

Green Innovation Fund Projects



Green Japan, Green Innovation

Working toward a carbon-neutral future.

Contents

Working toward a carbon-neutral future.	P.3
Green Innovation Fund Projects	P.4
List of Projects	P.6

Field of Green Power Promotion, etc.

Cost Reductions for Offshore Wind Power Generation	P.7
Development of Next-Generation Solar Cells	P.8

Field of Energy Structure Transformation

Large-scale Hydrogen Supply Chain Establishment	P.9
Hydrogen Production through Water Electrolysis Using Power from Renewables	P.10
Hydrogen Utilization in Iron and Steelmaking Processes	P.11
Fuel Ammonia Supply Chain Establishment	P.12
Development of Technology for Producing Plastic Raw Materials Using CO ₂ and Other Sources	P.13
Development of Technology for Producing Fuel Using CO ₂ , etc.	P.14
Development of Technology for Producing Concrete and Cement Using CO ₂	P.15
Development of Technology for CO ₂ Separation, Capture, etc.	P.16

Field of Industry Structure Transformation

Next-Generation Storage Battery and Motor Development	P.17
Development of In-vehicle Computing and Simulation Technology for Energy Saving in Electric Vehicles	P.18
Smart Mobility Society Construction	P.19
Next-generation Digital Infrastructure Construction	P.20
Next-generation Aircraft Development	P.21
Next-generation Ship Development	P.22
Development of Negative Emissions Technologies in Agriculture, Forestry, and Fisheries Industries	P.23
Promotion of Carbon Recycling Using CO ₂ from Biomanufacturing Technology as a Direct Raw Material	P.24
Decarbonization of thermal processes in manufacturing	P.25

Outreach Initiatives Related to Green Innovation Fund Projects	P.26
Background Information	P.27

Working toward a carbon-neutral future.

The driving force behind Japan's future growth is the challenge of achieving carbon neutrality.

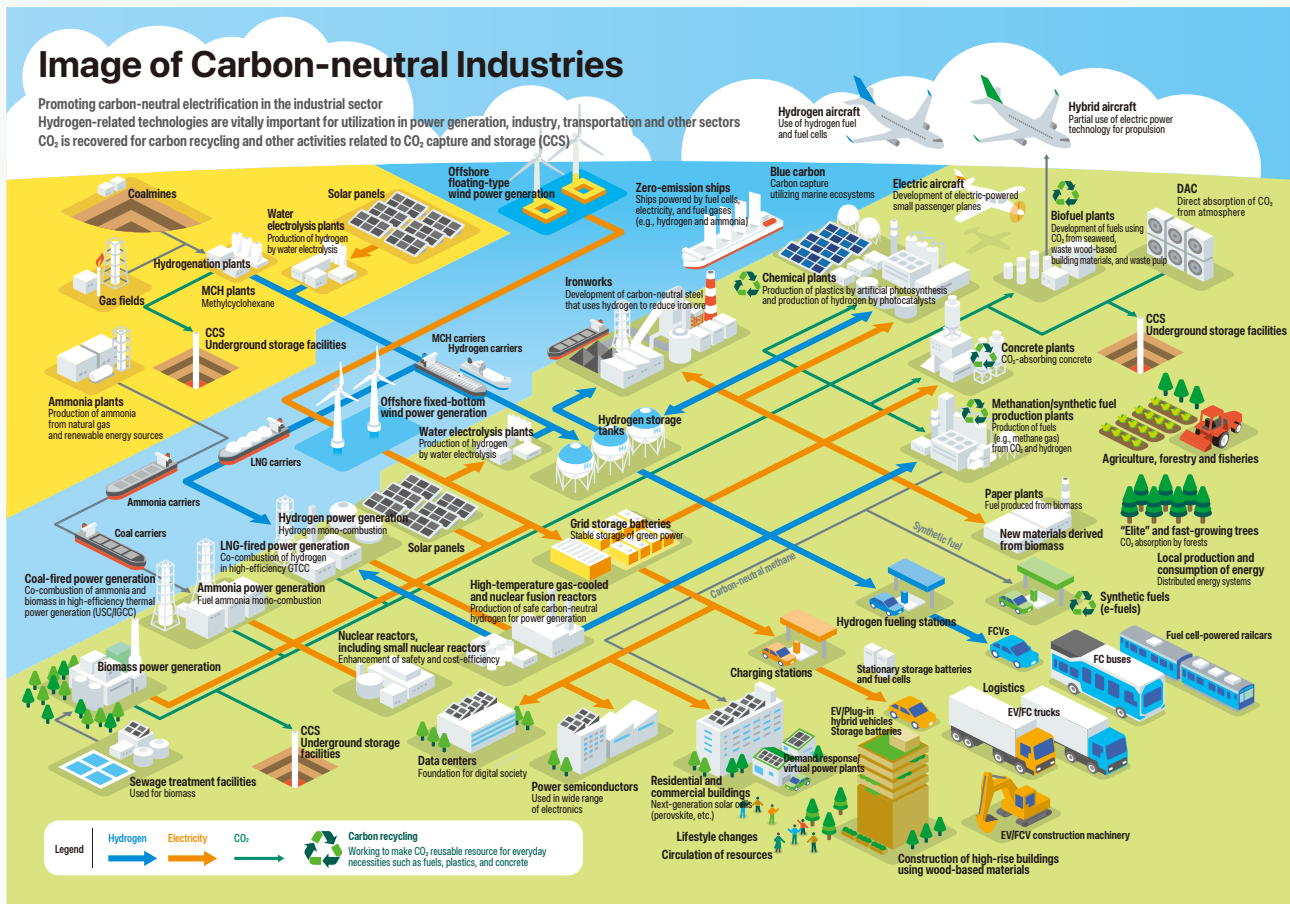
In October 2020, Japan declared that it aims to achieve carbon neutrality by 2050, with the goal of reducing overall greenhouse gas emissions to zero by this year. Carbon neutrality by 2050 cannot be realized through ordinary efforts. It is necessary to significantly accelerate efforts toward structural changes in the energy and industrial sectors, and undertake bold investment for innovation.

For this reason, the Ministry of Economy, Trade and Industry (METI), in collaboration with other ministries and agencies, formulated the "Green Growth Strategy through Achieving Carbon Neutrality in 2050."

The strategy specifies 14 promising areas expected to demonstrate future growth and provides action plans for each of these areas from the viewpoints of both industrial and energy policies. The strategy reflects Japan's determination to pursue ambitious goals while highlighting to the greatest extent possible realistic pathways toward their achievement.

Moreover, to support the forward-looking efforts of companies aiming to realize these goals, many kinds of policy measures are being mobilized. As part of this effort, a 2 trillion yen* fund has been established at NEDO in March 2021 to launch the Green Innovation Fund Projects.

*300 billion yen has been added to the second supplementary budget for FY2022, and 456.4 billion yen will be added to the initial budget for FY2023 (as of July 2023).



Source: Created by NEDO based on "Image of Carbon Neutral Industries" by METI

The Green Innovation Fund Projects, carried out on the basis of ambitious goals shared by the public and private sectors, aims to provide continuous support to companies and other organizations committed to addressing such goals as part of their business activities. Such support, available for up to a maximum of ten years, ranges from research and development (R&D) activities and demonstrations to social implementation of project outcomes.

Basic Policies for Green Innovation Fund (Summary)

01 Purpose and Outline

To achieve carbon neutrality by 2050, METI established a 2 trillion-yen fund as part of NEDO and provide continuous support for R&D projects, demonstrations, and social implementation projects for up to 10 years to companies that commit to ambitious goals.

02 Program Target

(Per project)
Ambitious 2030 targets, etc.
(Performance, Cost, etc.)

Monitor Cross-sectoral monitoring of fund projects based on the following;

- * International Competitiveness
- * Commercialization (TRL, etc.)
- * Potential for attracting private investment

- CO₂ Reduction Effect
- Economic Effect

03 Support Target

METI's support will focus on priority fields for which implementation plans have been formulated within the Green Growth Strategy, or key fields for which a future roadmap has been presented based on the "Basic Policy for Realization of GX", where policy effects are significant, and long-term continuous support is required to realize public implementation.

- ✓ Average size of conventional R&D projects (20 billion yen) or more.
- ✓ Projects for which short-term government support programs is sufficient are not eligible.
- ✓ Main implementers should be companies or other profit-making businesses capable of carrying out the entire process of public implementation (participation of small and medium-sized venture companies is encouraged; participation of universities and research institutions is also expected).
- ✓ The project must include innovative and fundamental R&D elements that are worthy of being commissioned by the government.

04 Strategy for Maximizing Results

To ensure that research and development results are steadily implemented publicly, METI seeks the commitment of the managers of companies and other organizations to persevere in challenging these goals as long-term business issues.

(Efforts required of company managers)

- * Submission of the vision and the long-term business strategy at the time of application
 - * Attendance and report to the WG
 - * Submission of a management sheet showing the status of initiatives
- (Implementation of a system to enhance commitment)
- 1) If the status of the project is inadequate, the project will be canceled, and a portion of the consignment fee will be returned.
 - 2) Introduction of a system (an incentive measure) that allows the government to pay more depending on the degree of achievement of targets.

The 14 priority fields in the Green Growth Strategy for which action plans have been compiled

- Upholding ambitious goals, steadily implement action plans corresponding to the phase of technology, and strengthen international competitiveness.
- Trial calculations indicate that the economic effect will be approximately 290 trillion yen and the effect in terms of employment will be approximately 18 million jobs in 2050.

Energy-related Industries

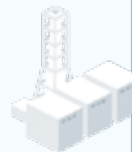
01 Offshore Wind Power, Solar Power, Geothermal Power

- By 2040, develop projects to generate 30-45GW [Offshore wind power]
- By 2030, aim for a power generation cost of 14 yen/kWh through next-generation solar cells [Solar power]



03 Next-generation Heat Energy

By 2050, aim to inject synthetic methane by 90% into existing infrastructure.



02 Hydrogen and Fuel Ammonia

- By 2050, introduce approximately 20 million tons [Hydrogen]
- Aim to capture a market of 500 billion yen in Southeast Asia [Fuel ammonia]



04 Nuclear Power

By 2030, establish underlying technologies related to carbon-free hydrogen production by high-temperature gas-cooled reactors (HTGR).



05 Automobiles and Storage Batteries

For passenger vehicles, electrified vehicles will account for 100% of new vehicle sales by 2035



06 Semiconductors and Information and Communication

By 2040, aim to achieve carbon neutrality in the semiconductor/information and communication industries.

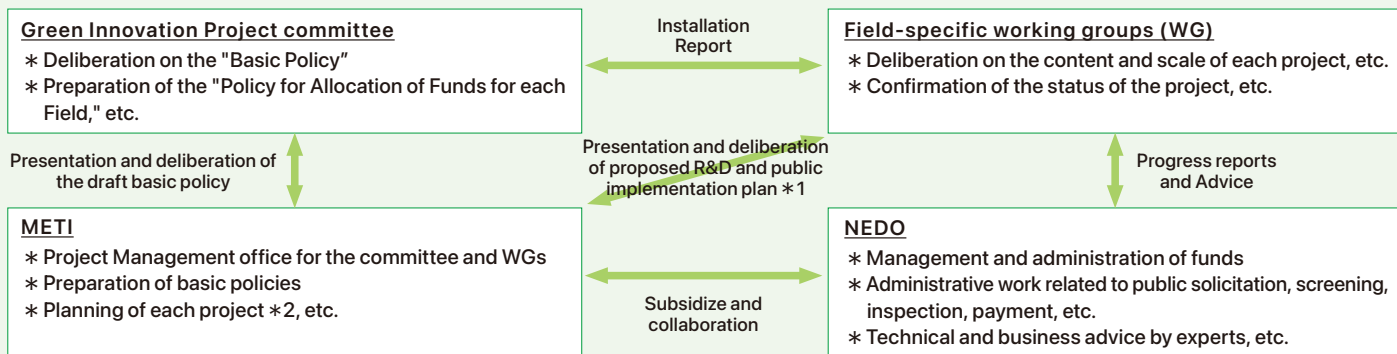


Fund Projects

Moreover, by leveraging government funding, this program is intended to serve as an impetus encouraging private sector investment in R&D activities and infrastructure development, and also attract global ESG-related funding, estimated to total approximately 35 trillion dollars, to Japan. Through such efforts, Japan aims to realize carbon neutrality by 2050.

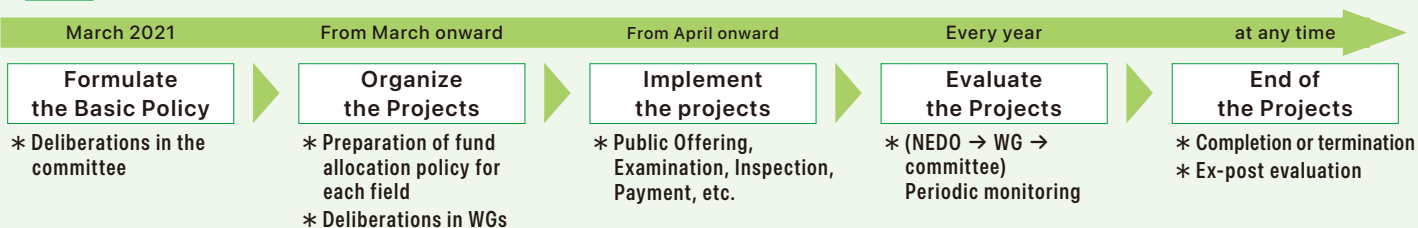
05 Scheme

Build a highly transparent and effective governance system that incorporates the knowledge of external experts and close cooperation among related organizations.



