes domestic sources.
While several methods for SAF production are available, in the Fischer-Tropsch (FT) synthesis method, which uses synthetic gas produced by gasifying biomass and other source materials, reducing the size of gasifiers and FT synthesis reactors is considered crucial. Compact design and modularization can significantly reduce initial plant investments and long-distance transportation costs from the source, potentially leading to the establishment of an affordable and stable decentralized fuel supply chain.
This project aims to establish a locally based fuel supply chain utilizing regional resources, and we will move ahead with the demonstration of small-scale, decentralized SAF production technology using gasification and FT synthesis with biomass and waste as the source. We will contribute to achieving a low-carbon, circular society and revitalizing regional economies, with the view to commercialization in the early 2030s.



5 Environmentally-conscious CCUS - Integrated demonstration facility and supply chain construction project

Ministry of the Environment

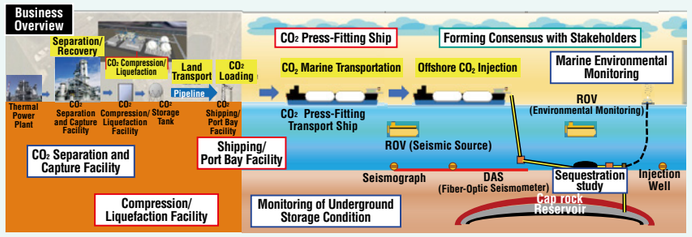
Implementation period: FY 2021- Q1 FY 2026

Study to Demonstrate CCS from Offshore

In Japan, CO_2 sources are not always located near sequestration sites. Therefore, it is necessary to transport the CO_2 to the sequestration site. This project involves a study for an integrated demonstration to monitor the behavior of sequestrated CO_2, which is separated and captured at the power plant, compressed, liquefied, loaded onto a CO_2 carrier using shipping equipment, transported to a sequestration site, and injected into the sub-seabed from offshore.

This project examines methods of transporting liquefied CO_2, injecting it from the sea, surveying sequestration sites, drilling, and monitoring, as well as summarizes the benefits, challenges, and risks from economic and environmental perspectives.

(A consortium of 13 organizations, including the Japan Carbon Frontier Organization is being formed for implementation)



6 Project Supporting the Establishment of a Sustainable Aviation Fuel (SAF) Production and Supply System

Ministry of Environment, Trade and Industry

Implementation period: FY 2024-2028

Achieving a system that enables a stable supply of SAF at internationally competitive prices as a subsidy recipient (implementing organization)

Green Transformation (GX) is required to achieve carbon neutrality by 2050. With demand for SAF expected to increase on a global scale, SAF production and supply capacity in Japan needs to be increased. By subsidizing the cost of investment in large-scale SAF production facilities to increase the production and supply of SAF, the project aims to establish a system that will enable a stable supply of SAF at internationally competitive prices and achieve a certain level of emission reductions. As the implementing organization, we select secondary implementing organizations that construct facilities through public solicitation, determine grants, and provide support services during implementation.

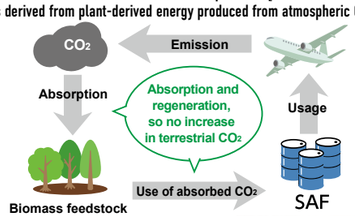
* Project Requirements:

(1) Manufacturing technology is HEFA or AtJ

(2)Production capacity of 100,000kL/year or more

(3)Greenhouse gas emission reduction rate is 1. At least 10% as neat SAF, and 2. At least 5% as mixed SAF for jet fuel oil.

SAF is a fuel that does not increase atmospheric CO_2 when used because it is derived from plant-derived energy produced from atmospheric CO_2.



21 raw materials are registered with ICAO*.
69 different combinations of raw materials, origins, and production methods.
* A specialized agency of the UN responsible for establishing international standards and legal frameworks for international civil aviation
E.g.: Municipal waste, used cooking oil, tallow, sugar cane, corn oil, etc.



