CCU Projects for Circular Economy

Challenging to utilize CO_2 as resources

Ministry of the Environment

The Ministry of the Environment of Japan (MOEJ) is promoting a recycling-oriented society by CCU (Carbon dioxide Capture and Utilization), recognizing that CCU technology can play an important role in such society, helping to achieve the goal of long-term climate change mitigation. MOEJ is working on 5 projects involving the latest technologies for CCU.

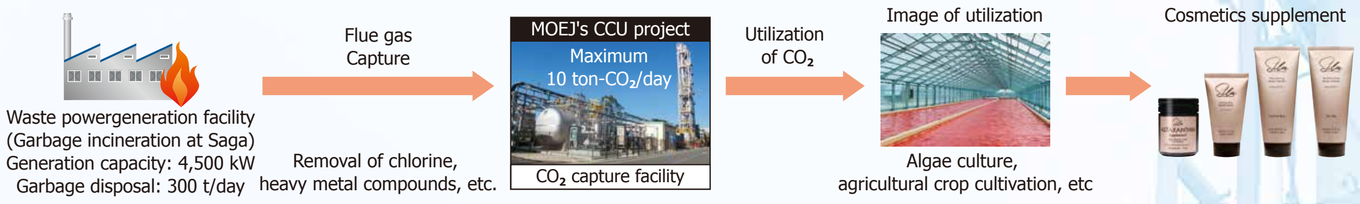
Predecessor of current CCU projects

SAGA CITY

Incineration Power Generation with CCU in Saga City

Period: FY2015–FY2016

This is the first demonstration of CCU from waste power generation in Japan. CO_2 capture facility was added to the waste power generation facility in Saga City. A part of CO_2 is sold to algae cultivator and it produces commercial products such as cosmetics and supplements with anti-aging effect, using the CO_2 from the waste power generation facility. This project gives significant additional worth to waste power generation facility, contributing to dissemination of CCU.



Technology for changing waste CO_2 into valuable material

CCU technologies have the potential to transform waste CO_2 into a valuable raw material or commodity for products that require carbon, reducing greenhouse gas emissions, and in some cases generating positive economic returns. Production of valuable materials will also offset the cost of CO_2 capture, the dominant cost factor of CCS (carbon dioxide capture and storage) which has been considered essential to meet climate goals.

MOEJ's CCU projects

Aim to establish the first CCU technologies for commercial-scale by 2023

Recycling-oriented society models with CCU technologies

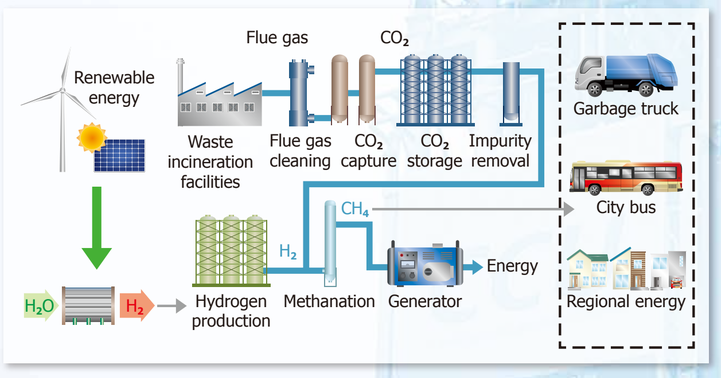
HITACHI ZOSEN CORPORATION

Methane production from CO_2 in Incineration Plant

Period: FY2018–FY2022

Methane production by reacting H_2 with CO_2 captured from waste incineration facilities.

Aims to produce methane from CO_2 with carbon free H_2 and to use it as a local energy source, reducing natural gas consumption.



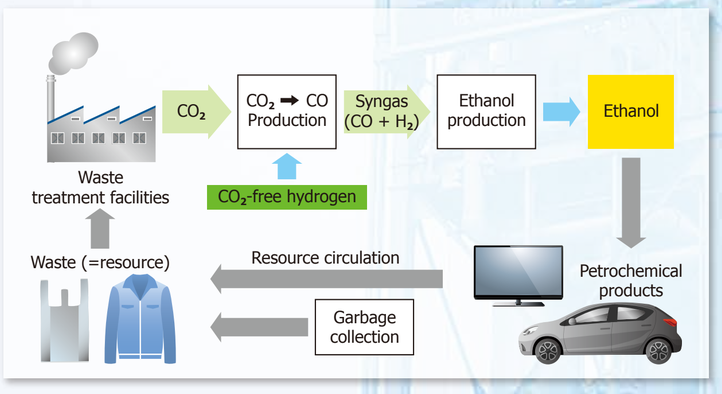
SEKISUI CHEMICAL CO., LTD

Ethanol production from CO_2 in a Waste Treatment Facility

Period: FY2018–FY2022

Ethanol production by reaction of syngas (CO + H_2), which is produced from CO_2 contained in flue gas of a waste treatment facility, using microbial catalysts.

