NEDO

New Energy and Industrial Technology Development Organization

Protect Environment, Create Future

Renewable Energy

Small Hydro Power

Solar Power

Biomass

Wind Power

Geothermal

Renewable Heat

Booth number 7E-24

New Energy and Industrial Technology Development Organization

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About NEDO

- NEDO is a national research and development agency that creates innovation by promoting technological development necessary for realization of a sustainable society.
- NEDO acts as an innovation accelerator to contribute to the resolution of social issues by developing and demonstrating high-risk innovative technologies having practical application.

NEDO's Missions

Addressing energy and global environmental problems

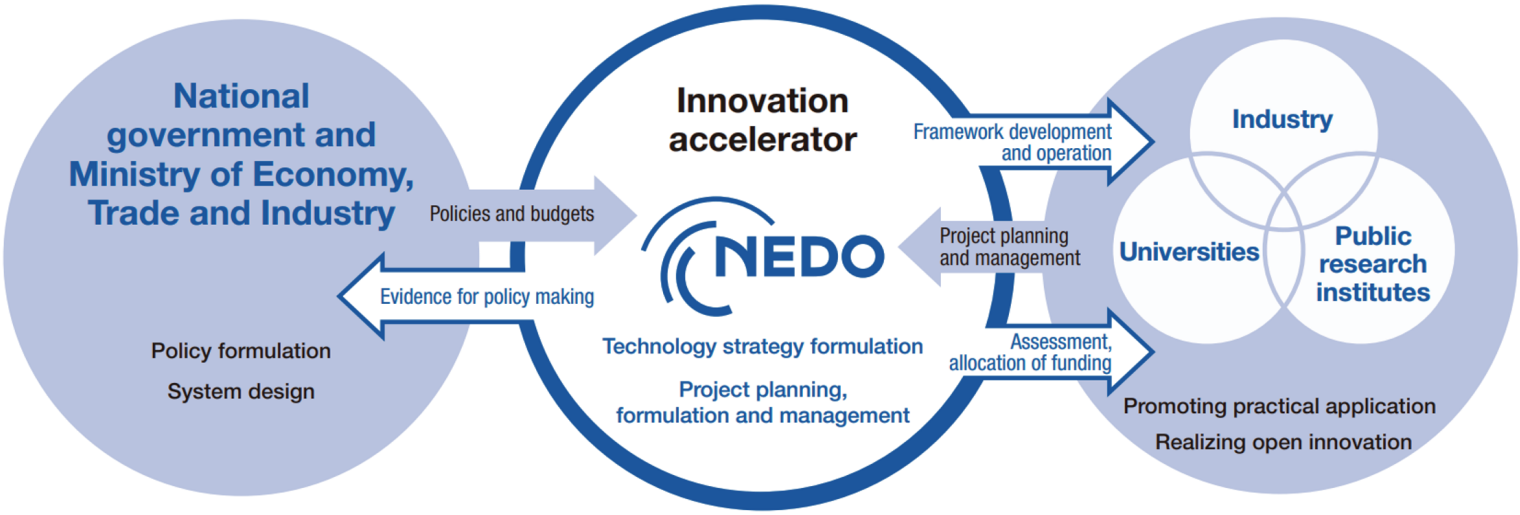
NEDO actively undertakes the development of new energy and energy conservation technologies. It also conducts research to verify technical results. Through these efforts, NEDO promotes greater utilization of new energy and improved energy conservation. NEDO also contributes to a stable energy supply and the resolution of global environmental problems by promoting the demonstration of new energy, energy conservation, and environmental technologies abroad based on the knowledge obtained from domestic projects.

Enhancing industrial technology

With the aim of raising the level of industrial technology, NEDO pursues research and development of advanced new technology. Drawing on its considerable management expertise, NEDO carries out projects to explore future technology seeds as well as mid- to long-term projects that form the basis of industrial development. It also supports research related to practical application.

Positioning of NEDO as an Innovation Accelerator

In order to contribute to the resolution of social issues, NEDO formulates technology strategies and project plans and, as part of its project management, establishes project implementation frameworks by combining the capabilities of industry, academia, and government. NEDO also promotes technology development by carrying out, evaluating, and allocating funding to promising projects to accelerate the practical application of project results.



NEDO History

In the 1970s, the world experienced two oil crises. To improve Japan’ s energy diversification, NEDO was established in 1980 to help usher in energy conservation and new energy technologies. In 1988, NEDO added research and development of industrial technology to its activities. Today, it uses its role as a research and development management organization to boost innovation and promote research and development on energy, environmental technology, and industrial technology.