- 1 A plan describing the project's goals for 2030, R&D items, maturity level of the target technologies (TRL, etc.), budget scale, etc. (A draft of the plan is discussed by the WG.)
- 2 Including the division office in charge of the project in the relevant ministry or agency.

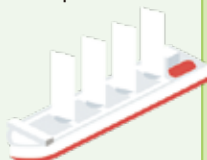
06 Program Schedule



Transportation and manufacturing-related industries

07 Shipping

Realize the commercial operation of zero-emission ships before 2028.



09 Food, Agriculture, Forestry, and Fisheries Industries

By 2050, achieve zero fossil-fuel-derived CO₂ emissions in the agriculture, forestry and fisheries industries.



11 Carbon Recycling and Materials

- By 2050, aim to bring the price of plastic raw materials made by artificial photosynthesis to the same level as existing products [Carbon recycling]
- Realize zero-carbon steel [Materials]



08 Logistics, People Flows, and Civil Engineering Infrastructure

By 2050, realize carbon neutral ports and decarbonization of construction works, etc.



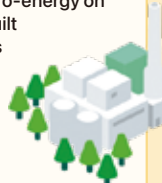
10 Aircraft

Aim for the phased implementation of core technologies for aircraft batteries, etc. from 2030.



12 Housing and Building and Next-generation Power Management

By 2030, realize zero-energy on average in newly built zero-energy homes (ZEH) and zero-energy buildings (ZEB). [Housing and building]



Home and office - related industries

13 Resource Circulation

By 2030, introduce approximately 2 million tons of bioplastics.



14 Lifestyle-related

By 2050, aim to realize carbon-neutral, resilient and comfortable living.



List of Projects

Projects ranging from research and development (R&D) activities and demonstrations to social implementation of project outcomes with view to realizing carbon neutrality by 2050

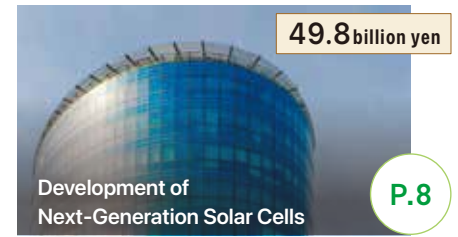
Field of Green Power Promotion, etc.



119.5 billion yen

Cost Reductions for Offshore Wind Power Generation

P.7



49.8 billion yen

Development of Next-Generation Solar Cells

P.8

Field of Energy Structure Transformation



300 billion yen

Large-scale Hydrogen Supply Chain Establishment


P.9



70 billion yen

Hydrogen Production through Water Electrolysis Using Power from Renewables

P.10



193.5 billion yen

Hydrogen Utilization in Iron and Steelmaking Processes

P.11



68.8 billion yen

Fuel Ammonia Supply Chain Establishment

P.12



126.2 billion yen

Development of Technology for Producing Raw Materials for Plastics Using CO₂ and Other Sources

P.13



115.28 billion yen

Development of Technology for Producing Fuel Using CO₂, etc.

P.14



56.78 billion yen

Development of Technology for Producing Concrete and Cement Using CO₂

P.15



38.23 billion yen

Development of Technology for CO₂ Separation, Capture, etc.

P.16

Field of Industry Structure Transformation



151 billion yen

Next-Generation Storage Battery and Motor Development

P.17



42 billion yen

Development of In-vehicle Computing and Simulation Technology for Energy Saving in Electric Vehicles

P.18



113 billion yen

Smart Mobility Society Construction

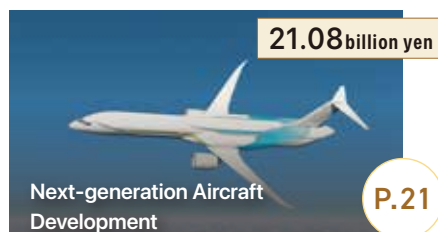
P.19



141 billion yen

Next-generation Digital Infrastructure Construction

P.20



21.08 billion yen

Next-generation Aircraft Development

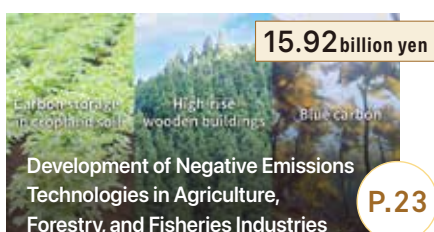
P.21



35 billion yen

Next-generation Ship Development

P.22



15.92 billion yen

Development of Negative Emissions Technologies in Agriculture, Forestry, and Fisheries Industries

P.23



176.7 billion yen

Promotion of Carbon Recycling Using CO₂ from Biomanufacturing Technology as a Direct Raw Material

P.24



32.51 billion yen

Decarbonization of thermal processes in manufacturing

P.25

*The amount shown in each project image is the maximum amount to be contributed from the fund (as of July 2023). In addition, there are other costs to be borne by the implementing companies, etc.



Cost Reductions for Offshore Wind Power Generation

Budget
Up to
119.5
billion yen

Project Overview

To achieve carbon neutrality by 2050, it is essential to introduce renewable energy as much as possible. Given the feasibility of large-scale introduction and cost reductions as well as the anticipated economic ripple effects, offshore wind power generation holds the key to making renewable energy a main source of power.

Offshore wind power has been expanding mainly in Europe, but the Asian market is expected to grow rapidly between now and 2050. Especially in Japan and other parts of Asia, which have large areas of deep sea, there is an increasing need for systems optimized to suit local oceanographic and meteorological conditions, such as low wind speeds, typhoons, and lightning strikes.

The aim of this project, therefore, is to establish technology that can achieve a power generation cost of 8 to 9 yen/kWh with fixed-bottom wind turbines under certain conditions, and technology to commercialize floating offshore wind turbines at internationally competitive cost levels.

Based on the results of demonstration projects carried out thus far, the cost of offshore wind power, particularly for floating wind turbines, can be quickly reduced, thereby facilitating an expansion in public implementation efforts.

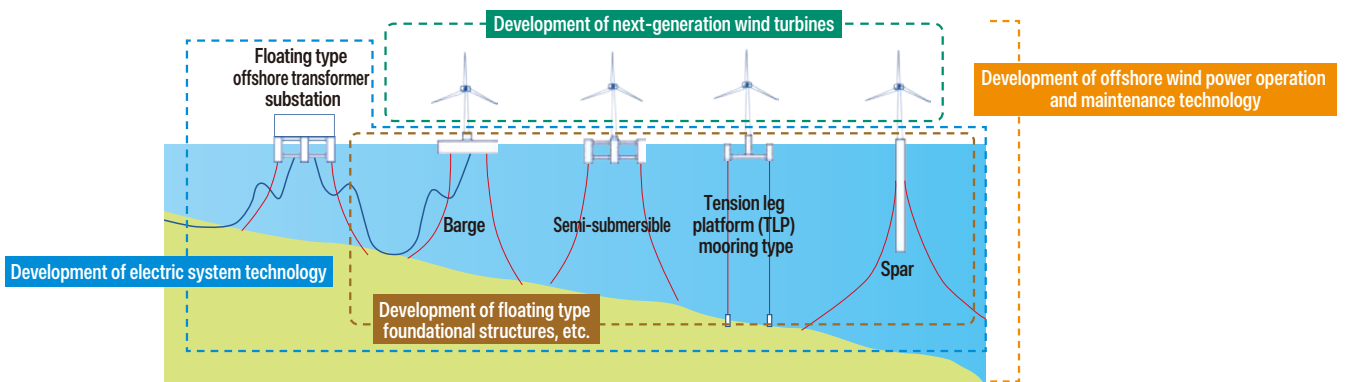
« Research & Development »

- Technology development project for next-generation wind turbines
 - Technology development project for basic manufacturing and installation cost reduction for floating wind turbines
 - Technology development project for offshore wind power-related electrical systems
 - Innovative offshore wind power operation and maintenance project
- ▼
- Floating offshore wind turbine demonstration project

CO ₂ Reduction Effect (Japan)	Economic Effect (World)
In2030 Approximately 3-7 million tons/year	In2030 Approximately 1 trillion yen
In2050 Approximately 90 million tons/year	In2050 Approximately 2 trillion yen

Source : METI, R&D and Social Implementation Plan

Image of technology development for floating type offshore wind power



Detailed information

<https://green-innovation.nedo.go.jp/en/project/offshore-wind-power-generation/>



Project period Maximum of 10 years from FY2021 to FY2030

Department in charge New Energy Technology Department

✉ gi-wind@nedo.go.jp

Development of Next-Generation Solar Cells

Budget
Up to
49.8
billion yen

Project Overview

To achieve carbon neutrality by 2050, it is necessary to introduce renewable energy sources, including solar power, as much as possible with the aim of using them as primary sources of power. In Japan, where most land is not flat, one way of securing suitable areas for solar power generation is installing next-generation solar cells that can be installed in places where existing photovoltaic cells could not (walls of buildings, factory roofs that can only support small loads, etc.). Installation in such locations, therefore, requires the development of lightweight next-generation solar cells that are flexible enough to be installed on curved surfaces such as walls and which are also comparable to existing photovoltaic cells in terms of performance (conversion efficiency, long-term reliability, etc.).

Through the development of basic technologies for next-generation solar cells (perovskite solar cells) and R&D for realizing technologies for various manufacturing processes (coating processes, electrode

formation, and sealing processes) for scaling up products, the aim of this project is to achieve the same electricity costs of 14 yen/kWh or less by 2030 as conventional silicon solar cells.

« Research & Development »

- Project for fundamental technology development of next-generation solar cells
- Project for practical realization of next-generation solar cells
- Project for demonstration of next-generation solar cells

CO₂ Reduction Effect (Japan)

In2030
Approximately **0.6** million tons/year

In2050
Approximately **100** million tons/year

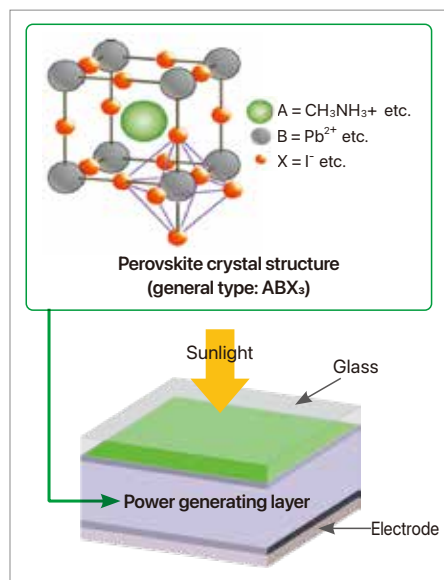
Economic Effect (World)

In2030
Approximately **12.5** billion yen

In2050
Approximately **1.25** trillion yen

Source : METI, R&D and Social Implementation Plan

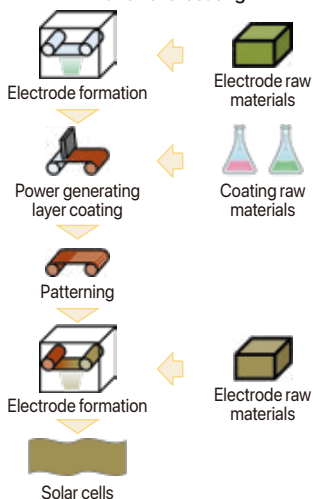
Improved performance at laboratory size



Source: The University of Tokyo

Upsized with enhanced durability

Development of basic technologies corresponding to each process, for example, technology for uniform nano-level coating



Source: Toshiba Corporation

Installation and commercialization



* Image

Source: Taisei Corporation

Detailed information

<https://green-innovation.nedo.go.jp/en/project/next-generation-solar-cells/>



Project period

Maximum of 10 years from FY2021 to FY2030

Department in charge

New Energy Technology Department

✉ nedo.gi-pv@ml.nedo.go.jp



Large-scale Hydrogen Supply Chain Establishment

Budget
Up to
300
billion yen

Project Overview

Hydrogen can not only directly contribute to the decarbonization of the power generation sector by converting surplus power into hydrogen for storage and utilization, it can also maximize its potential as a zero-emission renewable energy power source. Hydrogen is therefore expected to be used as a secondary energy source for achieving carbon neutrality and contribute to decarbonization in industrial fields such as raw material utilization and heat demand where decarbonization through electrification is difficult.

To promote the social implementation of hydrogen, supply costs must be reduced by increasing the size of supply facilities while also creating large-scale hydrogen demand. However, since long-term hydrogen demand is currently uncertain, it is difficult for private companies to make large-scale investments in infrastructure. To reduce this uncertainty, a social implementation model must be established that can increase supply and create hydrogen demand by maximizing use of existing infrastructure.

In addition to enlarging the transportation facilities, and other resources including hydrogen carriers, the project will implement demonstrations of hydrogen power generation at an actual power

plant (co-combustion with other fuels and single-fuel combustion using hydrogen only). The aim is to establish technologies that will make reducing supply costs possible along with creating a large-scale demand for hydrogen, and to achieve a hydrogen supply cost of 30 yen/Nm³ by 2030, and 20 yen/Nm³ or below by 2050 (similar level to fossil fuels).