(Source: Excerpt from SAF, Ministry of Land, Infrastructure, Transport and Tourism)

7 Support Project for Energy and Manufacturing Process Transition for Hard-to-Abate Industries

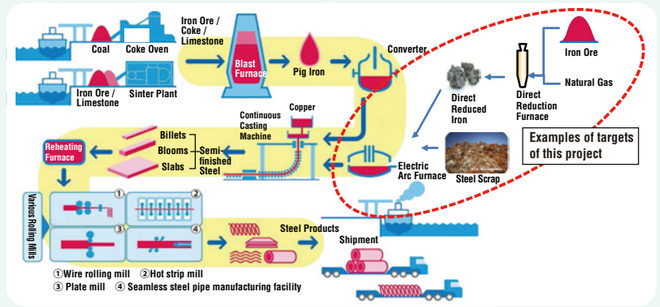
Ministry of Environment, Trade and Industry

Implementation period: FY 2026-2030

Achieving carbon neutrality while maintaining and strengthening the competitiveness of the steel, chemical, pulp and paper, and cement industries as a subsidy recipient (implementing organization)

To achieve carbon neutrality by 2050, the transition of energy and manufacturing processes needs to be advanced in "hard-to-abate" (HtA) industrial sectors, such as steel, chemicals, pulp and paper, and cement, thereby reducing CO_2 emissions and boosting industrial competitiveness. To promote decarbonization in hard-to-abate industries, this project subsidizes a portion of the costs associated with capital investments for manufacturing process transitions and fuel conversion of in-house power generation facilities, boilers, and other facilities. This will contribute to sustainable growth of key industries and achieve a carbon-neutral society.

As a subsidy recipient (implementing organization), JCOAL supports the smooth implementation of this project through the public solicitation and selection of indirect subsidy recipients for the construction of facilities, grant decisions, and progress management during project implementation.



Source: Ministry of Economy, Trade and Industry (METI), "Technology Roadmap for 'Transition Finance' in the Iron and Steel Sectors," with additions

Introduction of Initiatives

Accident Prevention at Biomass Power Generation Facilities

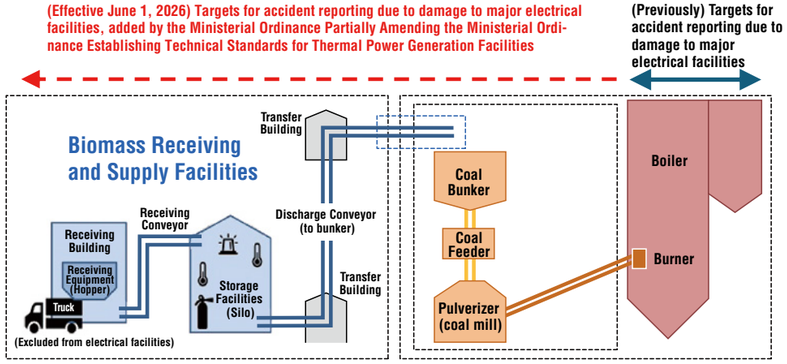
Support Project for Effective Measures to Prevent Accidents at Biomass Power Generation Facilities

Ministry of Economy, Trade and Industry, and others

Contributing to the prevention of global warming through projects and research related to woody biomass

With numerous woody biomass power plants being constructed to help combat global warming, we have launched individual advisory services and are conducting public relations activities, including holding lectures and distributing information. These efforts aim to reduce accidents from occurring by encouraging stakeholders to widely utilize the results of the survey on "Effective Measures for Accident Prevention at Biomass Power Generation Facilities" (completed in March 2025), which was conducted as part of the New Energy Security Regulation Enhancement Project commissioned by the Ministry of Economy, Trade and Industry (METI).

We offer comprehensive proposals for preventive or recurrence-prevention measures that can be effective against the frequent fire and explosion accidents that are occurring recently at power plants. These proposals cover fuel, equipment, and operational aspects, while also drawing on overseas case studies. Details are available in pamphlet format on the JCOAL website.