1974 Long-term Sunshine Project aimed at developing new energy technologies started
1978 Long-term Moonlight Project aimed at developing energy conservation technologies started
1980 **New Energy Development Organization established**
1988 **Research and development on industrial technology added. Name changed to New Energy and Industrial Technology Development Organization (NEDO)**
1993 New Sunshine Project started
1996 Integration with Coal Mine Damage Agency. Coal mine damage compensation program added.
2003 **Incorporated Administrative Agency New Energy and Industrial Technology Development Organization established under the Act on the New Energy and Industrial Technology Development Organization**
2006 Kyoto Mechanisms Credit Acquisition Program added
2007 Transitional operations related to coal mine damage recovery completed
2012 Coal and geothermal operations transferred to Japan Oil, Gas and Metals National Corporation
2014 Technology Strategy Center established
2015 **Status changed from incorporated administrative agency to national research and development agency**
2016 Kyoto Mechanisms Credit Acquisition Program discontinued
2021 Green Innovation Fund Projects started

1986
Experiments on a large-scale grid-connected photovoltaic power system started for the first time on Rokko Island in Hyogo Prefecture

1998
Development started on underlying optical disc technologies that later led to Blu-ray discs

2012
Commercial model demonstration hydrogen station constructed

2024 is the 50th anniversary of the Sunshine Project

In response to the first oil crisis in 1973, the “Sunshine Project ” was formulated in 1974 as a research and development plan for “new energy (alternative energy for oil)” technologies in order to mitigate the excessive dependence on oil and solve environmental problems escalated in the energy-intensive society. The Sunshine Project is the first long-term and comprehensive research and development project for new energy technologies in Japan and played a pioneering role in the global development of new energy technologies not limited to Japan.
In 1978, the long-term project “Moonlight project ” for energy-conservation technologies was also started. In 1993, these two plans were integrated into the “New Sunshine Project .”” Since its establishment in 1980, NEDO has been promoting technology development projects for renewable energy which has been important alternative for oil, according to the two energy project .

Green Innovation Fund Projects

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.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 Neutralityin 2050.” 2 trillion yen* fund has been established at NEDO in March 2021 to launch the Green

*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 July2023).

Field of Green Power Promotion, etc.

Cost Reductions for Offshore Wind Power Generation

Development of elemental technologies (wind turbine components, floating bodies, cables, etc.) for reducing the cost of floating offshore wind power generation, and operation.

Development of Next-Generation Solar Cells

Development and demonstration for reducing the cost of next-generation solar cells that can be installed on walls, etc., including perovskite solar cells.

Development of CO_2 Reduction Technology for Waste Treatment

Development and demonstration of raw material and fuel conversion technologies by incineration + CCUS, thermal decomposition, methane fermentation + biomethanation+fuel,etc.

Field of Energy Structure Transformation

Large-scale Hydrogen Supply Chain Establishment

Development and demonstration of technologies related to production, transportation, storage, power generation, etc. for expanding hydrogen supply capacity and reducing costs.

Hydrogen Production through Water Electrolysis Using Power from Renewables

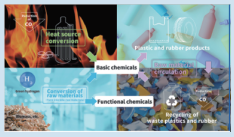
Development and demonstration for reducing the cost of water electrolysis equipment that produces hydrogen.

Hydrogen Utilization in Iron and Steelmaking Processes

Development and demonstration of steelmaking technology that uses hydrogen instead of coal (hydrogen reduction steelmaking technology).

Fuel Ammonia Supply Chain Establishment

Development and demonstration of technologies related to production, transportation, storage, power generation, etc. for expanding ammonia supply capacity and reducing costs.



Development of Technology for Producing Raw Materials for Plastics Using CO_2 and Other Sources

Development of technology to produce plastic materials from CO_2, waste plastic, waste rubber, etc.

Development of Technology for Producing Fuel Using CO_2, etc.

Development of technology to produce fuels for automobiles and jets, gases for household and industrial use, etc. using CO_2, etc.

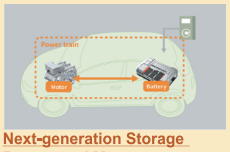
Development of Technology for Producing Concrete and Cement Using CO_2

Development for reducing the cost and improving the durability of concrete made by absorbing CO_2.

Development of Technology for CO_2 Separation, Capture, etc.

Development of various technological methods for separating/capturing CO_2 in accordance with the scale and concentration of CO_2 emissions through comparative studies.

Field of Industry Structure Transformation



Next-generation Storage Battery and Motor Development

Development of parts/materials, production processes, and recycling technologies for storage batteries and motors required for electric vehicles, drones, agricultural machinery, etc.

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

Development of in-vehicle computing and simulation technology for light vehicles and commercial vehicles, and business transformation of suppliers, etc.

Smart Mobility Society Construction

Development and demonstration of a system that conducts operational management and integrated energy management for electric and fuel cell vehicles to promote of Electrification of Commercial vehicles.

Next-generation Digital Infrastructure Construction

Development of technologies for energy saving of data centers and power semiconductors.

Next-generation Aircraft Development

Development of elemental technologies such as engines, fuel tanks, and fuel supply systems required for hydrogen-powered aircraft.

Next-generation Ship Development

Development of elemental technologies such as engines, fuel tanks, and fuel supply systems required for hydrogen-fueled ships and ammonia-fueled ships.

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

Development of CO_2 reduction and absorption technologies with promising marketability in the agriculture, forestry and fisheries sectors.

Promotion of Carbon Recycling Using CO_2 from Biomanufacturing Technology as a Direct Raw Material

Development of microorganisms that absorb a large amount of CO_2 and its fermentation production technology.