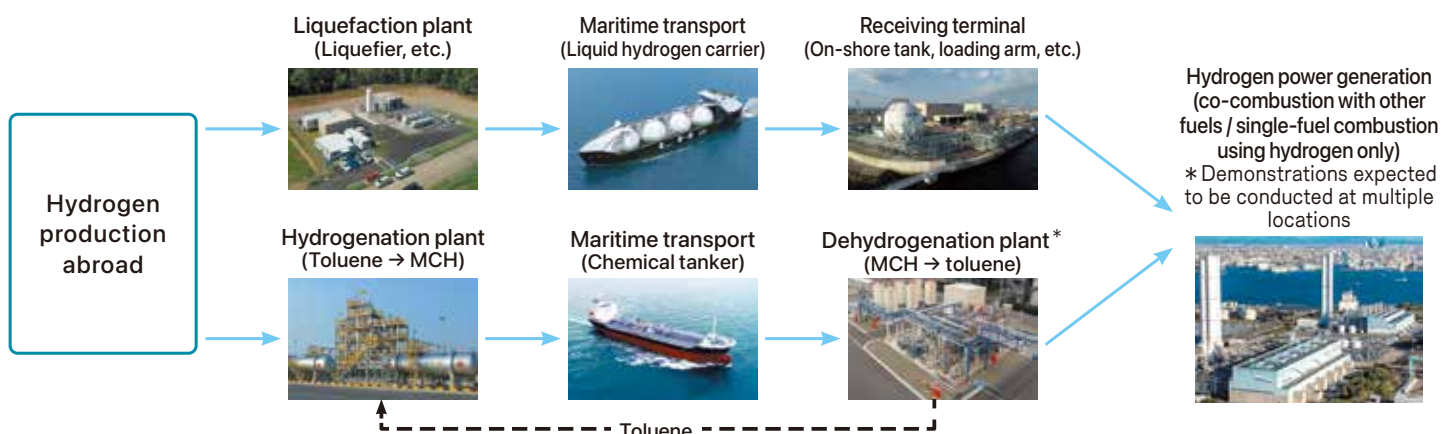
« Research & Development »

- Large-scale hydrogen supply chain demonstration, and development of innovative hydrogen transportation technology
- Developing a foundation for material evaluations to support R&D on liquefied hydrogen-related equipment
- Demonstration of hydrogen power generation technology at an actual power plant

CO ₂ Reduction Effect (World)	Economic Effect (World)
<u>In2030</u> Approximately 7 million tons/year	<u>In2030</u> Approximately 0.3 trillion yen/year
<u>In2050</u> Approximately 400 million tons/year	<u>In2050</u> Approximately 5.5 trillion yen/year

Source: METI, R&D and Social Implementation Plan

Large-scale hydrogen supply chain for liquid hydrogen and methylcyclohexane (MCH) (image)



* Oil refineries and other existing facilities are expected to be utilized to the maximum
Source: Created by the Agency for Natural Resources and Energy based on the websites of HySTRA, AHEAD, etc.

Detailed information

<https://green-innovation.nedo.go.jp/en/project/hydrogen-supply-chain/>



Project period Maximum of 10 years from FY2021 to FY2030

Department in charge Fuel Cell and Hydrogen Technology Office,
Smart Community and Energy Systems Department

✉ hydrogen@ml.nedo.go.jp



Hydrogen Production through Water Electrolysis Using Power from Renewables

Budget
Up to
70
billion yen

Project Overview

Hydrogen can not only directly contribute to the decarbonization of the power generation sector by converting surplus power into hydrogen for storage and utilization, it can also maximize its potential as a zero-emission renewable energy power source. Hydrogen is therefore expected to be used as a secondary energy source for achieving carbon neutrality and contribute to decarbonization in industrial fields such as raw material utilization and heat demand where decarbonization through electrification is difficult.

To promote the social implementation of hydrogen, supply costs must be reduced by increasing the size of supply facilities while also creating large-scale hydrogen demand. However, since long-term hydrogen demand is currently uncertain, it is difficult for private companies to make large-scale investments in infrastructure. To reduce this uncertainty, a social implementation model must be established that can increase supply and create hydrogen demand by maximizing use of existing infrastructure. One such model focuses on the utilization of water electrolyzers for self-consumption and hydrogen utilization in nearby areas.

To achieve this social implementation model, as well as establish a domestic hydrogen production base and develop markets overseas, the aim of this project is to develop technologies at a close-to-commercial level that will realize alkaline type water electrolyzers at a cost of 52,000 yen/kW and PEM type water electrolyzers at a cost of 65,000 yen/kW.

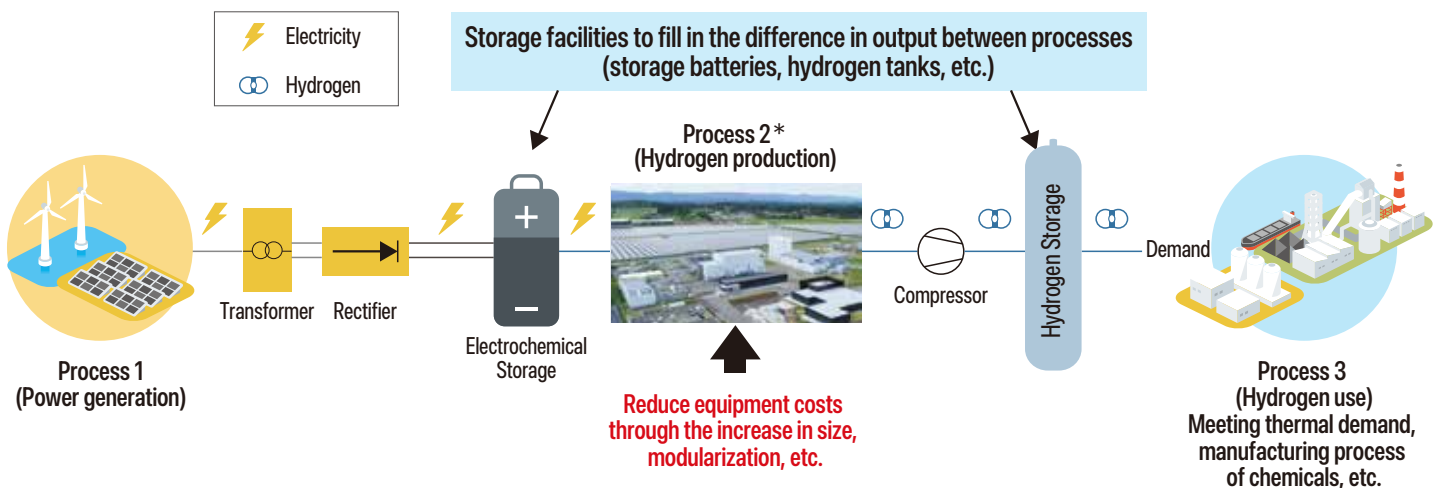
« Research & Development »

- Technology development for increasing the size of water electrolyzers, and Power-to-X large-scale demonstrations
- Establishment of performance evaluation technologies for water electrolyzers

CO ₂ Reduction Effect (World)	Economic Effect (World)
In2030 Approximately 40 million tons/year	In2030 Approximately 0.4 trillion yen (Total up to 2030)
In2050 Approximately 1.52 billion tons/year	In2050 Approximately 4.4 trillion yen/year

Source : METI, R&D and Social Implementation Plan

Power-to-X system's structure



* Utilize hydrogen that is manufactured using power generated from excess renewable energy in various sectors, such as industries including electric power, transportation, heating, and industrial raw materials.

Detailed information

<https://green-innovation.nedo.go.jp/en/project/hydrogen-production-water-electrolysis-utilizing-electric-power-derived/>



Project period

Maximum of 10 years from FY2021 to FY2030

Department in charge

Fuel Cell and Hydrogen Technology Office,
Smart Community and Energy Systems Department

✉ hydrogen@ml.nedo.go.jp

Hydrogen Utilization in Iron and Steelmaking Processes

Budget
Up to
193.5
billion yen

Project Overview

Steel is used in many products, ranging from spacecrafts to more common products such as automobiles, bullet trains, computers, smartphones, and houses, and the steel industry is the foundation for various other industries.

Even in the carbon-neutral society of 2050, demand is expected to remain high for automobiles, electronics, and infrastructure-related products. During the manufacturing process for these products, however, large quantities of CO₂ are emitted.

CO₂ emissions in the iron and steel industry totaled approximately 131 million tons in FY2020, and currently account for roughly 40% of all industrial CO₂ emissions in Japan.

Since ancient times, the primary method for making steel has been to use carbon, in the form of charcoal or coal, as the means for reducing iron ore. However, this method inevitably generates CO₂. Therefore, to reduce CO₂ emissions, it is necessary to radically change the steel-making process by moving away from coal as a raw material/reduction agent. For this reason, research is underway all over the world on steelmaking through the use of hydrogen reduction

where hydrogen is used instead of carbon to reduce iron ore, but this method has not yet been put into practical use.

To achieve carbon neutrality in the steelmaking process, this project aims to reduce CO₂ emissions by at least 50% through the application of hydrogen reduction technology to existing blast furnaces (using blast furnace hydrogen reduction technology) and technology for using hydrogen to directly reduce low-grade iron ore (using direct hydrogen reduction technology).

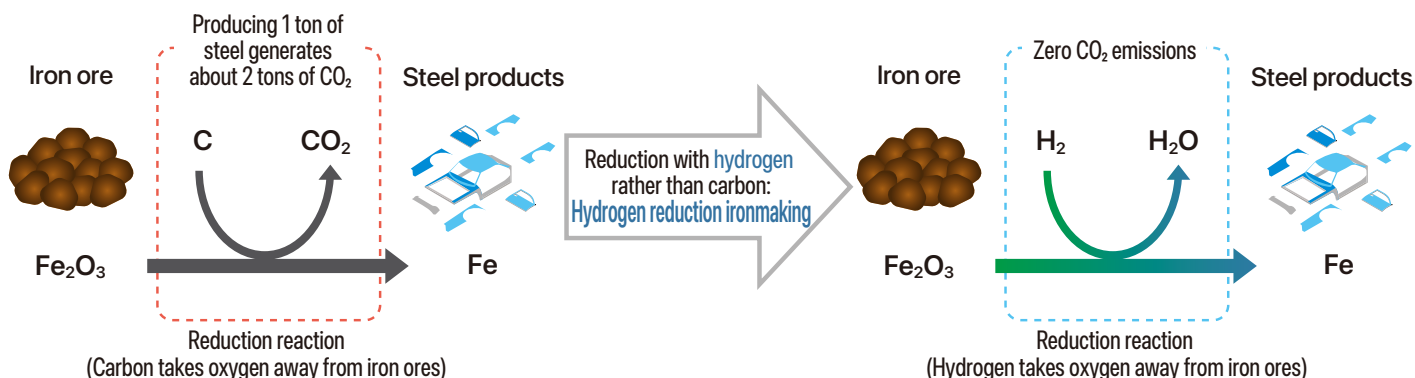
« Research & Development »

- Development of hydrogen reduction technology using blast furnaces
- Development of direct hydrogen reduction technology that reduces iron ore with hydrogen only

CO ₂ Reduction Effect		Economic Effect (World)	
<u>In2030</u>	(Japan)	<u>In2030</u>	
Approximately 2 million tons/year		Approximately 320 billion yen/year	
<u>In2050</u>	(World)	<u>In2050</u>	
Approximately 1.3 billion tons/year		Approximately 40 trillion yen/year	

Source: METI, R&D and Social Implementation Plan

Image of hydrogen reduction ironmaking



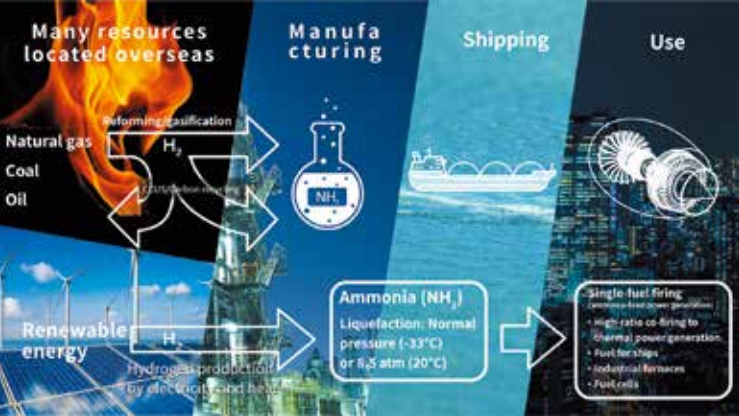
Detailed information

<https://green-innovation.nedo.go.jp/en/project/utilization-hydrogen-steelmaking/>



Project period Maximum of 10 years from FY2021 to FY2030

Department in charge Environment Department [✉ cct.projects@ml.nedo.go.jp](mailto:cct.projects@ml.nedo.go.jp)



Fuel Ammonia Supply Chain Establishment

Budget
Up to
68.8
billion yen

Project Overview

Similar to hydrogen, ammonia does not emit CO₂ during combustion, so it is expected to be used as a zero-emission fuel for power generation and shipping, thereby helping to realize carbon neutrality. For power generation applications in particular, it is important to promote the decarbonization of thermal power generation by replacing fossil fuels with ammonia. Ammonia can also be used as a hydrogen carrier, so by using existing infrastructure, it can be manufactured and transported inexpensively. Because of these characteristics, ammonia fuel is attracting attention all over the world, and demand is expected to increase rapidly in the future, especially in Asia.

However, ammonia is not currently used as a fuel, so to realize a society where ammonia fuel can be used, various issues must be addressed, such as expanding its use, securing stable supply sources, and reducing its cost.

To address these issues, the aim of this project is to realize technology necessary to reduce ammonia supply costs to the high 10 yen range perNm³ (equivalent to hydrogen bycalorific value) by 2030. Another goal concerns establishing high-ratio co-combustion and mono-fuel combustion technologies for using ammonia power generation to achieve the estimated domestic demand level of 30 million tons/year by 2050.

