CARBON
RECYCLING
FUND INSTITUTE

Carbon Recycling for the Creation of a “Sustainable Carbon Society”

Carbon Recycling Fund Institute

September 26, 2022
International Conference on Carbon Recycling 2022

Today's Agenda

- The Importance of Carbon Recycling
- Overview of the Carbon Recycling Fund Institute and its Activities
- Creating a “Sustainable Carbon Society”

The Importance of Carbon Recycling

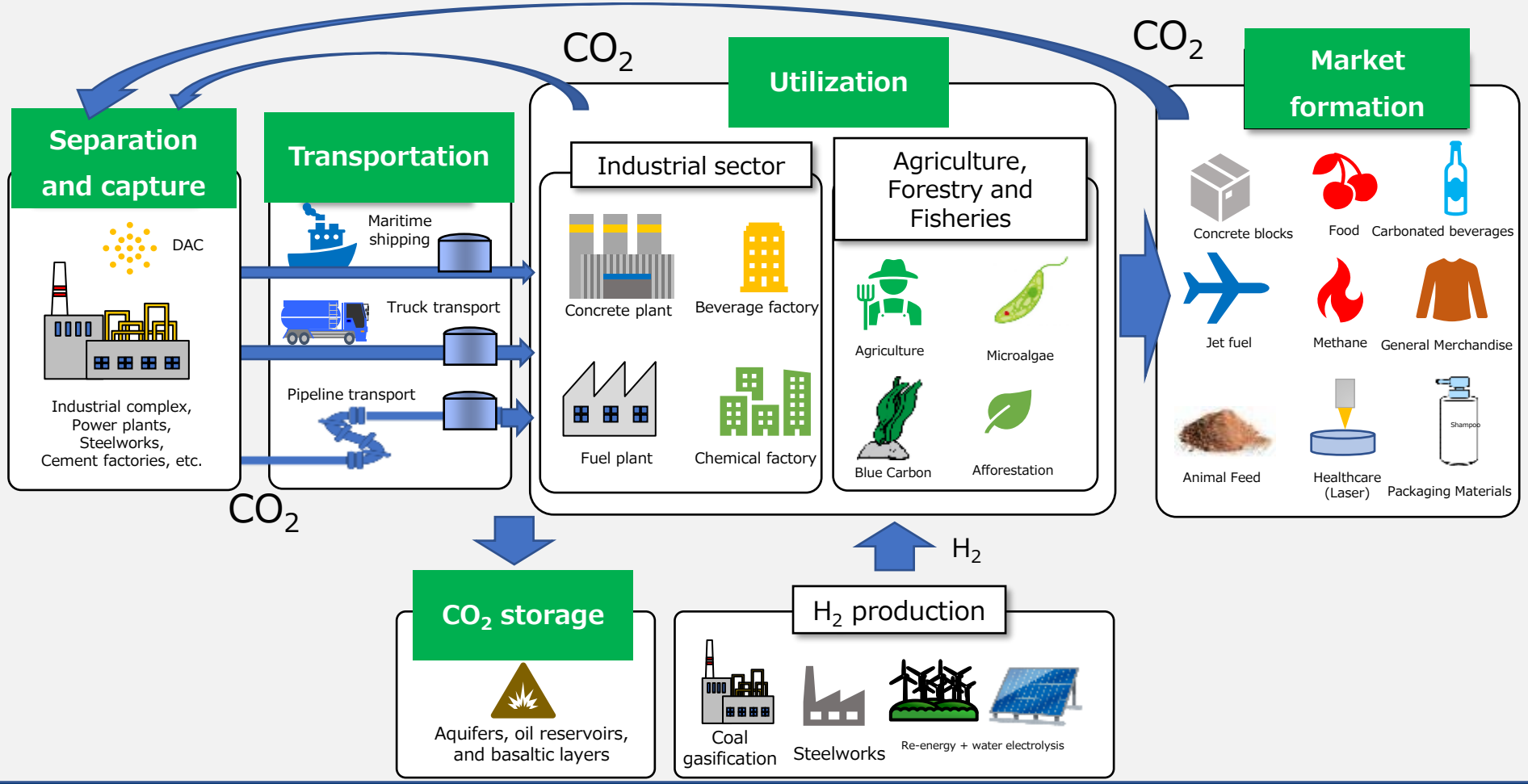
Carbon recycling is a solution, not only for global warming but also to sustainably procure energy and resources.