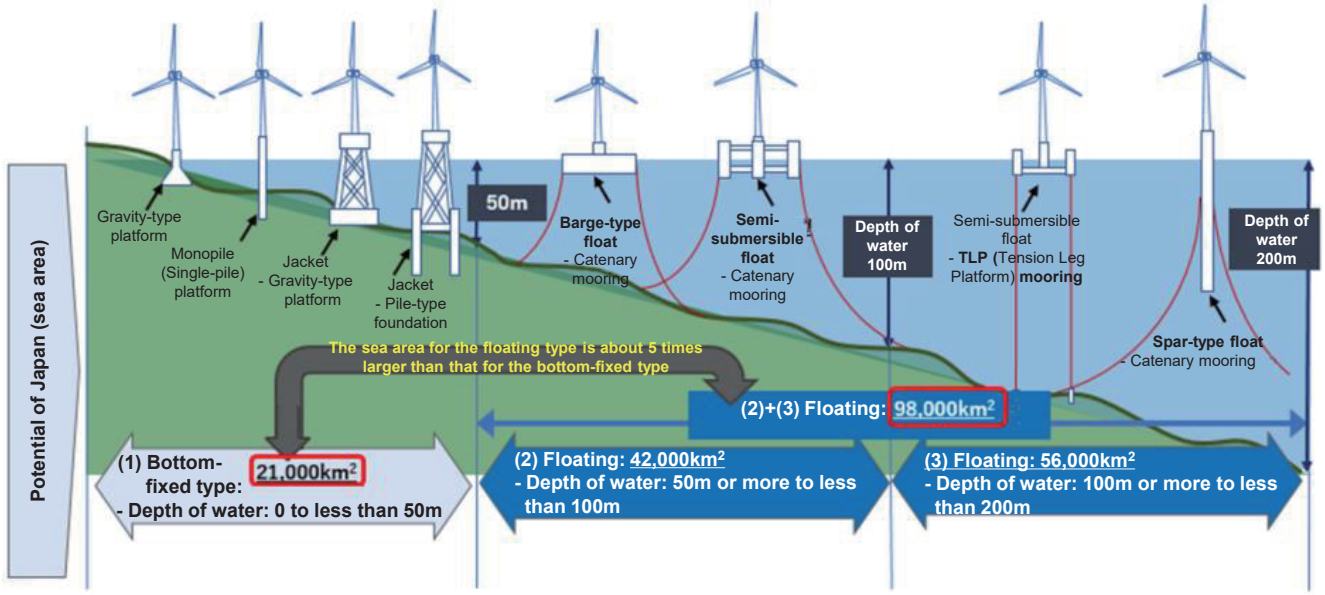
Decarbonization of Thermal Processes in Manufacturing

Development for decarbonization of thermal processes in industrial furnaces.

Overview of offshore wind power

Environment surrounding offshore wind power generation in Japan

The wind power generation market has been expanding rapidly worldwide; especially in Japan, which is surrounded by sea, the introduction of offshore wind power generation is expected to be encouraged. The enactment of the "Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities (Act on the Utilization of Sea Areas for Renewable Energy)" in 2019, and the setting of specific public-private goals by "2050 Carbon Neutrality Declaration" announced by the government in 2020, and "Vision for Offshore Wind Industry Vision（1st）" announced by the "Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation" are expected to encourage further expansion of the introduction of offshore wind power generation, especially floating offshore wind power generation.



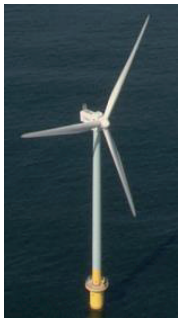
Note 1) The sea area is estimated assuming that the distance from the shore is less than 30 km, there is no social constraint, and the annual average wind speed is 7 m/s or higher.
Note 2) The position of the floating type in the figure is not the applicable range or the optimal depth of water

▲Types of offshore wind power generation

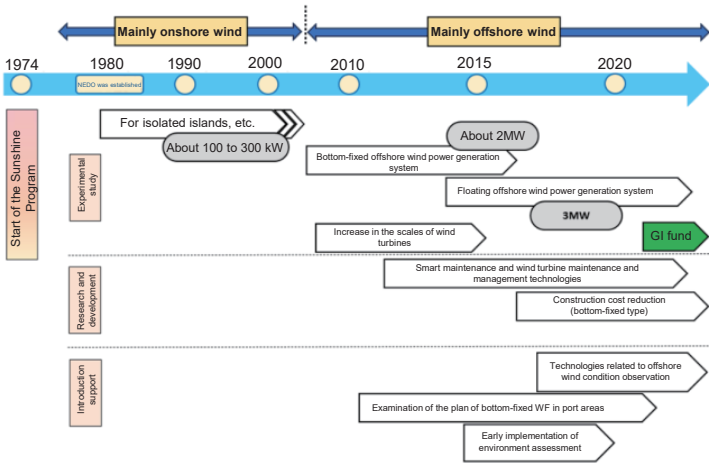
NEDO's initiatives

For further expand prevalence of offshore wind power, NEDO is conducting research and development of offshore wind power generation technologies adapted to the severe weather conditions in Japan, and projects to support the introduction of offshore wind power. NEDO will further promote the development of low-cost technologies for offshore wind power generation, aiming to reduce the cost of power generation and reinforce the competitiveness of the industrial competitiveness.
In FY2021, NEDO launched the project for "Cost Reduction of Offshore Wind Power Generation" within the green innovation fund project, and firstly started the development of element technologies in the fields of "wind turbines," "manufacturing and installation of floating platforms," "electric systems," and "operation and maintenance."