Accident Prevention at Biomass Power Generation Facilities

Introduction of Initiatives

A Project Our Organization Supports

Expanding from Coal Ash Utilization and Supply of Disaster Reconstruction Materials

Ministry of Economy, Trade and Industry, and others

Contributing to Civil Engineering and Environmental Fields with Locally Produced and Consumed Coal Ash Products



Product Image (OR Crete)

In Minamisoma City, Fukushima Prefecture, we operate a manufacturing and sales business of civil engineering materials using coal ash (fly ash) through Fukushima EcoCrete Co., Ltd., a joint venture established (commencing production in 2018). Aimed at recycling coal ash in Fukushima Prefecture, we produce approximately 90,000 tons annually of roadbed materials alternative OR Crete (Odaka Revive (Recycle) Crete). As part of our business expansion efforts, we also utilize combustion ashes from biomass power plants.

Following the publication of technical guidelines by the Japan Society of Civil Engineers on the use of coal ash blended materials (March 2021), we promote the widespread adoption of effective coal ash utilization products in the civil engineering and environmental fields. We actively implement initiatives such as applying carbonation technology to achieve CO_2 reduction.

(Joint project with Japan Land Development and Shinwa Trading Co., Ltd.)



Entire view of Fukushima EcoCrete Plant

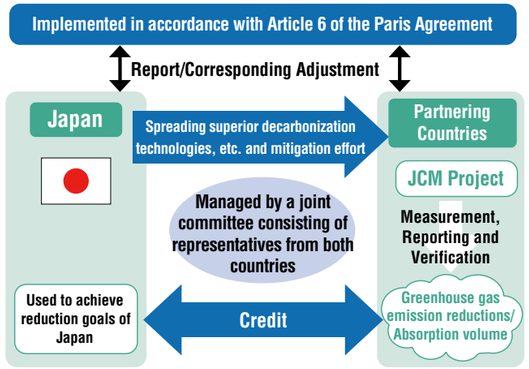
Introduction of Initiatives

Contributing to Global Carbon Neutrality with Japanese Technology

1 Japan's Initiative to Obtain Carbon Credits

Implemented in accordance with Article 6 of the Paris Agreement

As countries and companies worldwide work towards carbon neutrality by reducing CO_2 emissions, attention is turning to carbon pricing as a cost-effective method. Carbon pricing options include carbon taxes, emissions trading, and carbon credits. Among these, carbon credits through the private-led Joint Crediting Mechanism (JCM) are particularly promising for promoting emission reductions through bilateral credit projects. At JCOAL, we not only support the global promotion of innovative CCT (Clean Coal Technologies) but also collaborate with Japanese government agencies to actively contribute to private sector initiatives for CO_2 reduction abroad. Our aim is to facilitate the issuance of carbon credits through technology dissemination, thereby supporting global efforts towards carbon neutrality.



Source: Materials of Ministry of the Environment

2 International Business Development for Just and Inclusive Energy Transition

Clean Coal Day (CCD) International Symposium

We organize the CCD International Symposium with METI (Ministry of Economy, Trade and Industry), NEDO (New Energy and Industrial Technology Development Organization), and JOGMEC (Japan Organization for Metals and Energy Security). This international symposium features presentations and panel discussions on topics such as decarbonization technologies, with participants including government agencies, affiliated companies, academia, and international organizations.



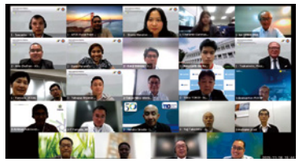
Energy Security with Decarbonization Symposium

Since FY2023, JCOAL holds the "Energy Security with Decarbonization Symposium" in collaboration with JOGMEC, focusing on coal upstream decarbonization and the stable supply of coal. This symposium is held the day after the CCD International Symposium. Presentations are given by representatives from the government agencies of countries as well as affiliated companies, academia, and international organizations.