Promoting implementation of carbon recycling in society and the creation of a "Sustainable Carbon Society."

Realizing a truly sustainable society through a virtuous circle of environment and economy.

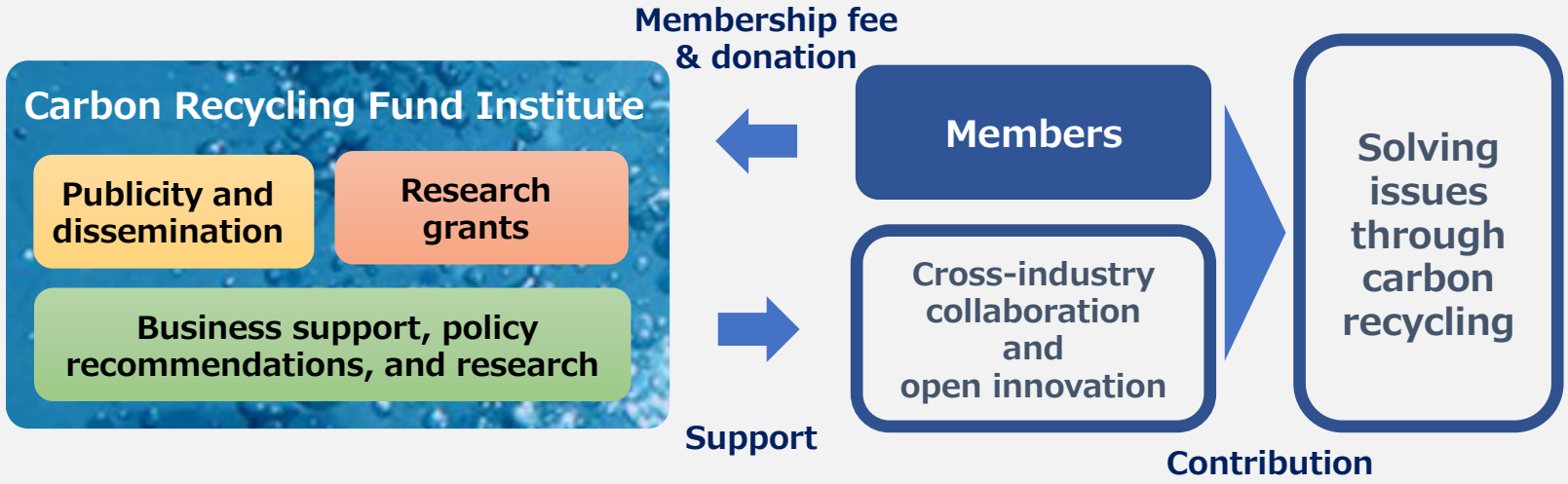
Construction of a CO_2 Value Chain

The value of CO_2 can be appreciated and increased by constructing a CO_2 value chain that includes separation and capture, transportation, utilization and market formation, as well as CO_2 storage and H_2 production.



Overview of Carbon Recycling Fund Institute (CRF)

- **Background of establishment**: In August 2019, 15 private enterprises voluntarily established CRF with the aim of simultaneously solving global warming and improving global energy access.
- **Mission**: In cooperation with the government, promote implementation of carbon recycling in society and support company business development.
- **Business scheme**:



- **URL**: https://carbon-recycling-fund.jp/aboutus/en.php

  https://carbon-recycling-fund.jp/

Members of CRF

- **109 Companies, 9 local governments, 4 academia from various sectors**
- **Creating innovation through cross-industry collaboration**

Corporate members

<Chemicals>
- AGC Inc.
- Asahi Kasei Corp.
- BASF Japan Ltd.
- Cabot Japan K.K.
- Denka Co., Ltd.
- DIC Corporation
- JSR Corporation
- Mitsubishi Chemical Corporation
- MITSUBISHI GAS CHEMICAL COMPANY, INC.
- Mitsui Chemicals, Inc.
- TODA KOGYO CORP.
- Toray Industries, Inc.

<Electric power>
- Electric Power Development Co., Ltd. (J-POWER)
- The Chugoku Electric Power Company, Incorporated

<Precision, Electronics>
- Furukawa Electric Co., Ltd.
- Shimadzu corporation
- Ushio Inc.