◂100kW wind turbine installed on Miyake Island in the early 1980s



Bottom-fixed offshore wind power generation facility (off the coast of Choshi)▸



Project Highlights (1)
-Demonstration Project of Next-Generation Offshore Floating Wind Turbine(Barge-type)-

Demonstration of floating offshore wind power generation for cost reduction off the coast of Kitakyushu

NEDO is proceeding with a demonstration project to establish the technology for the Barge-type steel floating wind power generation system, which can be installed in a relatively shallow area for the floating system with a depth of water of about 50m.

The design, fabrication, etc. of the demonstration system started in FY2016, and the demonstration operation started in May 2019. During the demonstration operation, the on-site performance verification of the demonstration system, the development of efficient maintenance and management methods, etc. are performed to establish low-cost and compact floating offshore wind power generation system technology.

▲Demonstration system installed in an actual sea area

▲All forms of barge-type floats

Project Highlights (2)
-Demonstration project of construction technology for the suction bucket foundation-

Performed an demonstration study of the suction bucket foundation in an actual sea area

Hitachi Zosen Corporation and Toyo Construction Co., Ltd. have performed an demonstration study of the suction bucket foundation construction technology using multi-bucket platforms which can be applied to bottom-fixed offshore wind power generation systems of 15MW or more in 2022.
In the actual sea area test, it was confirmed that the system could be removed securely, there were only minimal environmental impacts in terms of vibration, noise, and pollution, and the vertical accuracy could be easily ensured.

▲2022 actual sea area test

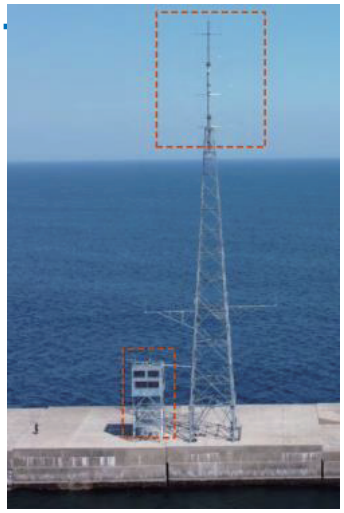
Project Highlights (3)
-Project for Supporting the Introduction of Wind Power Generation-

Constructed the first test site for wind observation equipment in Japan

In order to ensure the accuracy of remote sensing used to evaluate the feasibility of wind power generation, calibration tests of observation equipment are essential but the lack of domestic test sites is regarded as an obstacle.

In this project, NEDO will construct the first domestic test site for observation equipment reflecting the needs of the industry as well as consider and propose the basic specifications required of the test site.

▲Platform for the installation of the Doppler lidar



▲Weather observation mast installed on a breakwater at Mutsu-Ogawara Port

Green innovation fund project/Cost Reduction of Offshore Wind Power Generation

Overview of the project

As part of the green innovation fund project, NEDO started the project for "Cost Reduction of Offshore Wind Power Generation" aiming at further prevalence of offshore wind power generation, mainly the floating type, by reducing the cost. Since 2021, NEDO has been proceeding with the research and development of element technologies in four fields as Phase 1.

Together with the experimental study (Phase 2) to be conducted in the future, NEDO aims at further prevalence of offshore wind power generation, the mainly floating type, through early cost reduction.

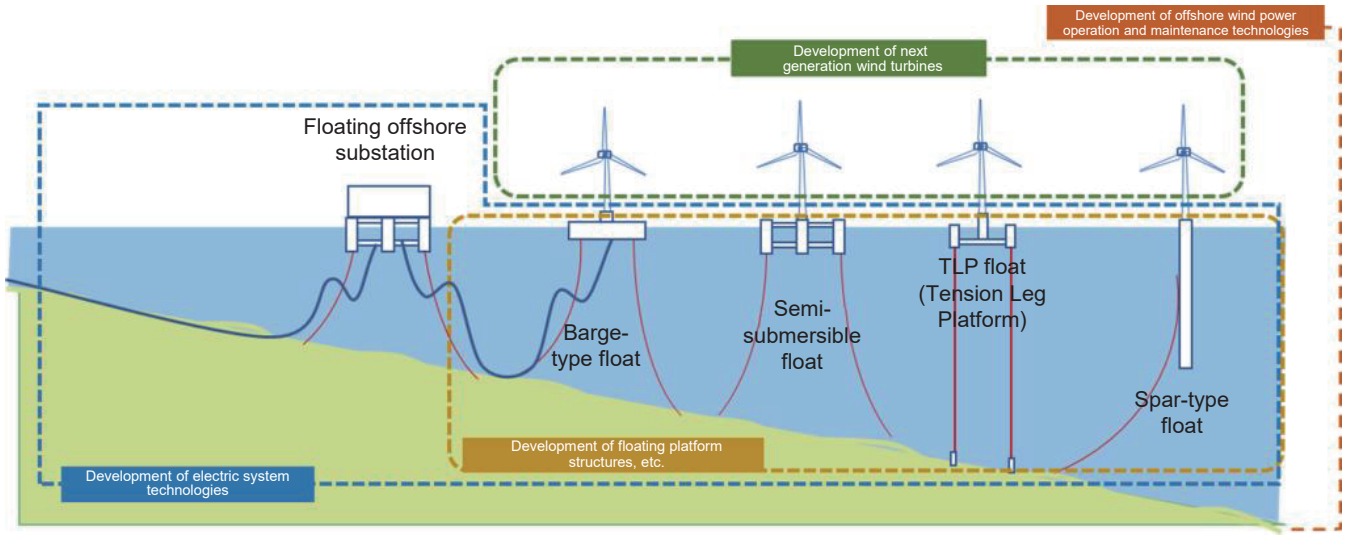
Phase 1 (1) to (4)