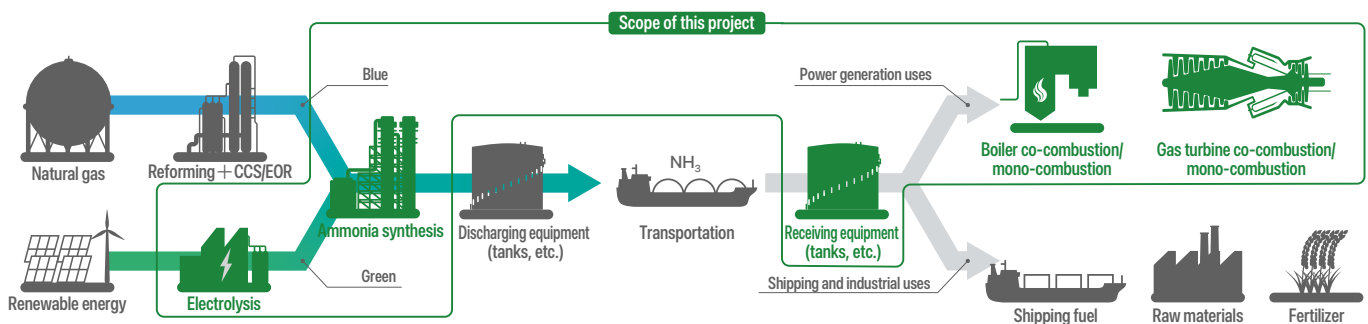
Research & Development

- Reduction of ammonia supply costs
- High-ratio co-combustion and mono-fuel combustion needed for ammonia power generation

CO ₂ Reduction Effect		Economic Effect (World)	
In2030	(Japan)	In2030	
Approximately 6.15 million tons/year		Approximately 0.75 trillion yen	
In2050	(World)	In2050	
Approximately 1.15 billion tons/year		Approximately 7.3 trillion yen/year	

Source : METI, R&D and Social Implementation Plan

Fuel Ammonia Supply Chain



Source: Created by NEDO based on diagram produced by IHI Corporation

Detailed information

<https://green-innovation.nedo.go.jp/en/project/building-fuel-ammonia-supply-chain/>



Project period

Maximum of 10 years from FY2021 to FY2030

Department in charge

Reduction of Ammonia Supply Costs : Smart Community and Energy Systems Department

✉ smartcommunity@ml.nedo.go.jp

Use of Ammonia for Power Generation : Environment Department

✉ cct.projects@ml.nedo.go.jp



Development of Technology for Producing Raw Materials for Plastics Using CO₂ and Other Sources

Budget
Up to
126.2
billion yen

Project Overview

Carbon Recycling is a key technology that effectively utilizes CO₂ as a resource for realizing a carbon neutral society. As of 2019, the industrial sector accounts for 29.3% of total CO₂ emissions in Japan, and the chemical industry, which accounts for 18.6% of the industrial sector, emits 60.18 million tons on an annual basis.

Most of the raw materials for plastics are derived from naphtha (crude gasoline), which is obtained from refining petroleum, and about half of the CO₂ emitted by the chemical industry is due to processes like cracking naphtha to produce basic chemicals such as ethylene and propylene.

In addition, about 84% of waste plastics are recycled, but some 57% of these are used as a heat source for waste-to-energy plants, etc. (thermal recycling), and are eventually discharged as CO₂. So drastic measures are therefore necessary.

The aim of this project, therefore, is to develop four carbon recycling technologies related to the manufacture of plastic raw materials: advanced technology for naphtha cracking furnaces by adopting

carbon-free heat sources, technology for producing chemicals from waste plastics and rubber, technology for producing functional chemicals from CO₂, and technology for producing chemicals from alcohols.

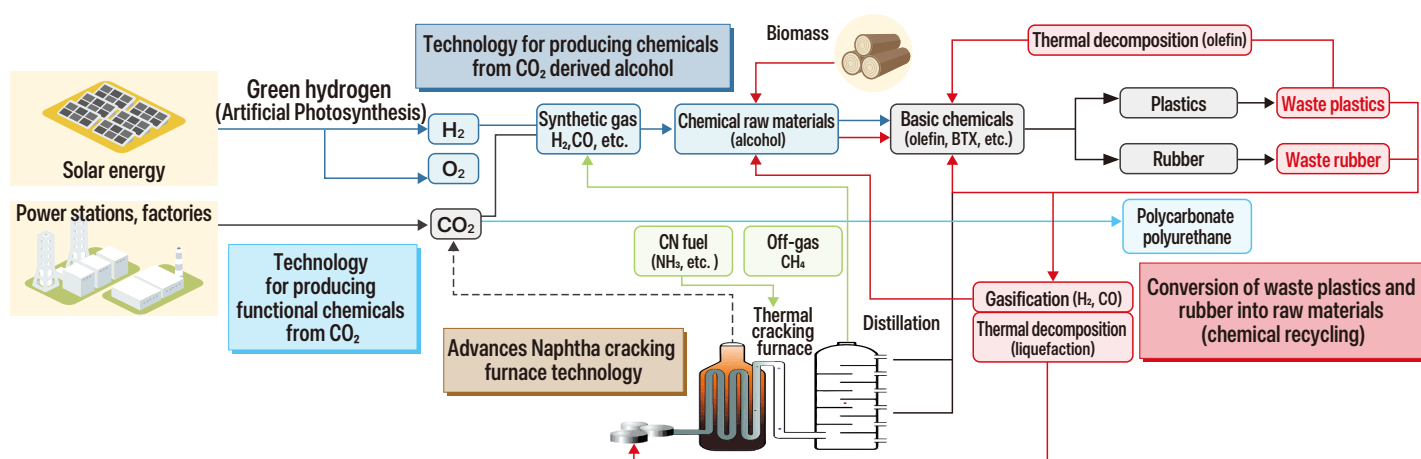
« Research & Development »

- Development of advanced technology for naphtha cracking furnaces by adopting carbon-free heat sources
- Development of technology for producing chemicals from waste plastics and rubber
- Development of technology for producing functional chemicals from CO₂
- Development of technology for producing chemicals from alcohols

CO ₂ Reduction Effect (World)	Economic Effect (World)
In2030 Approximately 40 million tons/year	In2030 Approximately 10 trillion yen/year
In2050 Approximately 1.1 billion tons/year	In2050 Approximately 360 trillion yen/year

Source : METI, R&D and Social Implementation Plan

Positioning of R&D topics under project



Detailed information

<https://green-innovation.nedo.go.jp/en/project/development-plastic-raw-material-manufacturing/>



Project period

Maximum of 10 years from FY2021 to FY2030

Department in charge

Materials Technology and Nanotechnology Department

✉ gi_cr_plastic@nedo.go.jp



Development of Technology for Producing Fuel Using CO₂, etc.

Budget
Up to
115.28
billion yen

Project Overview

To achieve carbon neutrality by 2050, it is essential to replace fossil fuels with fuels that do not increase CO₂ levels in the atmosphere when burned.

Such fuels have the potential to transform the energy supply and demand structure in Japan—which is dependent on fossil fuels from other countries—making it important from the perspective of energy security. Using existing infrastructure will greatly help reduce initial costs. The goal is to solve issues related to production technology and lower production costs to implement them throughout society.

It is necessary to promote the development of technology for carbon recycling fuels as one of the various options for realizing a decarbonized society. This project will work toward the social implementation of two liquid fuels—(1) synthetic fuels and (2) sustainable aviation fuels (SAF)—and two gaseous fuels—(3) synthetic methane and (4) green LPG.

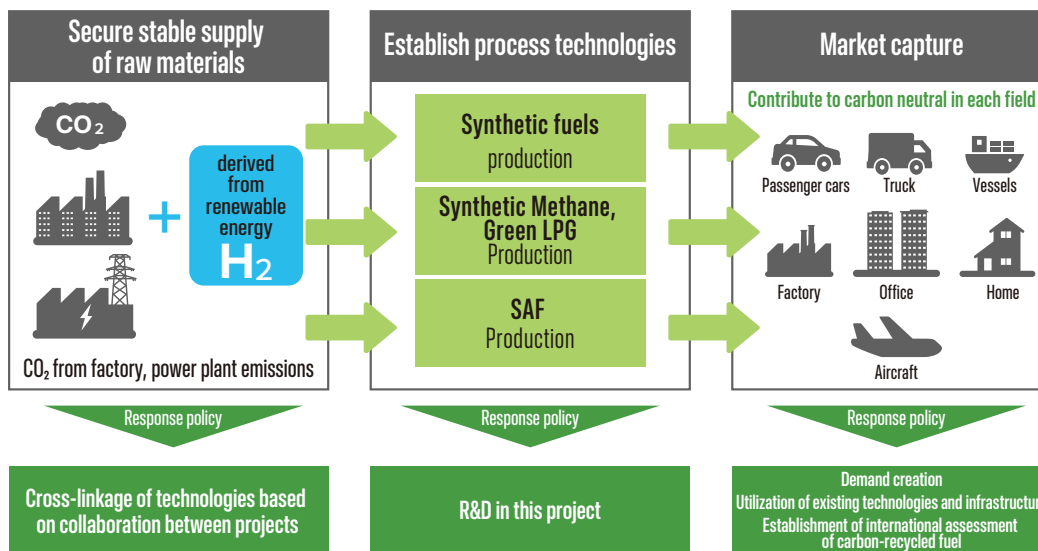
« Research & Development »

- Development of technology for improving production yield and utilization technology of synthetic fuels
- Development of technology for producing Sustainable Aviation Fuel (SAF)
- Development of innovative technology for the production of synthetic methane
- Development of technology for synthesizing green LPG without fossil fuels

CO ₂ Reduction Effect (World)	Economic Effect (World)
<u>In2030</u> Approximately 6.008 million to 9.438 million tons/year	<u>In2030</u> Approximately 270.4 billion to 1.1 trillion yen (Total up to 2030)
<u>In2050</u> Approximately 320 million tons/year	<u>In2050</u> Approximately 17.1 trillion yen (Total up to 2050)

Source : METI, R&D and Social Implementation Plan

Image of utilization of CO₂ etc. in major carbon recycle fuels



Source: METI, Development of technology for producing fuel using CO₂, etc, revision

[Detailed information](https://green-innovation.nedo.go.jp/en/project/development-fuel-manufacturing-technology-co2/)

<https://green-innovation.nedo.go.jp/en/project/development-fuel-manufacturing-technology-co2/>



Project period Maximum of 9 years from FY2022 to FY2030

Department in charge

- Synthetic Fuels (Improving Production : Environment Department ✉ cct.projects@ml.nedo.go.jp)
- Synthetic Fuels (Utilization Technology) : Energy Conservation Technology Department ✉ gi8eng@ml.nedo.go.jp
- Sustainable Aviation Fuels (SAF) : New Energy Technology Department ✉ nedo.biofuel@ml.nedo.go.jp



Development of Technology for Producing Concrete and Cement Using CO₂

Budget
Up to
56.78
billion yen

Project Overview

Carbon Recycling is a key technology that effectively utilizes CO₂ as a resource for realizing a carbon neutral society. Japan has a competitive edge in the field of CO₂ separation and capture, as well as certain kinds of chemicals relevant to this technology.

Due to the high potential for CO₂ fixation and the stability of products, the use of CO₂ in concrete, cement, and carbonates (hereinafter referred to as "concrete and cement fields") in particular will be implemented in society, which is expected to greatly reduce CO₂ levels. In Japan, the United States, and Europe, R&D and demonstration projects in this area are already underway.

In order to achieve decarbonization in concrete and cement field, however, it is necessary to reduce CO₂ emissions and increase CO₂ fixation of concrete, a product used all around the world, as well as promote its use by reducing costs. Cement, a material used in concrete, also emits CO₂ through the decarbonization reaction of limestone, one of its raw materials, making it another issue that needs to be addressed.

To realize a carbon neutral society, the aim of this project is to address the above issues related to the social implementation of Carbon Recycling technologies, and strategically promote their diffusion in Japan and overseas.