Aims to use ethanol for petrochemicals conventionally produced from fossil fuel.



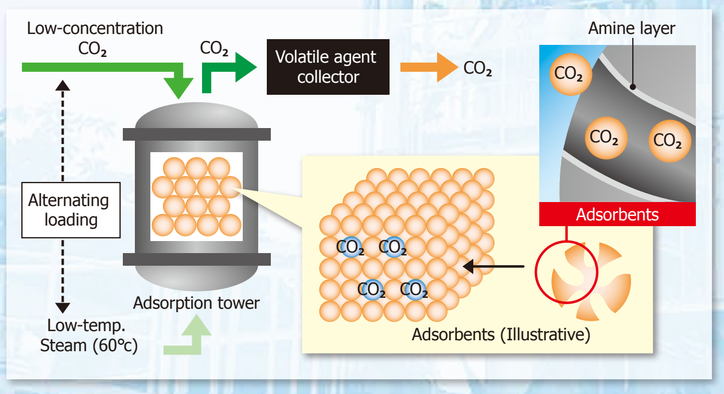
KAWASAKI HEAVY INDUSTRIES, LTD.

Low-concentration CO_2 Capture and Utilization System

Period: FY2019–FY2021

CO_2 capture technology with lower energy consumption applicable to low-concentration CO_2 flue gas using amine-impregnated solid sorbent.

Aims to use the captured CO_2 for enhanced cultivation of algae and plants in greenhouses or producing chemicals.



Recycling-oriented society models with artificial photosynthesis technologies

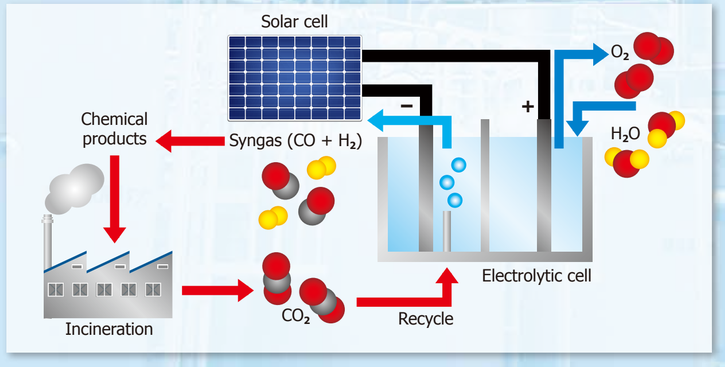
TOYOTA CENTRAL R&D LABS., INC.

Efficient Syngas Production from CO_2 and Water at Ambient Temperature and Pressure

Period: FY2018–FY2020

Syngas (CO + H_2) production with high solar conversion efficiency (10%) at ambient temperature and pressure by using CO_2 and water.

Aims to substitute natural gas by the produced syngas for chemical production and heating.



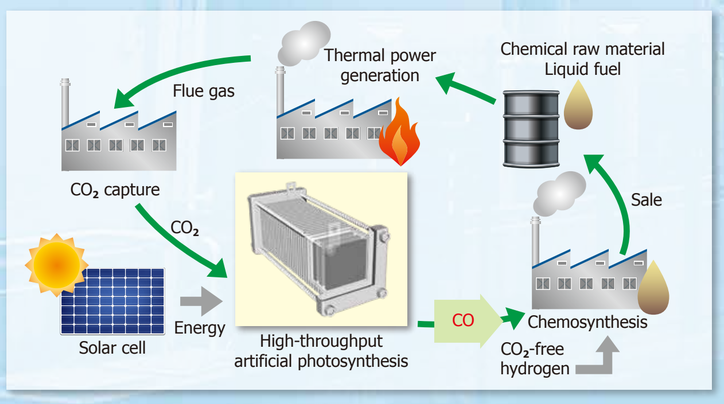
TOSHIBA CORPORATION

Localized CO_2 Utilization via Artificial Photosynthesis at a Large Emission Source

Period: FY2018–FY2022

CO_2 capture from flue gas of a thermal power plant and CO production using high-throughput artificial photosynthesis technology.

Aims to use the produced CO as raw material for chemicals and fuels in a local society.