<Energy>
- ENEOS Holdings, Inc.
- Idemitsu Kosan Co., Ltd.
- INPEX CORPORATION
- ITOCHU ENEX CO., LTD.
- Japan Petroleum Exploration Co., Ltd.
- NIPPON COKE & ENGINEERINGCOMPANY, LIMITED
- Osaka Gas Co., Ltd.
- SANIN-SANSO CO., LTD.
- Tokyo Eco Service Co., Ltd.
- TOKYO GAS CO.,LTD.
- TOSHIBA ENERGY SYSTEMS & SOLUTIONS CORPORATION
- NIPPON COKE & ENGINEERING COMPANY, LIMITED
- Hitachi, Ltd.

<CO_2 Utilization, Renewable energy, Recycling>
- euglrna Co., Ltd.
- Geothermal Energy Research and Development Co., Ltd.
- KANKYOU SYSTEMS, INC.
- Utilization of Carbon Dioxide Institute Co., Ltd.

<Iron, Nonferrous metal, Cement>
- AIZAWA Concrete Corporation
- Kobe Steel, Ltd.
- Mitsubishi UBE Cement Corporation
- MITSUI MINING & SMELTING CO., LTD.
- Nippon Steel Corporation
- SUMITOMO OSAKA CEMENT CO.,LTD.
- TAIHEIYO CEMENT CORPORATION
- UBE INDUSTRIES,LTD.

<Trading company>
- Cosmos Shoji Co., Ltd.
- ITOCHU Corporation
- JFE Shoji Corporation
- Marubeni Corporation
- Mitsubishi Corporation
- MITSUI & CO., LTD.
- SEIKA CORPORATION
- Sojitz Corporation
- Sumitomo Corporation
- Tokyo Boeki Holdings Corporation
- TOKYO SANGYO CO.,LTD
- Toyota TsushoCorporation

<Heavy industries>
- IHI Corporation
- Kawasaki Heavy Industries, Ltd.
- Mitsubishi Heavy Industries, Ltd.
- Sumitomo Heavy Industries, Ltd.

<Engineering>
- Chiyoda Corporation
- Ebara Corporation
- FUSO Corporation
- HITACHI ZOSEN CORPORATION
- Hitachi Power Solutions Co., Ltd
- JFE Engineering Corporation
- JGC HOLDINGS CORPORATION
- NGK INSULATORS,LTD.
- NIPPON STEEL ENGINEERING CO., LTD.
- Toyo Engineering Corporation
- Yokogawa Electric Corporation

<Printing, Visual creation, Translation>
- Dai Nippon Printing Co., Ltd.
- SunFlare Co., Ltd.
- Toppan Printing CO., LTD.

<Automotive>
- AISAN INDUSTORY., LTD.
- NGK SPARK PLUG CO., LTD.
- Nissan Motor Co., Ltd.

<Aviation, Transpoation>
- JAMCO CORPORATION

<Construction, Real estate>
- Dome Gold Mines Ltd.
- FKG Corporation
- FUTURE ESTATE Co., Ltd.
- Hitachi Plant Services Co., Ltd.
- HOUSEI
- Hulic Co., Ltd.
- Kumagai Gumi Co., Ltd.
- OBAYASHI CORPORATION
- Ohmori Construction Co., Ltd.
- Mitsui Fudosan Co., Ltd.
- SHIMIZU CORPORATION
- Shin Nippon Air Technologies Co., Ltd.
- Social Welfare Research Corporation, Inc
- TAIHEI DENGYO KAISHA, LTD.
- TAISEI CORPORATION
- TOA CORPORATION
- Vertex Corporation
- WAKACHIKU CONSTRUCTION CO.,LTD.

<Banks, Financing, Insurance>
- Daiwa Securities Group Inc.
- FUKOKU MUTUAL LIFE INSURANCE COMPANY
- Nippon Life Insurance Company
- Mizuho Financial Group, Inc.
- MUFG Bank, Ltd.
- Sumitomo Mitsui Banking Corporation
- Sumitomo Mitsui Trust Panasonic Finance Co., Ltd.
- Tokio Marine & Nichido Fire Insurance Co., Ltd.

<IT, Analysis, Assessment>
- Boston Consulting Group
- Central Research Institute of Electric Power Industry
- Mizuho Research & Technologies, Ltd.
- NTT Data Institute of Management Consulting, Inc.

<Food>
- ASAHI QUALITY & INNOVATIONS, LTD.