- (1) Development of next-generation wind turbine technologies
- (2) Project to develop technologies to reduce the costs of the manufacturing and installation of floating platforms
- (3) Development of electric system technologies related to offshore wind power
- (4) Sophistication of offshore wind power operation and maintenance

Phase 2

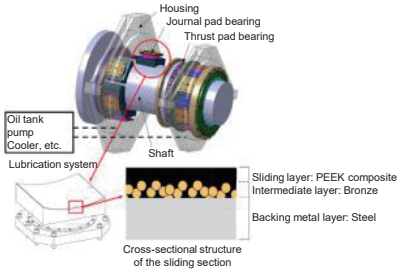
Demonstration of floating offshore wind power generation

It is necessary to improve the reliability and reduce the cost by the integrated design considering the behavior, performance, workability, and cost of the wind turbine, float, mooring system, and cable, is required to improve reliability and lower costs, so NEDO will perform demonstration integrating related technologies in the whole system committing to the cost reduction of power generation in the entire project involving users (electricity generation utilities).

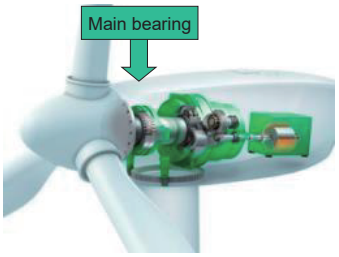


Research and Development Phase 1-(1)
Technology Development Project for Next-Generation Wind Turbines

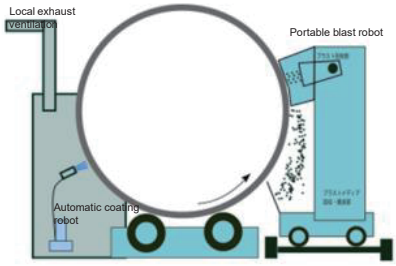
NEDO promotes the development of technologies related to the optimization of the wind turbine specifications, high-quality mass production technologies considering cooperation with global manufacturers, in order to streamline and optimize the whole value chain of wind turbines making use of the strengths of Japan, namely production technologies, quality control, and robotics such as automation of plants, as well as the technologies cultivated through onshore wind power and the domestic manufacturing foundation.



▲Development of sliding bearings



▲Development of low-cost ultra-large main bearings



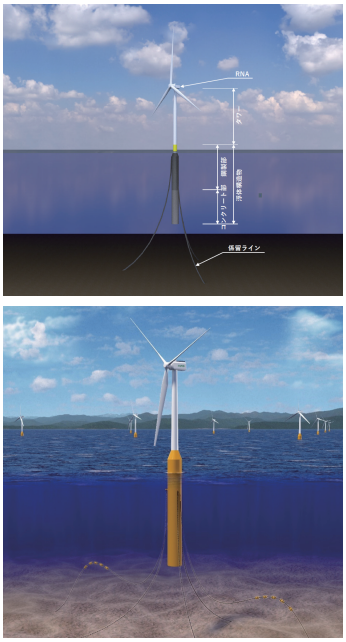
▲Development and demonstration of high-efficiency production technologies of towers

Research and Development Phase 1-(2) Technology development project for basic manufacturing and installation cost reduction for floating wind turbines

NEDO promotes the development of technologies related to the optimization of floating platforms and mooring systems and the development of low-cost construction technologies in order to establish mass production technologies of floats ahead of other countries, utilizing the strengths of Japan, namely shipbuilding technologies and infrastructures such as docks.

Semi-submersible

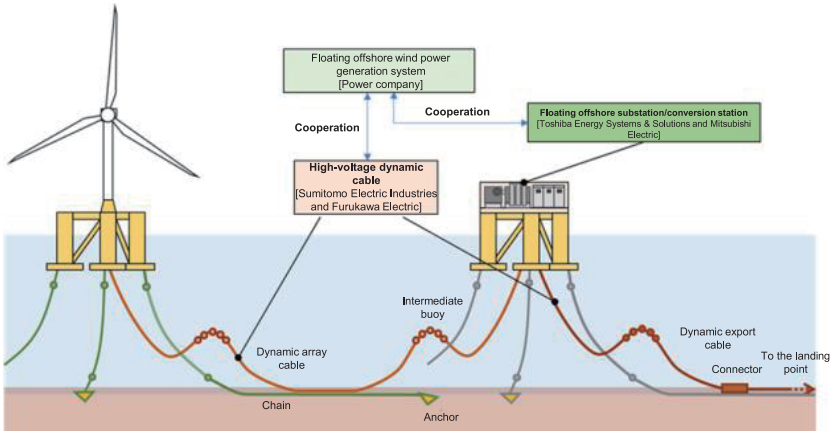
Spar type



TLP mooring system

Research and Development Phase 1-(3) Technology development project for offshore wind power-related electrical systems

NEDO develops technologies related to high-voltage dynamic cables and floating offshore substations to adapt to severe weather conditions such as typhoons and hydrographic conditions such as wave, which are characteristic of Japan and Asia.