Progress of MOEJ's CCU projects

FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022
Project in Saga City			Promotion of a CO_2 Recycling Society by CCU				

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

–Japan proclaims a "decarbonized society" as its ultimate goal and aims to accomplish it ambitiously as early as possible in the second half of this century. Toward that end, Japan has set a long-term temperature goal of reducing GHG emissions by 80% by 2050, and will boldly take measures towards its realization *(Chapter 1: Basic Concepts, 2. Japan's Long-term Vision, p.15).*

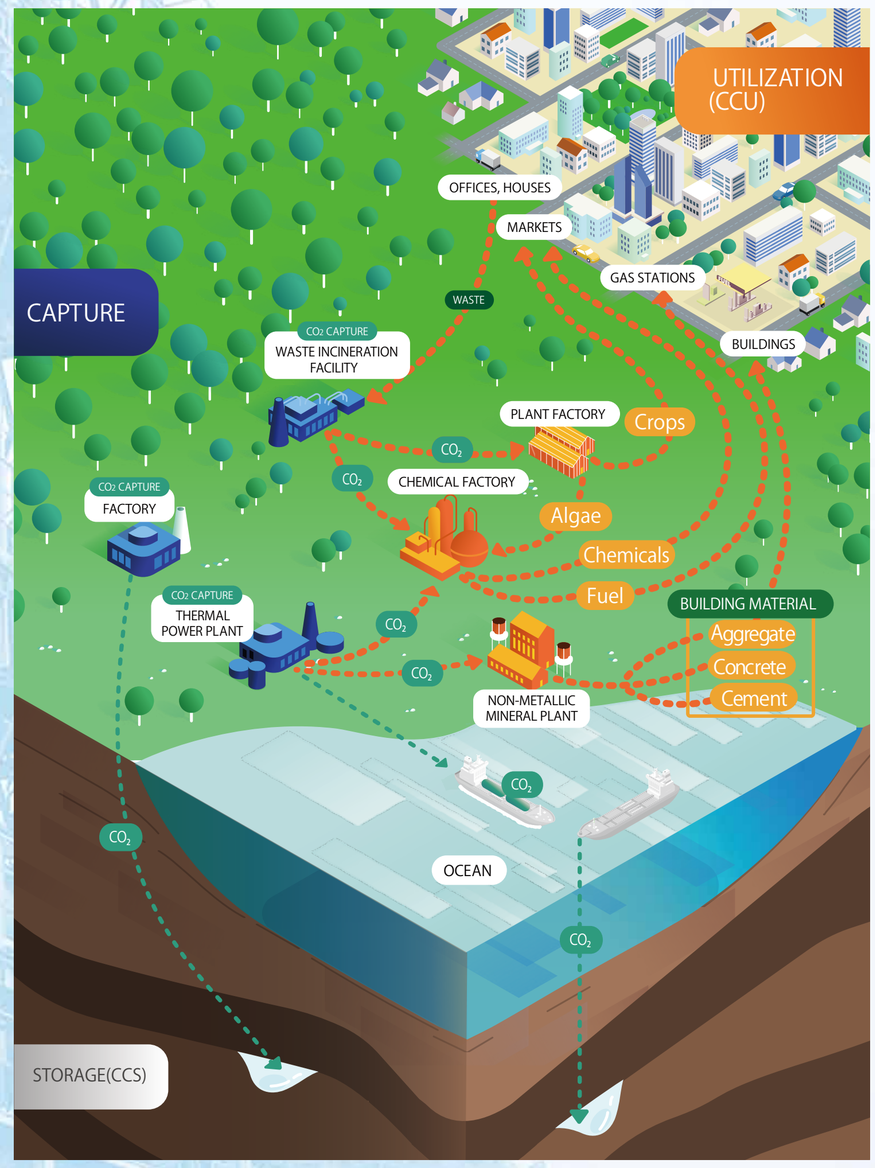
–It is also necessary to identify concrete targets in terms of costs and efficiencies in the key areas for decarbonization such as hydrogen, carbon dioxide capture and storage (CCS), carbon dioxide capture and utilization (CCU), renewable energy, storage batteries and nuclear energy, as well as challenges and systems including collaboration both in Japan and overseas *(Chapter 1: Basic Concepts, 3. Basic Principles in Policy towards the Long-term Vision, p.16).*

What is CO_2 Capture and Utilization (CCU)?

CCU is the process of using CO_2 captured from various emitters as a feedstock for products or services. The range of applications is very large and includes direct use, where the CO_2 is not chemically or biologically altered (non-conversion), and the transformation of CO_2 to a useful product (conversion).

Most of the existing applications involve direct use of CO_2, including the production of food and carbonated beverages, gas shielded welding, extraction of plant constituents, water treatment, fire suppression and the enhancement of the growth of plants in greenhouses. In addition to these, CO_2 has been used for Enhanced Oil Recovery (EOR) for several decades.

CO_2 can also act as a feedstock for many industrial processes and biologically or chemically converted into fuels, chemicals and construction materials which substitute products currently produced predominantly from fossil resources. When the energy or hydrogen for the CO_2 conversion process are supplied by renewables, such technologies could dramatically curb greenhouse gas emissions.



CCU = Carbon dioxide Capture and Utilization

Representatives of MOEJ's CCU projects

Hitz Hitachi Zosen

SEKISUI

Kawasaki Powering your potential

TOYOTA CENTRAL R&D LABS

TOSHIBA