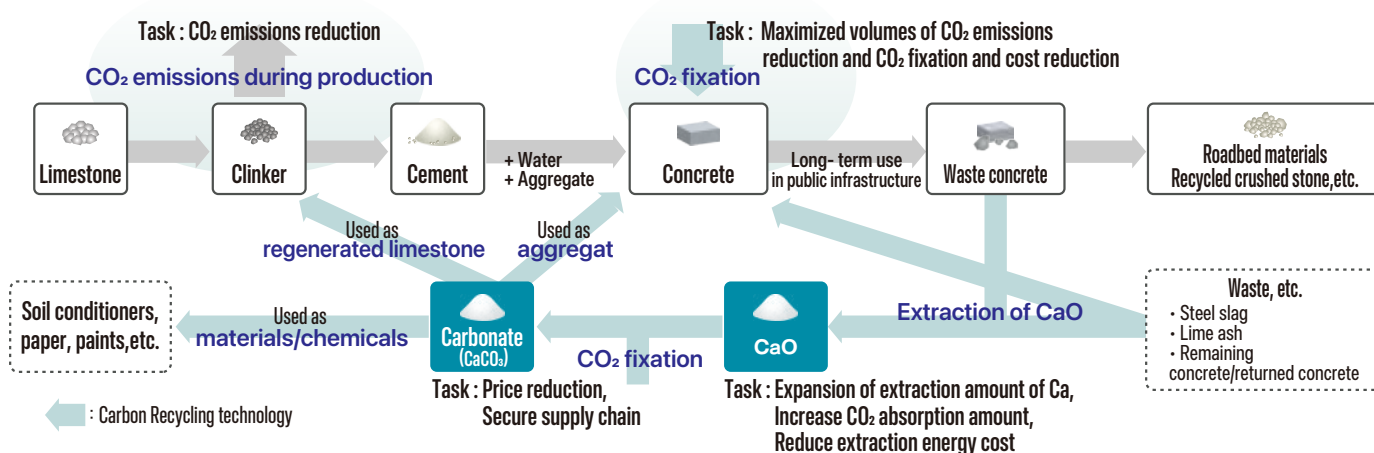
« Research & Development »

- Development of concrete produced with maximized volumes of CO₂ emissions reduction and CO₂ fixation
- Development of technology related to quality control/fixation evaluation methods for concrete produced with maximized volumes of CO₂ emissions reduction and CO₂ fixation
- Design and demonstration of CO₂-recovering cement production process
- Establishment of carbonic acid chloride technology using various calcium sources

CO ₂ Reduction Effect (World)	Economic Effect (World)
In2030 Approximately 0.6 to 1.4 billion tons/year	In2030 Approximately 380 billion yen
In2050 Approximately 3 billion tons/year	In2050 Approximately 156 trillion yen

Source : METI, R&D and Social Implementation Plan

Producing concrete and cement using CO₂



Detailed information

<https://green-innovation.nedo.go.jp/en/project/development-manufacturing-concrete-using-co2/>



Project period Maximum of 10 years from FY2021 to FY2030

Department in charge Environment Department cct.projects@ml.nedo.go.jp



Development of Technology for CO₂ Separation, Capture, etc.

Budget
Up to
38.23
billion yen

Project Overview

The power sector is moving toward decarbonization by introducing renewable energy to the greatest extent possible. However, in order to meet domestic demand for electricity, it is necessary to maintain a certain amount of thermal power generation and capture the resulting CO₂ emissions.

At the same time, while efforts to realize decarbonization in the industrial sector are moving forward, by such means as electrification and fuel conversion to hydrogen, demand for fossil fuels is expected to continue to some degree due to cost-related factors. In addition, it is difficult to avoid CO₂ emissions emanating from raw materials used in industrial sectors such as cement, steel, and chemicals.

There is consequently an increasing need for CO₂ separation and capture technologies in both the power generation and industrial sectors. However, challenges include the large amount of energy inputs needed for separation and capture and high costs for the equipment and materials used for capture.

The aims of this project are to establish technology for the first time for low-pressure, low-concentration CO₂ separation and capture at

a concentration of 10% or less, to expand the business for CO₂ separation and capture equipment and materials, and to strengthen Japan's international competitiveness in the carbon recycling market while linking these results to the development of negative emission technologies such as Direct Air Capture (DAC).

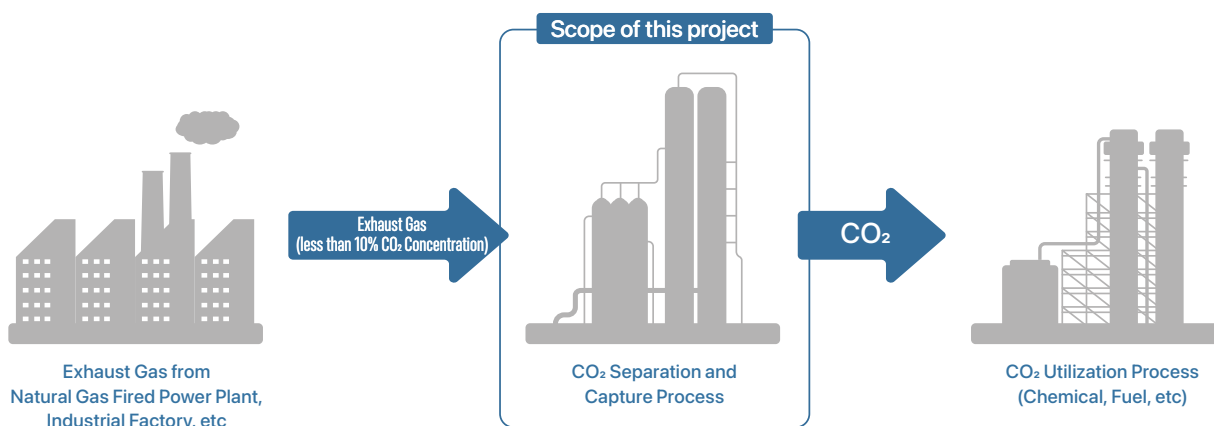
« Research & Development »

- Technology development and demonstration of large-scale CO₂ separation and capture from natural gas-fired power generation exhaust gas
- Technology development and demonstration of small- and medium-scale CO₂ separation and capture from factory exhaust gas, etc.
- Establish a common base for evaluating the standards of CO₂ separation materials

CO ₂ Reduction Effect (World)	Economic Effect (World)
In2030 Approximately 1.6 billion tons/year	In2030 Approximately 6 trillion yen/year
In2050 Approximately 8 billion tons/year	In2050 Approximately 10 trillion yen/year

Source : METI, R&D and Social Implementation Plan

CO₂ (Low Pressure/Low Concentration) Separation and Capture Process



Detailed information

<https://green-innovation.nedo.go.jp/en/project/development-co2-separation-recovery/>



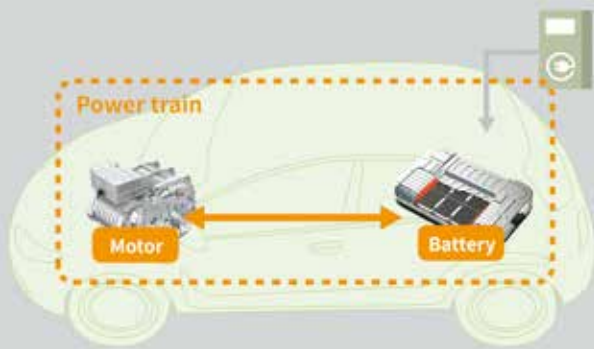
Project period

Maximum of 9 years from FY2022 to FY2030

Department in charge

Environment Department

✉ cct.projects@ml.nedo.go.jp



Next-generation Storage Battery and Motor Development

Budget
Up to
151
billion yen

Project Overview

Use of automobiles accounts for 16% of total CO₂ emissions both globally and domestically. The movement toward the use of electric vehicles to stem global warming is accelerating worldwide, and the spread of electric vehicles and plug-in hybrid vehicles is rapidly expanding in Europe and China. Efforts to support the development of fuel-cell trucks and buses are also increasing in many countries. To maintain and strengthen competitiveness in the automotive industry, the main pillar of Japan's economy, it is essential to accelerate initiatives toward electrification.

The challenges to be addressed toward the widespread use of electrified vehicles include expanding social acceptance through vehicle price reductions and infrastructure development such as electrified vehicle charging infrastructure and hydrogen stations. Another challenge will be to strengthen electrified vehicle-related technologies, supply chains, and value chains, including storage batteries, fuel cells, and motors. It is especially important to develop small lightweight storage batteries and motors for light and commercial vehicles which face restrictions in terms of vehicle body design and whose pricing is an important issue for consumers. In addition to developing highly efficient motors, another important issue, from the perspective of reducing life cycle CO₂ emissions of a car, is the reduction of CO₂ emissions during the manufacture and disposal of storage batteries and motors. In addition, since significant amounts of natural resources, such as lithium, nickel, cobalt, graphite, neodymium, and dysprosium, are used for

producing storage batteries and motors, materials with lower supply chain risks must be developed to overcome constraints on resource availability, and issues related to recycling must also be addressed.

The aim of this project, therefore, is to address the following technological issues: 1. Improving the performance and affordability of storage batteries and motor systems, 2. Improving performance and promoting resource saving at the level of materials, and 3. Commercializing advanced recycling technologies. The aim of this project is also to strengthen the industrial competitiveness of storage batteries and motors along with developing basic technologies to support electrified vehicles in the future and strengthen supply and value chains.

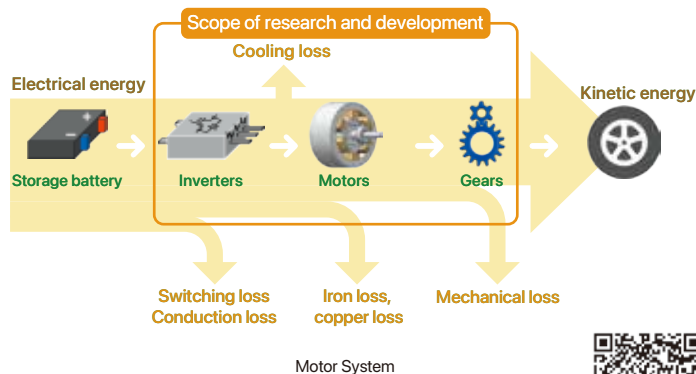
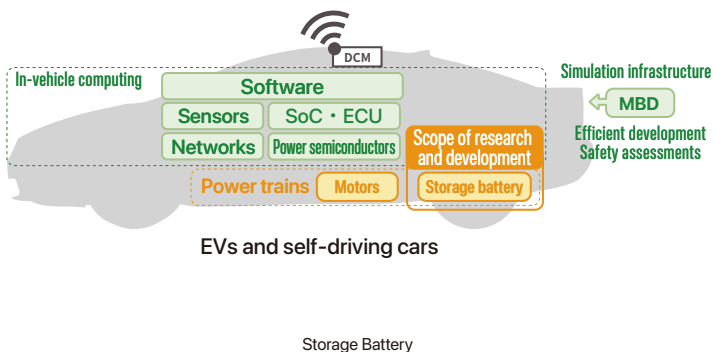
« Research & Development »

- Research and development of high-performance storage batteries and materials
- Development of technology for storage battery recycling
- Development of high-efficiency and high-power-density technologies for mobility-related motor systems

CO ₂ Reduction Effect (World)	Economic Effect (World)
In2040 Approximately 260 million tons/year	In2040 Approximately 62 trillion yen
In2050 Approximately 940 million tons/year	In2050 Approximately 182 trillion yen

Source : METI, R&D and Social Implementation Plan

R&D Targets under Project



Detailed information

<https://green-innovation.nedo.go.jp/en/project/development-next-generation-storage-batteries-next-generation-motors/>



Project period

Maximum of 9 years from FY2022 to FY2030

Department in charge

Storage Battery : Electricity Storage Technology Development Division,
Smart Community and Energy Systems Department

Motor System : Robot and Artificial Intelligence Technology Department

✉ gi_battery@ml.nedo.go.jp

✉ gi_motor@nedo.go.jp



Development of In-vehicle Computing and Simulation Technology for Energy Saving in Electric Vehicles

Budget
Up to
42
billion yen

Project Overview

As a comprehensive effort to reduce CO₂ emissions from the use of automobiles, it is expected that publicly implementing automated driving will lead to the prevention of traffic congestion and accidents that cause such congestion.

However, in-vehicle computing, which is required for automated driving, uses a significant amount of power, which can affect the driving time and distance of electric vehicles, and given the current technology, could be a bottleneck to widespread use of electric vehicles.

Therefore, in order to greatly improve the energy efficiency of in-vehicle computing (namely by reducing power consumption by 70% compared to current technology), this project will conduct R&D on improving the energy efficiency of automated driving software and sensor systems, which have a significant effect on power consumption.

At the same time, in order to strengthen the competitiveness of the entire supply chain, where development systems for electrification and automation need to be transformed, the project will develop a standard simulation model for electric vehicles overall that is compatible with automated driving.

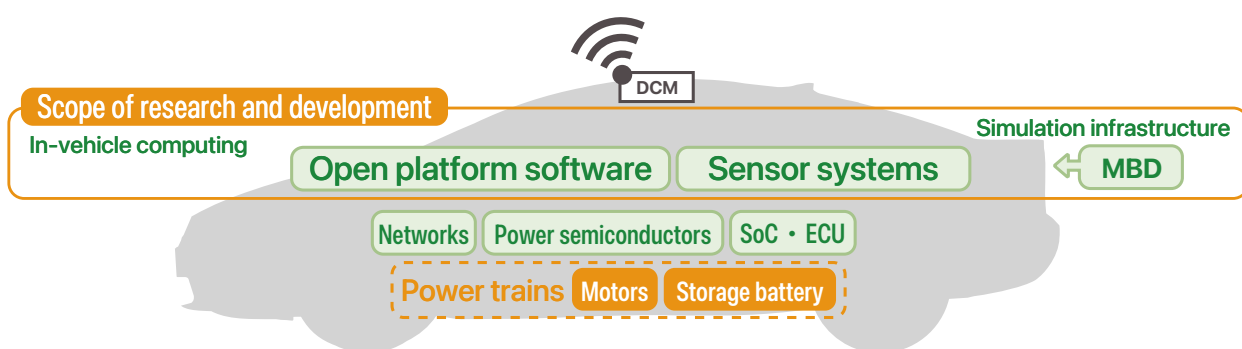
« Research & Development »

- Development of automated driving open platform software
- Development of automated driving sensor systems to realize high performance and low power consumption
- Development of electric vehicle simulation infrastructure

CO ₂ Reduction Effect (Japan)	Economic Effect (World)
In2030 Approximately 1.69 million tons/year	In2030 Approximately 43 trillion yen
In2050 Approximately 13.2 million tons/year	In2040 Approximately 148 trillion yen/year

Source : METI, R&D and Social Implementation Plan

R&D Targets under Project



EVs and self-driving cars

Detailed information <https://green-innovation.nedo.go.jp/en/project/in-vehicle-computing-simulation-technology/>



Project period Maximum of 9 years from FY2022 to FY2030

Department in charge Robot and Artificial Intelligence Technology Department [✉ gi_vehicle_computing@nedo.go.jp](mailto:gi_vehicle_computing@nedo.go.jp)



Smart Mobility Society Construction

Budget
Up to
113
billion yen

Project Overview

CO₂ emissions during the automobile use phase account for about 16% of total CO₂ emissions both in Japan and abroad, and in Japan, about 40% of these emissions come from vehicles intended for commercial use. Electrification for commercial vehicles, in addition to passenger cars, is also underway worldwide with the aim of curbing global warming.