Post Conference Webinar (PCW)

We hold the Post Conference Webinar (PCW) with the cooperation of the ASEAN Centre for Energy (ACE) to follow up on the outcomes of the "Clean Coal Day International Symposium" and the "Energy Security with Decarbonization Symposium." This webinar aims to further promote the efforts of ASEAN countries toward a just and inclusive energy transition.



Strengthening Information Dissemination

The outcomes of both symposiums are disseminated as JCOAL STATEMENT. Starting from 2025, we are strengthening our information dissemination efforts by compiling and globally publishing the "JCOAL e-book 2025," which includes the outcomes of the "Clean Coal Day International Symposium", the "Energy Security with Decarbonization Symposium" and the PCW. It also includes the carbon neutrality initiatives of companies in Japan and overseas.

JCOAL e-book 2025

Comprehensive Energy Cooperation with the State of Wyoming, U.S.



From left: Mark Gordon, Governor of Wyoming, Osamu Tsukamoto, President of JCOAL

Following the conclusion of an MOU with the State of Wyoming in 2016, JCOAL has been advancing cooperation in the energy sector, including coal trade and CCUS research and development. Since 2021, we have continued to enhance our cooperative relationship through initiatives such as demonstrating CO_2 separation and capture technology using solid adsorbents at the Integrated Test Center in Gillette, Wyoming, under a project commissioned by the Ministry of the Environment.
In conjunction with a visit by a delegation led by Governor Mark Gordon, we signed a new five-year Memorandum of Understanding (MOU) in May 2026 aimed at further expanding collaboration. This cooperation is a vital initiative that balances a stable energy supply with resolving environmental issues, contributing to the development of the energy sector and achieving carbon neutrality in both Wyoming and Japan.

Introduction of Initiatives

Development of Coal Resources - Towards stable coal supply

1 Building relationships with coal-mining countries

A stable energy supply is essential for coal importing countries

Japan's energy policy is based on "S+3E," placing an emphasis on Safety, and pursuing the goals of increasing self-sufficiency and ensuring a stable supply system (Energy Security), reducing costs (Economic Efficiency) and reducing CO_2 emissions (Environment).
To achieve carbon neutrality, it is necessary to reduce the consumption of fossil fuels. However, fossil fuels, including coal, are still needed to produce thermal power to coordinate with fluctuations in renewable energy. It is important to establish win-win relationships with coal-producing countries to secure a stable supply of coal, and we have implemented the following initiatives so far in this regard.

Bio-coal Briquette Dissemination Program in Mozambique (JOGMEC)





More than 90% of the people of Mozambique use firewood and charcoal as household fuel and it causes serious deforestation.
The use of bio-coal briquettes made from coal and agricultural waste which cannot be exported is being promoted as an alternative fuel to address these household fuels.

Overseas Geological and Geophysical Survey (JOGMEC)

To secure a stable supply of coal, we are conducting coal exploration jointly with coal-producing countries. Up till now, we have conducted drilling exploration in Australia, Mozambique, Indonesia, Vietnam, and other countries.



Exploration for Anthracite Coal in Vietnam

2 Human resource development initiatives

Educating young human resources to lead the future

We provide on-site training at coal mines and coal-related facilities in coal-producing countries for young employees at member companies and college students, and also holds a "Seminar on Coal Basics." We are also committed to building human networks through the implementation of capacity building training and collaboration programs for young and mid-career professionals in Asian and African countries.



Seminar on Coal Basics (Tokyo)



Internships for Japanese students
(Open-pit coal mine in NSW, Australia)

X (Twitter)

Web

Instagram



Office: 3F Daiwa Nishi-Shimbashi Bldg.
3-2-1 Nishi-Shimbashi, Minato-ku,
Tokyo 105-0003, Japan
Tel: 03-6402-6100
Fax: 03-6402-6110

Access

JR	Shimbashi Station	Karasumori Exit
Mita Line	Onarimon Station	Exit A5
Ginza Line	Toranomon Station	Exit B1
Hibiya Line	Toranomon Hills Station	Exit A1b

Oct.2026