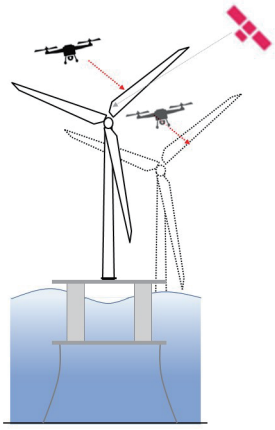


▲Equipment subject to research and development and implementation organization

Research and Development Phase 1-(4) Innovative offshore wind power operation and maintenance project

NEDO develops technologies related to operation and maintenance, repair technologies, and sophistication of monitoring and inspection technologies for sophistication of maintenance, which accounts for more than 30% of costs.

▲Sophistication of operation and maintenance by remote control and automation

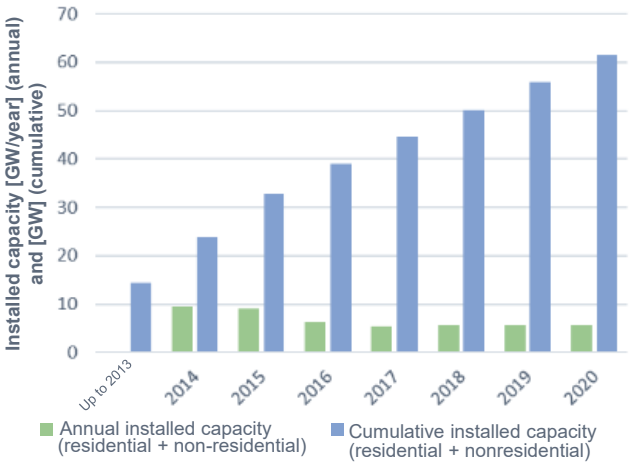


▲Development of a drone for appearance inspections

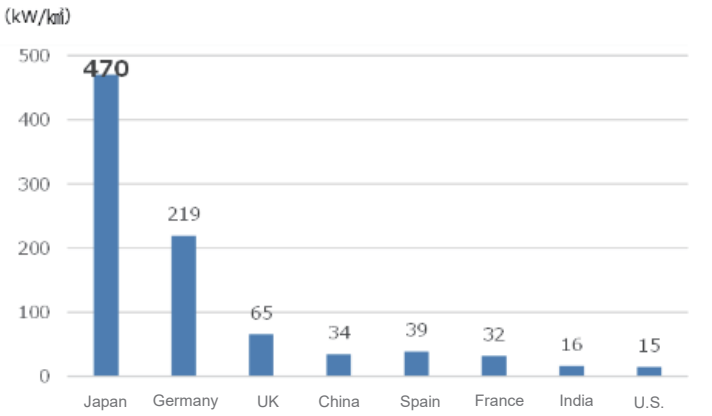
◀Development of CLV (Cable Laying Vessel)

Current status of Photovoltaic power generation in Japan

Since the FIT system was started in 2012, the installed capacity has increased rapidly, and the cumulative installed capacity in Japan is 60GW or more. Japan is already ranked No.1 in terms of the installed capacity per the national land area and photovoltaic power generation is expanding rapidly, but it is necessary to solve the issues about to come up to the surface such as the lack of suitable sites, safety concerns due to defects in the installation and management of power generation facilities, concerns about industrial wastes due to mass disposal of PV cell modules expected to occur in the future, and problems with stable supply including output instability.



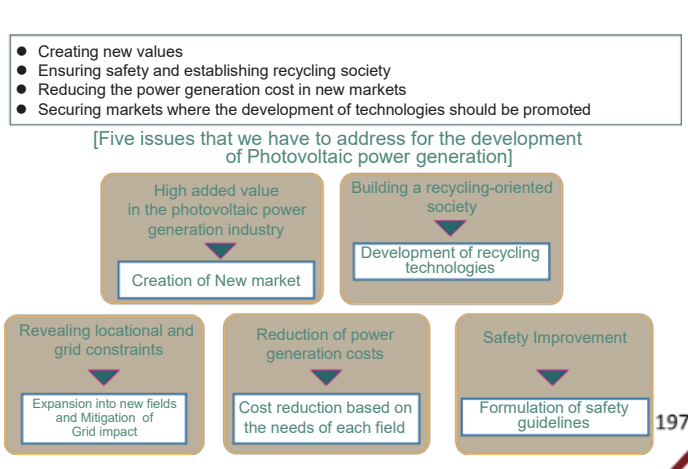
■ **Installed capacity of Photovoltaic Power Generation in Japan**
Source: Prepared by NEDO based on the data of the Ministry of Economy, Trade and Industry