<Others>
- JAPAN COAL FRONTIER ORGANIZATION
- KDDI Corporation
- Organization for Industrial Complex Transformation
- The Institute of Energy Economics, Japan
- Tokyo University of Science Foundation
- Utilization of Carbon Dioxide Institute Co., Ltd.

Local government members
- Akita Prefecture
- Annaka City, Gunma Prefecture
- Kagawa Prefecture
- Hiroshima Prefecture
- Hokkaido
- Osakikamijima-cho, Hiroshima Prefecture
- Saikai City, Nagasaki Prefecture
- Takehara City, Hiroshima Prefecture
- Tomakomai City, Hokkaido

Academia
- Sakanishi Kinya (AIST)
- Momose Kazu (Akita University)
- Nagasaki University
- Tokyo University of Science

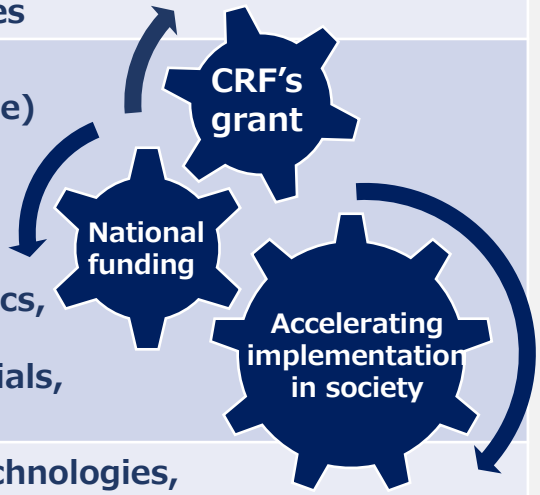
Individual members
- Einaga Yasuaki
- Katsu Kinichi
- Hanawa moriyuki
- Ohno Yotaro
- Sakurai Shigetoshi
- Takeishi Masayuki
- Terashima Chiaki
- Yamada Hidetaka
- Yoshihara Tomomichi
- Kaku Sen
- Kawamura Hiroyuki
- Hashimoto Kenji
- Minenura Kenji
- Takeuchi Aya
- Takahashi Tsuneo
- Ueno Hiromoto
- Yoshida Taiji

As of 1st September 2022

CRF Activities: Research Grant

- Exploring research seeds (ideas, people) and supporting efforts related to carbon recycling through flexible operations that take advantage of private funds.

	Features
Eligibility	Researchers or teams affiliated with companies, universities, etc. A startup support framework newly established in FY2022
Research targets	Research on carbon recycling that uses CO_2 (or carbon atoms) as a resource, related technologies, and social science to solve social issues <Expected Fields> 1. CO_2 fixation by mineralization (materials such as concrete) 2. Conversion to fuels 3. Conversion to chemicals 4. Separation and recovery (including direct-air capture) 5. Social science 6. Utilization of CO_2 sinks (soil, forests, blue carbon, biologics, agriculture, forestry and fisheries) 7. Other (H_2 production, geo-engineering, functional materials, medical fields, etc.)
Evaluation points	Creativity, innovativeness, superiority over conventional technologies, method to determine issues, and social realization potential through collaboration with companies
Grant scale	Approx. 10 million yen per case (average: approx. 7 million yen per case)
Number of applications and accepted cases	FY2020: 39 applications → 12 accepted FY2021: 46 applications → 12 accepted FY2022: 55 applications → 14 accepted and 29 applications for startup support → 2 accepted
Attribution of research results	Research results basically belong to researchers