As the commercial use of electric vehicles (EVs) expands, society will face issues including increased demand for electricity for recharging and increased social costs such as power grid reinforcement due to overlapping recharging timing. For transportation companies that own vehicles, there are concerns that recharging will reduce transportation efficiency and increase transportation business costs, such as the review of contracted electricity consumption and the installation and maintenance of related equipment. Therefore, it is necessary to manage operational planning and power demand in an integrated manner. In addition, the commercial use of fuel cell vehicles (FCVs) requires the optimal placement and administration of hydrogen stations, which are expensive to maintain.

Therefore, in order to reduce costs and optimize the operation of the entire social system that contributes to the spread and expansion of electric vehicles (EVs and FCVs), this project will build an

optimization simulation system for the entire society based on external data such as vehicle and driving data, energy consumption, infrastructure usage status, and maps [1].

In addition, we will conduct research and development involving a large-scale demonstration of commercial use of electric vehicles by multiple companies to collect the data necessary for this purpose and to realize operation management and integrated energy management to expand the introduction of electric vehicles on a transportation company-by-company basis [2].

« Research & Development »

- R&D for development of simulation model to promote widespread use of commercial EVs
- R&D for development of integrated energy/fleet management system to realize large-scale introduction of commercial EVs

CO₂ Reduction Effect (World)

In2040
Approximately **90** million tons/year

In2050
Approximately **260** million tons/year

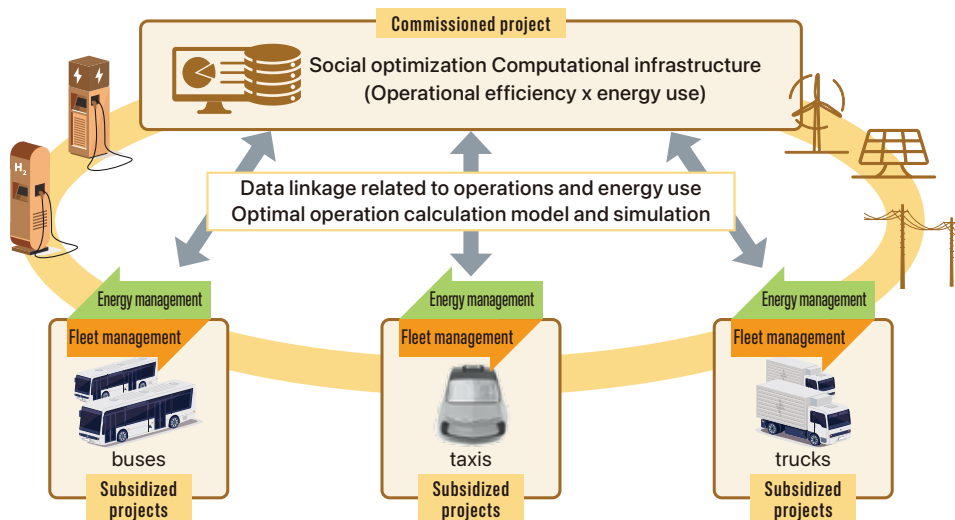
Economic Effect (World)

In2040
Approximately **2.6** trillion yen/year

In2050
Approximately **7.1** trillion yen/year

Source : METI • Ministry of Land, Infrastructure, Transport and Tourism (MLIT), R&D and Social Implementation Plan

[1] Development of simulation system to achieve global optimization of a society



[2] Research and development of energy management integrated with operation management for transportation companies

Detailed information

<https://green-innovation.nedo.go.jp/en/project/smart-mobility-society/>



Project period Maximum of 9 years from FY2022 to FY2030

Department in charge Energy Conservation Technology Department

✉ gi-smartmobility@nedo.go.jp



Next-generation Digital Infrastructure Construction

Budget
Up to
141
billion yen

Project Overview

Increasingly electrified and digitalized society can realize Carbon Neutrality in all fields including manufacturing, services, transportation, and infrastructure. Therefore, the semiconductor/information and communication industries, as a foundation for digitization and electrification, are the key to advancing green and digital initiatives at the same time.

In addition, Power semiconductors are used to control various electrical products related to everyday life, such as automobiles and industrial equipment, electric power generation and railways, and home appliances.

To realize a carbon-neutral society, the energy efficiency of such electric devices is extremely important. Demand is expected to increase with the development of electric and digital technologies in the following areas:

1. Medium-capacity electric vehicles,
2. Large-capacity renewable energy power generation systems, and
3. Power supplies for small-capacity data centers.

Moreover, data flows are increasing rapidly (at an annual rate of approximately 30%), resulting in a steady expansion in the market for

data center servers. Because of this rapid increase in large-scale data centers, power consumption for all data centers is expected to increase, and the current pace of technological evolution will not be able to keep pace with increases in power consumption.

The aim of this project, therefore, is by 2030 to: reduce the power loss of next-generation power semiconductors by more than 50%, reduce the cost of such semiconductors to a level similar to that of silicon(Si) power semiconductors, and improve data center efficiency by over 40%.

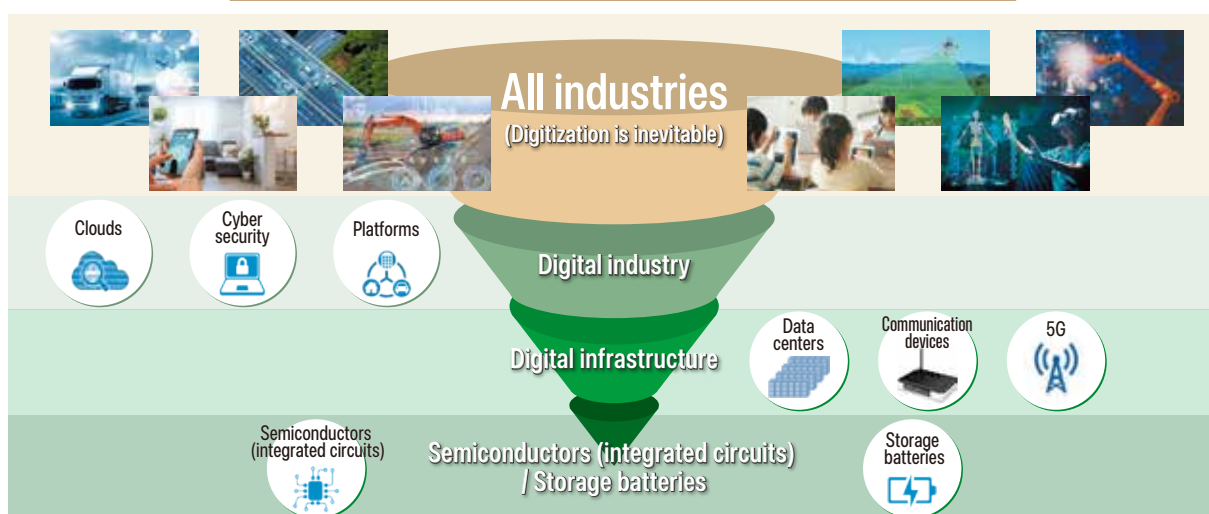
« Research & Development »

- Development of next-generation green power semiconductor technology
- Development of next-generation green data center technology

CO ₂ Reduction Effect (World)	Economic Effect (World)
In2030 Approximately 175.6 million tons/year	In2030 Approximately 19 trillion yen
In2050 Approximately 449 million tons/year	In2050 Approximately 88 trillion yen

Source : METI, R&D and Social Implementation Plan

Digital transformation/digitization forms basis of all industries: Need for the strategy for semiconductors and the digital industry



Detailed information

<https://green-innovation.nedo.go.jp/en/project/building-next-generation-digital-infrastructure/>



Project period Maximum of 10 years from FY2021 to FY2030

Department in charge Internet of Things Promotion Department gi-digital@ml.nedo.go.jp



Next-generation Aircraft Development

Budget
Up to
21.08
billion yen

Project Overview

Although the COVID-19 pandemic has caused a global downturn in the aircraft industry, the International Air Transport Association (IATA) expects demand for air travel to recover to 2019 levels by 2024, and then, due to economic growth in emerging countries, continue sustainable annual growth levels of approximately 4%. In this context, the aircraft industry can still be considered a growth industry.

The International Civil Aviation Organization (ICAO) has adopted a goal of no increase in CO₂ emissions from international aviation after 2020, and, as the demand for carbon-neutral solutions rapidly increases, is carrying out technology development related to weight reduction and efficiency improvement of aircraft bodies and engines, mainly through European and U.S. aircraft manufacturers. Furthermore, since Airbus announced its intent to launch a "carbon-neutral aircraft" in 2035 that uses hydrogen fuel and fuel cells, the competition for developing hydrogen aircraft has intensified.

The aim of this project, therefore, is to promote the development of core technologies for hydrogen aircraft, as well as technologies for

dramatically lighter primary structural components with complex shapes necessary for next-generation aircraft. Through this project, the global movement toward carbon neutrality is considered an opportunity to strengthen the competitiveness of Japan's aircraft industry. By leveraging Japan's strengths in core technologies for hydrogen and materials, the aim of the project is also to improve Japan's level of participation (currently about 20 to 30%) in joint international aircraft development projects.

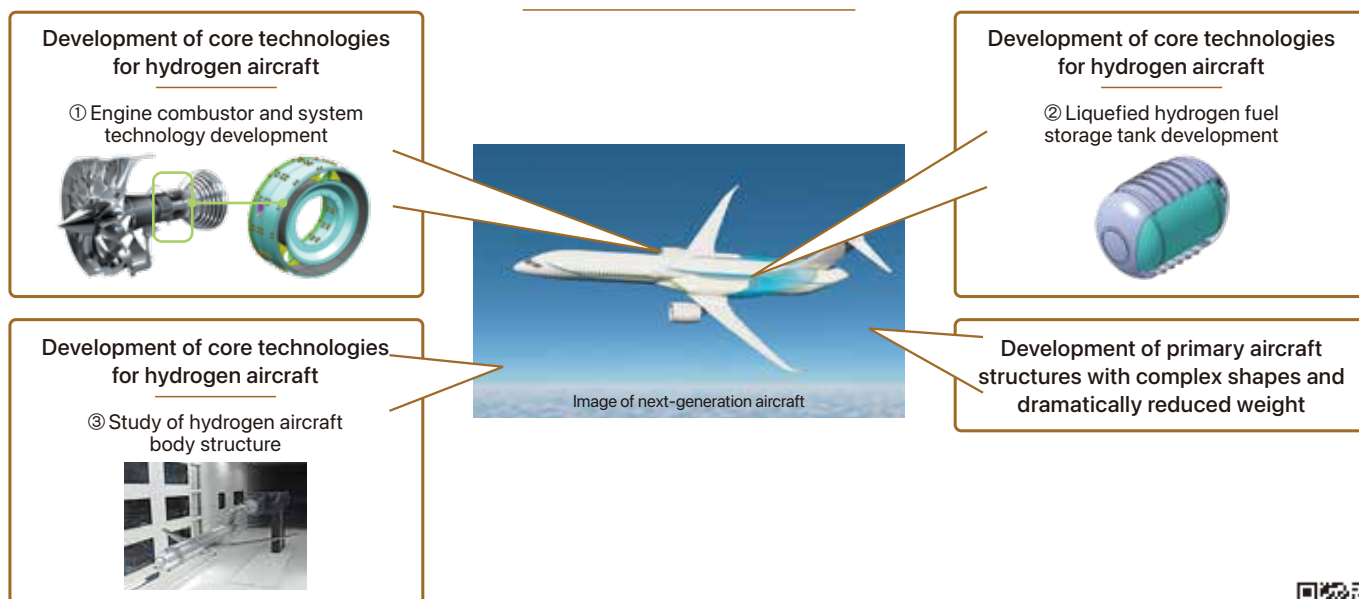
« Research & Development »

- Development of core technologies for hydrogen aircraft
- Development of primary aircraft structures with complex shapes and dramatically reduced weight

CO ₂ Reduction Effect (World)	Economic Effect (World)
In2050 Approximately 390 million tons/year	In2050 Approximately 1.2 trillion yen/year

Source: METI, R&D and Social Implementation Plan

R&D targets under project



Detailed information

<https://green-innovation.nedo.go.jp/en/project/development-next-generation-aircraft/>



Project period

Maximum of 10 years from FY2021 to FY2030

Department in charge

Materials Technology and Nanotechnology Department

✉ gi-aircraft@nedo.go.jp



Next-generation Ship Development

Budget
Up to
35
billion yen

Project Overview

As of 2018, international shipping accounts for approximately 2.1% of global CO₂ emissions. Since the global economy is growing, demand for shipping is expected to continue increasing and, if no action is taken, CO₂ emissions from the shipping sector will also continue to increase.