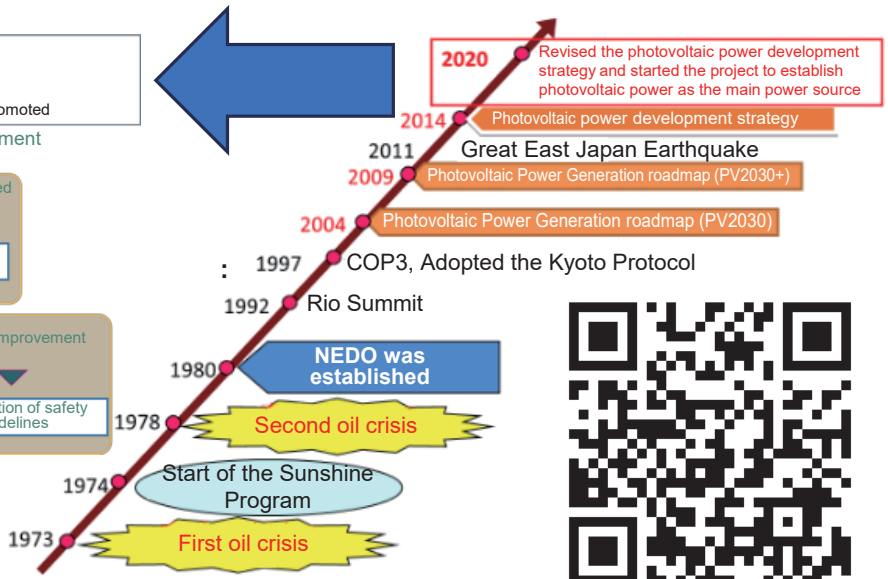
■ **Photovoltaic power system capacity per national land area**
Source: Excerpted from the material of the WG of the fields of encouragement of prevalence of green electricity in the Green Innovation Project Subcommittee, the Industrial Structure Council, the Ministry of Economy, Trade and Industry (August 2023)

Revision of the "Photovoltaic Power Generation Development Strategy (2020)" and NEDO's initiatives

NEDO revised the photovoltaic power development strategy in 2020, and started a project to develop technologies to promote Photovoltaic power generation as a main power source in 2020 to solve emerging issues
In addition, with the aim of achieving "2050 Carbon Neutrality," which is to reduce the total greenhouse gas emissions to zero by 2050, NEDO started the green innovation fund project in 2021 and has been engaging in initiatives for further prevalence of photovoltaic power generation.



■ **Issues in the Photovoltaic Power Generation Development Strategy (2020)**
Source: NEDO



■ **History of NEDO and Photovoltaic power Generation Development Strategy**
Source: NEDO

★See this page for the text of the technology strategy★

Development of technologies to promote Photovoltaic Power Generation as a main power source

Development of module and system technologies, technologies to ensure safety and reliability, module recycling technologies, and common infrastructure technologies for further prevalence of Photovoltaic Power Generation

In Japan, solar power generation is rapidly prevailing under the FIT system, which was started in 2012, but various issues have emerged in the realization of society with wide prevalence of Photovoltaic Power Generation.
In this project, NEDO has been engaging in research and development to solve such issues and further expand the installed capacity of Photovoltaic Power Generation.
For example, NEDO developed module and system technologies, which allowed the introduction of Photovoltaic Power Generation into new markets where it has not been introduced with conventional technologies, technologies for reliability evaluation and recovery, and recycling technologies for the disposal of Photovoltaic Power Generation modules; formulated guidelines to solve issues related to the use of Photovoltaic Power Generation as long-term stable power generation; and examined how to overcome system constraints. *Period of implementation: FY2020 t FY2024 Budget for FY2023: 31. 4 billion yen

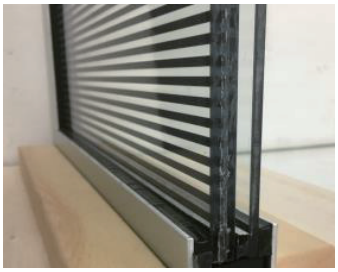
★Check the website of this project★

Development of Technologies to promote Photovoltaic power generation as main power source Research and development item (1)

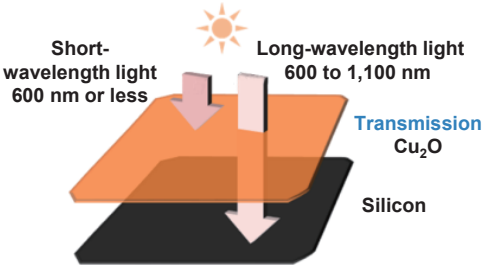
Development of PV Power Generation Technologies to Create New Markets

NEDO will expand the installed capacity of Photovoltaic Power Generation by developing, for example, technologies to improve power generation efficiency, reduce weight, follow curved surfaces, and reduce costs, for locations where it has been difficult to introduce Photovoltaic Power Generation using conventional technologies.
For example, in order to maximize power generation in a lightweight, flexible, and limited footprint, such as a system for moving objects, NEDO will develop multijunction solar cells to realize ultra-high efficiency that cannot be achieved with single-layer solar cells.
NEDO is also developing technologies for cost reduction as well as efficiency improvement and module technologies reflecting various market requirements.