Research Grant:16 Projects Adopted in FY2022

Field	Study title	Name of Research Representative (Organization)
CO_2 fixation by mineralization	Development of next-generation CO_2 solid adsorbent without the use of water or heat	Kiminori SATO（Tokyo Gakugei University）
	Development of a novel CO_2 immobilization technology using microbial fuel cell	Daisuke SANO（Tohoku University）
	Practical strengthening of biomass concrete using wood ash	Masahiro OUCHI (Kochi University of Technology)
Conversion to fuels	Development of heat exchanger-less CO_2 methanation process using advanced thermal storage technology	Takahiro NOMURA (Hokkaido University)
Conversion to chemicals	Ultra-high efficient CO_2 reduction developed using an innovative photocatalyst design	Tomoko YOSHIDA (Osaka Metropolitan University)
	Small molecule conversion in nanopores created by cyclic porphyrin assemblies	Yusuke KURAMOCHI (Tokyo University of Science)
Conversion to chemicals (Using organisms)	Development of microbial production technology for nylon precursor compounds from biomass resources	Masashi SHIMIZU (Micro Bio Factory Co., Ltd.)
	Development of a clean carbon recycling process using microbes with C1 methanol, which is industrially available in stable supply	Shuhei NODA (RIKEN)
Reuse and recycle of carbon resources, etc.	Development of CO_2 reduction method using hydrothermal processing of industrial waste	Naoto TSUBOUCHI (Hokkaido University)
	[Startup support framework] Development of carbon neutral technology and carbon value creation using biomass materials	Koryu KAWATANI (Innovare Co., Ltd.) International joint research with the Bandung Institute of Technology, etc.
CO_2 separation and recovery	Selective airborne CO_2 collection triggered by solidification	Fuyuhiko INAGAKI（Kobe Gakuin University）
	[Startup support framework] Development of a direct air capture (DAC) system incorporating porous PCPs/MOFs	Daisuke ASARI (Atomis Inc.)
Social sciences	Message design to promote carbon recycling products	Hidenori KOMATSU （Central Research Institute of Electric Power Industry）, International joint research with Saint Mary's University
Utilization of CO_2 sinks	Development of ocean mobility for visualization of CO_2 absorption and circulation processes in the ocean and analysis of blue carbon in coastal shallow water areas	Ikuo YAMAMOTO（Nagasaki University） Joint research with JAMSTEC, Meteorological Research Institute, Nagasaki Marine Industry Cluster Promotion Association
	Epigenetics analysis of plants for the development of functional fertilizers that increase the photosynthesis rate under long-term and high carbon dioxide concentrations	Shoko MATSUSHITA plant CO2(Nihon University)
	Enhancement of plant CO_2 uptake using a chemical compound	Yohei TAKAHASHI (Nagoya University)

CRF Activities: Nurturing the Next Generation

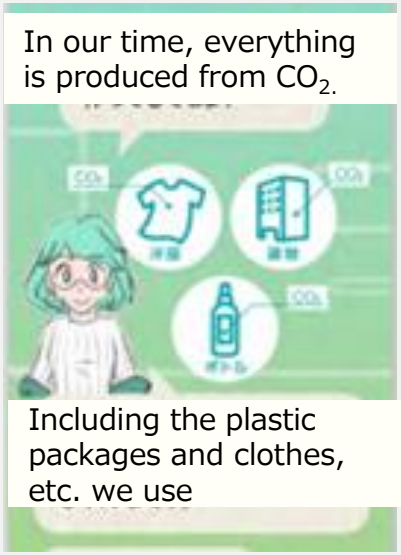
Promoting programs to nurture young people who will be responsible for carbon recycling in 2030-2050.

■ "University of Carbon Recycling“ ; workshop training for members

- ✓ Creating like-minded acquaintances
- ✓ Fostering entrepreneurship

■ "The Tale of Carbo & Lisa“ ; digital contents for children

- ✓ Acquisition of accurate knowledge
- ✓ Promoting enthusiasm



CRF Activities: Policy Recommendations

- **Recommendations to handle issues hindering the commercialization of carbon recycling-related technologies and products**
- **Outline: Announced in August 2022**

① Promoting Innovation and Human Resource Development

- Accelerating the implementation of carbon recycling technologies and products in society and expanding support for organizations involved with such implementation
- Expansion of measures to train human resources who will be responsible for carbon recycling and can foster social acceptance

② Constructing a CO_2 Value Chain

- Dissemination through incentives such as premiumization in carbon recycling technologies and products
- Increased discussion of social systems such as carbon prices and carbon taxes
- Exercising leadership in data analysis and international rule-making related to CO_2 sinks
- Facilitating discussions on CO_2 storage, including CCS

③ Regional Revitalization and Expansion into Global Markets

- Creation of cases that leverage regional strengths and features, including collaboration with agriculture, forestry, and fisheries
- Out-source (license) to Asia as a growing Japanese industry, lead nations in the Asian region toward carbon neutrality

For the Creation of a “Sustainable Carbon Society”

A multi-faceted approach and wide-ranging collaborations are essential for implementation of carbon recycling in society.

The Carbon Recycling Fund Institute will continue in its efforts to creat a “Sustainable Carbon Society”.