To achieve carbon neutrality in the shipping sector, it is essential to move away from existing heavy fuel oil to gas fuels such as hydrogen, ammonia, and clean methane from recycled carbon dioxide. It is also necessary to develop shipping products that utilize hydrogen and ammonia as fuels and reduce methane slip on vessels fueled by LNG that contains clean methane from recycled carbon dioxide.

With the goal of realizing zero-emission ships by 2050, under this project, engines, fuel tanks, and fuel supply systems will be developed for ships using hydrogen and ammonia fuels and carry out demonstration operations using actual ships. Technology will also be developed to

prevent methane slip, an important challenge for using LNG-fueled ships. The project ultimately aims to strengthen the international competitiveness of Japan's shipping-related industries, and promote social implementation in conjunction with the shipping industry.

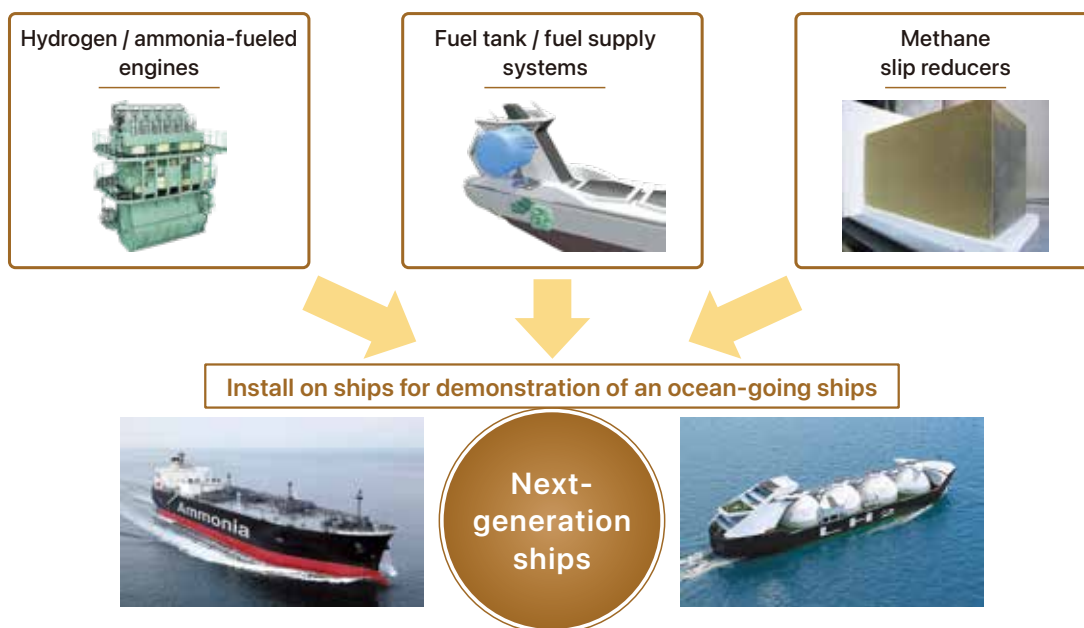
« Research & Development »

- Development of hydrogen-fueled ships
- Development of ammonia-fueled ships
- Preventing methane slip on LNG-fueled ships

CO ₂ Reduction Effect (World)	Economic Effect (World)
In2030 Approximately 0.33 million tons/year	In2030 Approximately 0.17 trillion yen
In2050 Approximately 560 million tons/year	In2050 Approximately 6.8 trillion yen

Source : MLIT, R&D and Social Implementation Plan

Aiming for conversion from heavy fuel oil to low- and zero-carbon fuels such as hydrogen, ammonia, and LNG fuel



Detailed information <https://green-innovation.nedo.go.jp/en/project/development-next-generation-vessels/>



Project period Maximum of 10 years from FY2021 to FY2030

Department in charge Frontier and Moonshot Technology Department [✉ gi-ship-kobo@nedo.go.jp](mailto:gi-ship-kobo@nedo.go.jp)



Development of Negative Emissions Technologies in Agriculture, Forestry, and Fisheries Industries

Budget
Up to
15.92
billion yen

Project Overview

Industries in the food, agriculture, forestry, and fisheries sector are expected to play multiple roles, including the provision of stable supplies of high-quality food, replenishment of the atmosphere and water sources, and promotion of biodiversity conservation through the appropriate management and conservation of croplands, forests, and oceans. Moreover, the amount of greenhouse gases captured and stored in areas such as croplands and forests reached 44.5 million tons in FY2020.

With a view to achieving carbon neutrality by 2050, the Ministry of Agriculture, Forestry and Fisheries formulated its "Strategy for Sustainable Food Systems," known as MeaDRI (Measures for Achievement of Decarbonization and Resilience with Innovation) in May 2021. This strategy clarifies Japanese government policies intended to accelerate R&D and the commercialization of technologies, including those that; promote the use of biochar to capture and store carbon on croplands, promote the use of wood-based materials for the construction of high-rise buildings, and promote the use of seaweed beds to capture and store CO₂ (the latter being an example of the "blue carbon" concept).

In this project, which focuses on the development of promising negative emissions technologies for CO₂ capture and storage anticipated in the agriculture, forestry and fisheries industries, emphasis will be placed on the promotion of ambitious R&D efforts that go beyond conventional ideas and technical limitations, targeting impactful issues that will lead to the creation of future growth industries.

« Research & Development »

- Development of technologies to realize and effectively utilize high-functional biochar and other materials
- Development of wood-based large-scale isotropic cross-sectional structural members for the construction of high-rise buildings and other structures
- Development of technologies for constructing seaweed beds in support of blue carbon efforts

CO ₂ Reduction Effect		Economic Effect	
In2030	(Japan)	In2030	(Japan)
Approximately 0.53 million tons/year		Approximately 54.4 billion yen/year	
In2050	(World)	In2050	(World)
Approximately 46.61 million tons/year		Approximately 2.0 trillion yen/year	

Source : Ministry of Agriculture, Forestry and Fisheries, R&D and Social Implementation Plan

R&D contents tackled in this project

Cropland carbon storage using High-functional biochar

Biochar + Effective microorganisms for aiding supply of fertilizer constituents and promoting growth → High functional biochar

New engineered wood for urban carbon storage

Characteristics of conventional wood-based materials: Strong orientation, Weak orientation → Isotropic large-scale cross-sectional structural members: Strong in both orientations → Buildings constructed with wood-based materials

Promotion of blue carbon

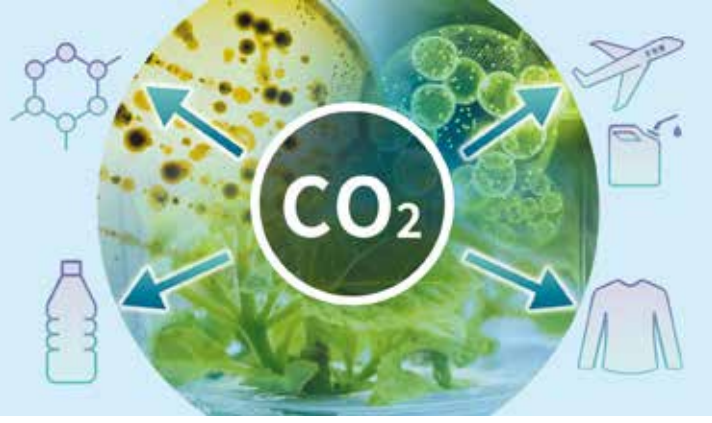
Base blocks for seaweed farming, Seaweed transplant cartridges → Seaweed beds in the ocean

Detailed information <https://green-innovation.nedo.go.jp/en/project/development-co2-agriculture-forestry-fisheries-industries/>



Project period Maximum of 9 years from FY2022 to FY2030

Department in charge Frontier and Moonshot Technology Department gi-agri@nedo.go.jp



Promotion of Carbon Recycling Using CO₂ from Biomanufacturing Technology as a Direct Raw Material

Budget
Up to
176.7
billion yen

Project Overview

Since carbon recycling that leverages biomanufacturing technology can be expected to greatly improve productivity in the future due to the application of cutting-edge bio technologies such as genome editing and genome construction, it is a viable option for helping realize a carbon neutral society.

Biomanufacturing refers to activities for producing chemicals used in bioplastics, functional materials, fuels, and foods (such as protein and livestock feed) using CO₂ recovered from biomass resources and the atmosphere as a raw material. In the industrial sector in Japan, biomanufacturing-related industries such as chemicals, textiles, and food/beverages discharge 89.017 million tons of CO₂ per year, and biomanufacturing technologies can be expected to help reduce CO₂ emissions.

Through promoting joint development efforts between microorganism modification platform businesses, who play a central role in biomanufacturing, and businesses in a variety of fields such as innovative materials and fuels, this project aims to nurture and strengthen operating companies that will drive large-scale fermentation and biomanufacturing production. Moreover, by leveraging the technologies of platform businesses related to the highly efficient development of microorganisms, the inherent capacity of microorganisms to fixate CO₂ will be fully maximized with

a view to resolving technical issues and promoting carbon recycling through biomanufacturing that uses CO₂ as a raw material. In addition, by constructing a value chain ranging from the supply of CO₂ raw materials to the manufacturing of products, and by promoting upscaled commercial production and more sophisticated manufacturing technologies, the project aims to realize both the social application of new biomanufacturing products made from CO₂ raw materials and the structural transformation of the industrial sector through carbon recycling.

« Research & Development »

- Sophistication of microorganisms and modification of platform technologies for accelerating the development of useful microorganisms
- Development and enhancement of microorganisms that can produce materials using CO₂ as raw material
- Development and demonstration of technologies using microorganisms that can produce materials using CO₂ as raw material

CO₂ Reduction Effect (World)

In2040
Approximately **1.35** billion tons/year

In2050
Approximately **4.21** billion tons/year

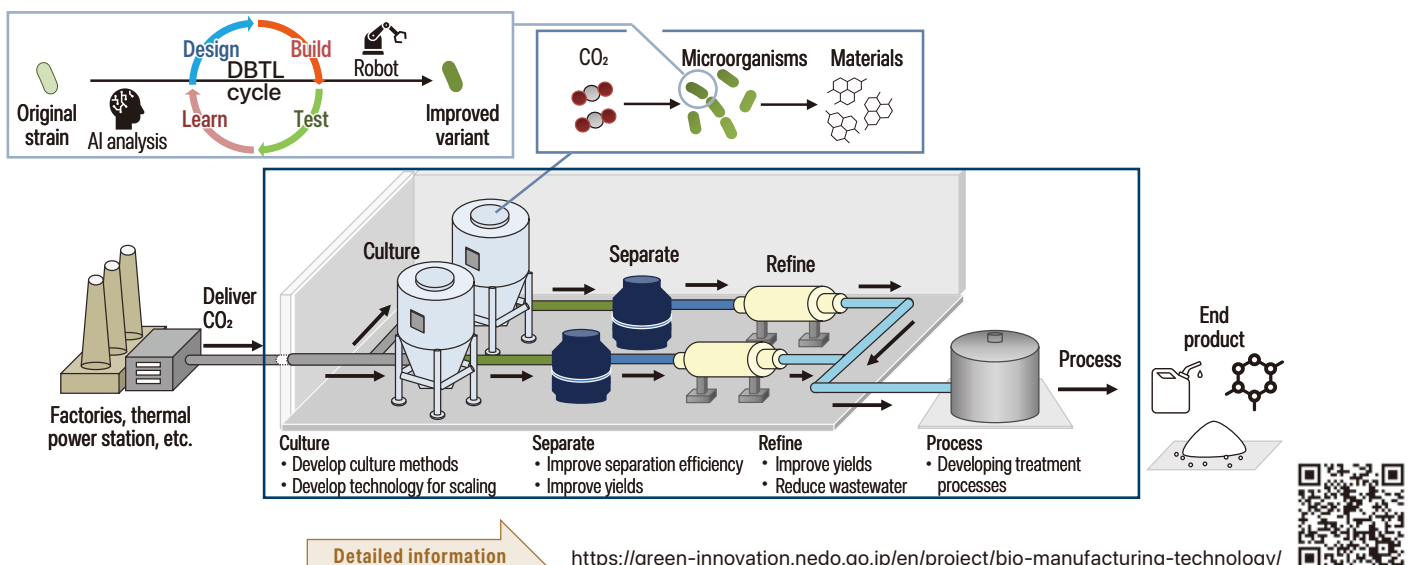
Economic Effect (World)

In2040
Approximately **65.4** trillion yen/year

In2050
Approximately **199.4** trillion yen/year

Source: METI, R&D and Social Implementation Plan

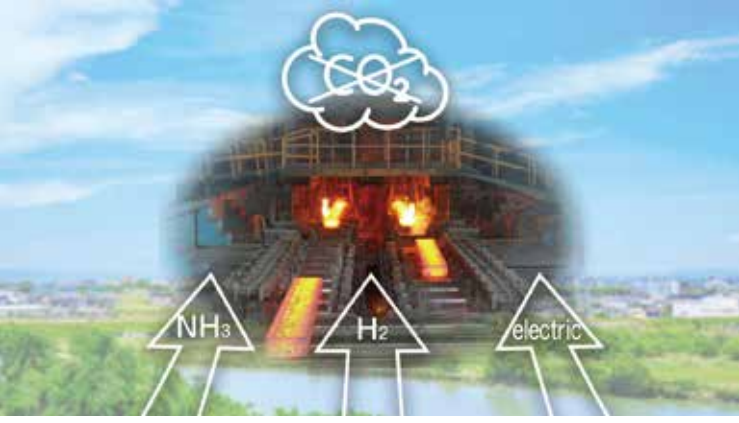
Manufacturing Flow of Products based on Microorganisms Using CO₂ as a Raw Material



Project period Maximum of 9 years from FY2022 to FY2030

Department in charge Bioeconomy Promotion Division, Materials Technology and Nanotechnology Department

✉ gi_bio@ml.nedo.go.jp



Decarbonization of thermal processes in manufacturing

Budget
Up to
32.51
billion yen

Project Overview

The production industry accounts for about 30% of the CO₂ emissions of Japanese industry, and since a large amount of CO₂ is emitted from industrial furnaces used in the thermal process of heating metals, the decarbonization of thermal processes in manufacturing is an urgent issue.

Industrial furnaces used for thermal processes include "combustion furnaces," which heat by burning fuel, and "electric furnaces," which heat by electricity.

Combustion furnaces are fueled by natural gas and other fossil fuels, and the use of ammonia and hydrogen, which do not emit CO₂ during combustion, is promising for decarbonization, but the challenge is to establish combustion technologies that achieve combustion stability and NO_x reduction, while suppressing chemical changes such as nitriding and hydrogen embrittlement in metal products.

On the other hand, electric furnaces, which do not emit CO₂ when used, are a promising option for decarbonization, but there are some issues to be solved, such as the need for a special high-voltage power contract and installation of power receiving equipment when transitioning from combustion furnaces to electric furnaces.

Given the economics, efficiency, and characteristics of electric

furnaces, it is important to establish a combustion furnace option as well.

This project will develop technologies for combustion furnaces compatible with ammonia and hydrogen fuels, etc., and for minimizing and increasing the efficiency of electric furnace receiving capacity, which is essential for promoting the transition from combustion to electric furnaces, with a view to establishing a supply base for zero-emission fuels in the future.

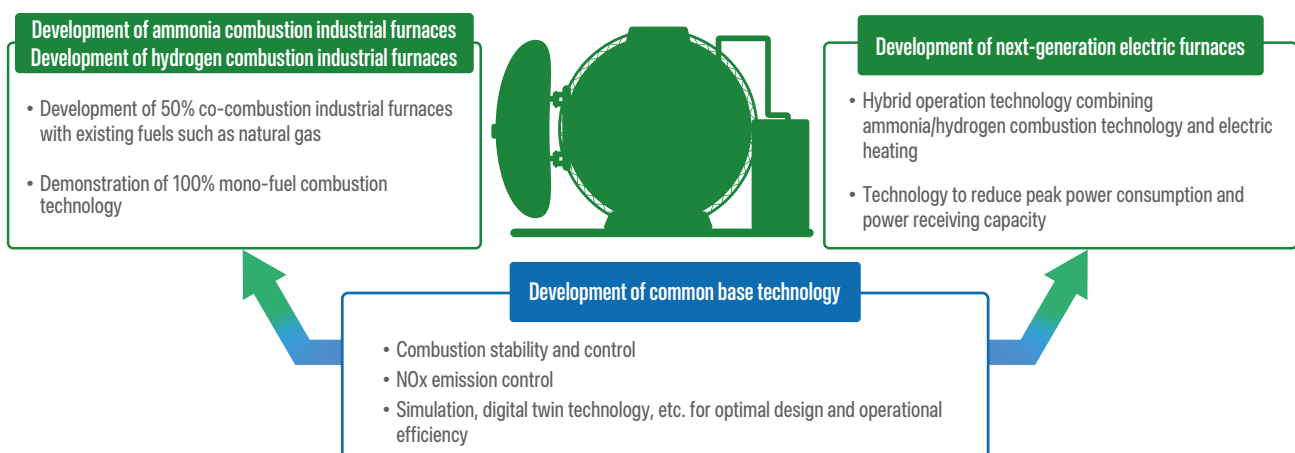
« Research & Development »

- Establishment of ammonia and hydrogen combustion industrial furnace technology for handling metal products
- Establishment of technology to reduce the capacity of electric furnace receiving equipment and increase efficiency

CO ₂ Reduction Effect (Japan)	Economic Effect (World)
In2040 Approximately 0.02 billion tons/year	In2040 Approximately 4.2 trillion yen (Total up to 2040)
In2050 Approximately 0.08 billion tons/year	In2050 Approximately 10.0 trillion yen (Total up to 2050)

Source: METI, R&D and Social Implementation Plan

Development of industrial furnaces that handle carbon-neutral compatible metal products



Detailed information <https://green-innovation.nedo.go.jp/en/project/thermal-processes-in-manufacturing/>



Project period Maximum of 9 years from FY2023 to FY2031


Department in charge Energy Conservation Technology Department [✉ gi-thermal-process@ml.nedo.go.jp](mailto:gi-thermal-process@ml.nedo.go.jp)

Outreach Initiatives Related to Green Innovation Fund Projects


Dedicated Website

A dedicated website has been established to provide information to the public regarding the Green Innovation Fund Projects. In addition to introducing Green Innovation Fund Projects through management interview video, special reports, and project updates, information related to relevant industries and technologies is provided using a dashboard format.

Video





Project information




Special reports

(Only available in Japanese)






<https://green-innovation.nedo.go.jp/en/>



Dashboard



Public Symposium

The Nikkei SDGs forum special symposium "Toward a carbon-neutral future with the Green Innovation Fund" was held.

The Ministry of Economy, Trade and Industry (METI), NEDO, and Nikkei Inc. hosted the Nikkei SDGs forum special symposium "Toward a carbon-neutral future with the Green Innovation Fund" in February 2023.

The symposium showcased government initiatives, including the Green Innovation Fund Projects, as well as the challenges posed by companies and others with ambitious program targets. In the panel discussion, the panelists discussed industry-academia-government-finance initiatives and collaboration, maximizing the results of the Green Innovation Fund Projects, and realizing social implementation at an early date.



Inquiries

- For general inquiries related to Green Innovation Fund Projects, please contact the NEDO Green Innovation Fund Projects Coordination Office

NEDO Green Innovation Fund Projects Supervision Office

✉ green-innovation@nedo.go.jp

- Implementation contents, etc. of each project in the Green Innovation Fund Projects concerning the system

For inquiries related to the implementation of specific Green Innovation Fund Projects, please contact the NEDO department responsible for project implementation.

- Other Inquiries

https://qasys.nedo.go.jp/webapp/form/13394_evt_7/index.do

Inquiries on other NEDO activities may be submitted via the inquiries page on our website.

(Inquiries may be submitted at any time, however, please allow time for NEDO to respond during regular business hours)



NEDO's SNS

NEDO regularly releases information to the public regarding our activities via news releases, public solicitations, event-related announcements, and other types of communication.

Twitter



Facebook



Only available in Japanese

NEDO also provides regular updates on social media platforms regarding Green Innovation Fund Projects so please follow us on Facebook, Twitter, and YouTube.

#NEDO

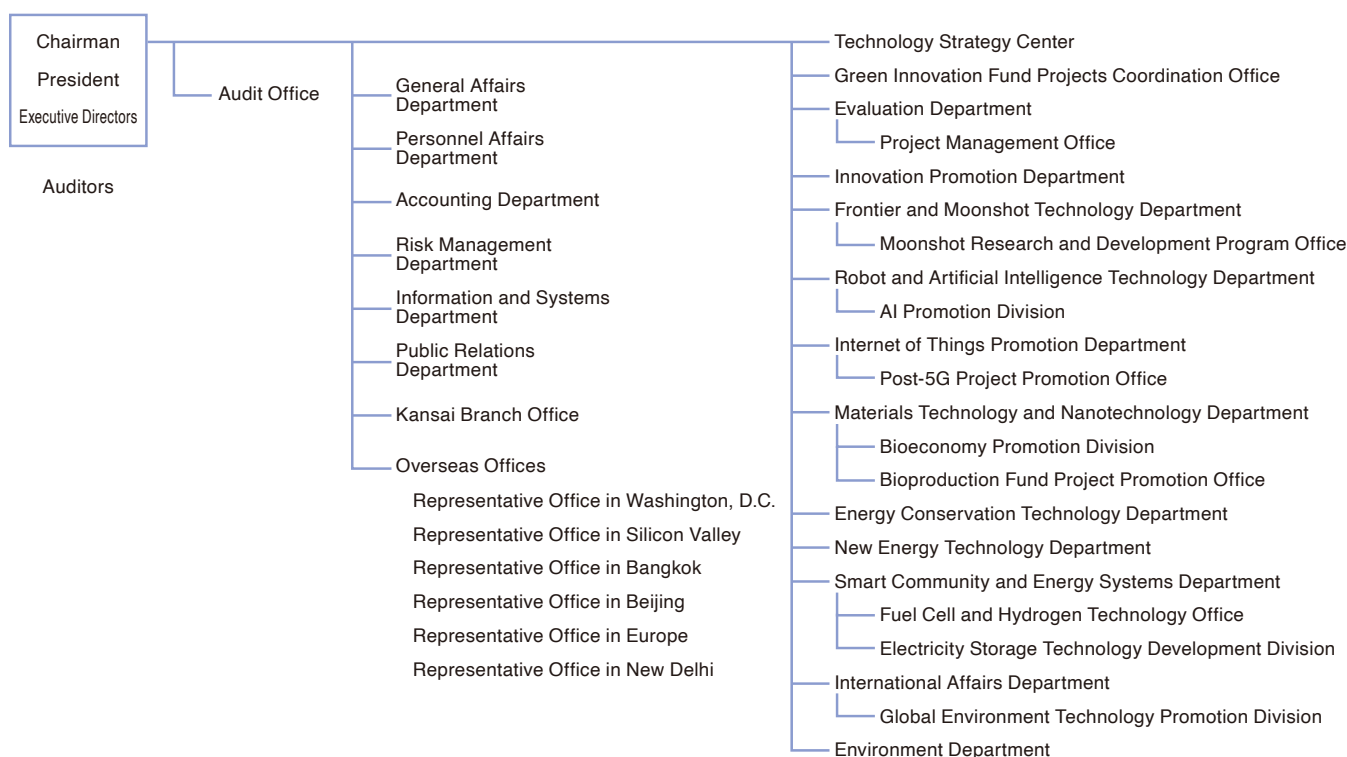
#Green Innovation Fund Projects

Background Information

Designation	National Research and Development Agency New Energy and Industrial Technology Development Organization (NEDO) Business name: New Energy and Industrial Technology Development Organization (NEDO)
Foundation	Originally established on October 1, 1980; reorganized as an incorporated administrative agency on October 1, 2003
Purpose	The purpose of NEDO is to enhance industrial technology and promote commercialization by comprehensively performing functions such as: promoting research and development (R&D) carried out using skills from the private sector; promoting R&D carried out by the private sector with regard to technology for non-fossil energies, combustible natural gas, and coal; promoting the technology required for the rational use of energy and technology in mining and industry; and promoting the utilization of such technology in cooperation with the international community; to thereby contribute to ensuring a stable and efficient energy supply in accordance with the changes in the domestic and foreign economic and social environments and to the development of the economy and industry.
Details of Major Operations	Operations relating to technology development management (national projects and practical application promotion activities)
Minister in Charge	Minister of Economy, Trade and Industry
Governing Laws	Act on General Rules for Incorporated Administrative Agencies Act on the New Energy and Industrial Technology Development Organization
Personnel	1,464 (as of April 1, 2023)
Budget	Approximately 152.8 billion yen (initial budget for FY 2023) *In addition to the above, fund projects and other activities will be implemented.
Executives	Chairman Mr. SAITO Tamotsu President Mr.YOKOSHIMA Naohiko Executive Directors Mr.YOSHIOKA Masatsugu, Dr. YUMITORI Shuji, Mr.NISHIMURA Tomoyasu, Mr.HAYASHI Shigekazu, Dr.IIMURA Akiko Auditors Mr.YABUTA Keisuke, Mr. FUKUSHIMA Michi

(as of October 1, 2023)

Organization



(as of July 1, 2023)



Domestic Offices

● **Head Office**

MUZA Kawasaki Central Tower
1310 Omiya-cho, Saiwai-ku
Kawasaki City, Kanagawa 212-8554 Japan
Tel: +81-44-520-5100
Fax: +81-44-520-5103

● **Kansai Branch Office**

9th Floor, Knowledge Capital Tower C Grand Front Osaka
3-1 Ofuka-cho, Kita-ku, Osaka 530-0011 Japan
Tel: +81-6-4965-2130
Fax: +81-6-4965-2131

Overseas Offices

● **Washington, D.C.**

1717 H Street, NW, Suite 815
Washington, D.C. 20006, U.S.A.
Tel: +1-202-822-9298
Fax: +1-202-733-3533

● **Europe**

10, rue de la Paix 75002
Paris, France
Tel: +33-1-4450-1828
Fax: +33-1-4450-1829

● **Beijing**

2001 Chang Fu Gong Office Building
Jia-26, Jian Guo Men Wai Street
Beijing 100022, P.R. China
Tel: +86-10-6526-3510
Fax: +86-10-6526-3513

● **Silicon Valley**

3945 Freedom Circle, Suite 790
Santa Clara, CA 95054 U.S.A.
Tel: +1-408-567-8033

● **New Delhi**

15th Floor, Hindustan Times House
18-20 Kasturba Gandhi Marg
Connaught Place
New Delhi 110 001, India
Tel: +91-11-4351-0101
Fax: +91-11-4351-0102

● **Bangkok**

8th Floor, Sindhorn Building Tower 2
130-132 Wittayu Road, Lumpini
Pathumwan
Bangkok 10330, Thailand
Tel: +66-2-256-6725
Fax: +66-2-256-6727