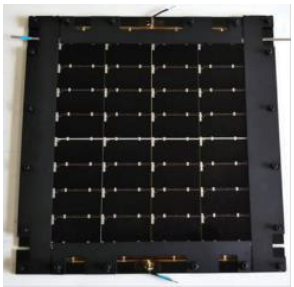
Research and development of modules to create new markets



■ Building-integrated PV cell
Source: Kaneka Corporation



■ Multijunction PV cells using Cu2O
Source: Toshiba Corporation

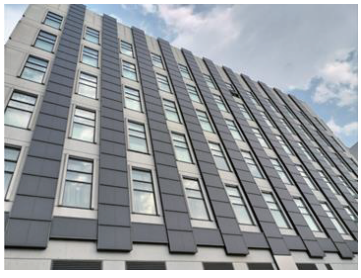


■ Compound/Si stacked PV cells
Source: Sharp Corporation

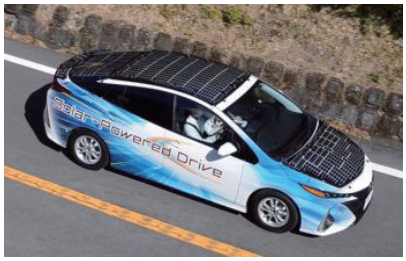
Expanding solar power generation market

Roof	Window/Wall	Moving object

Source: Kaneka Corporation VISOL



Source: Taisei Corporation

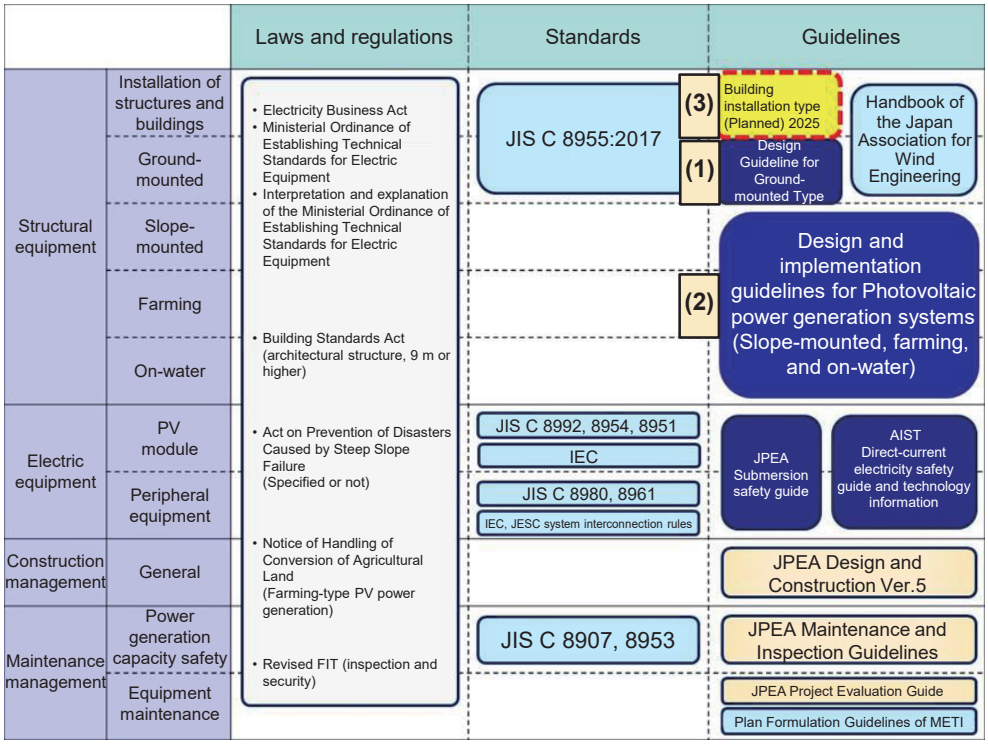


Source: Toyota Motor Corporation PRIUS PHV

Development of technologies to promote photovoltaic power generation as a main power source Research and development item (2)

Development of Technologies to Ensure Safety and Reliability of PV Systems

Following the publication of (1) Design Guidelines for Ground-mounted Systems 2019, NEDO published (2) Design Guidelines for New Installation Environments of Slopes, Water, and Farming in November 2021, and formulated and published "Design Guidelines for Photovoltaic Power Generation Systems of Special Installation Types (Slope-mounted Type, Farming Type, On-water Type) 2023" in April 2023.In FY2025, NEDO plans to formulate guidelines for (3) building installation type.



■Current laws, regulations, standards, and guidelines Source: NEDO

■Farming-type PV

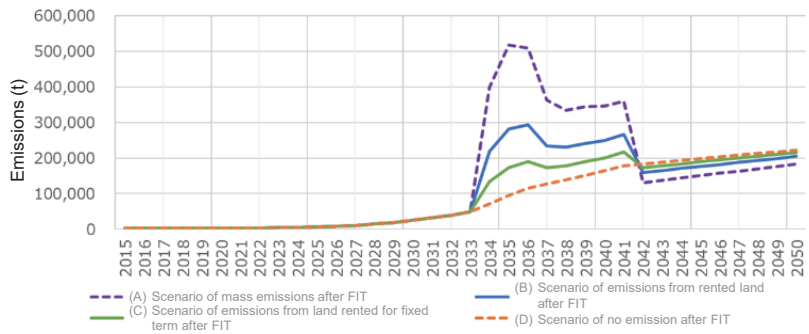
■On-water PV

★(2) Guidelines 2023★

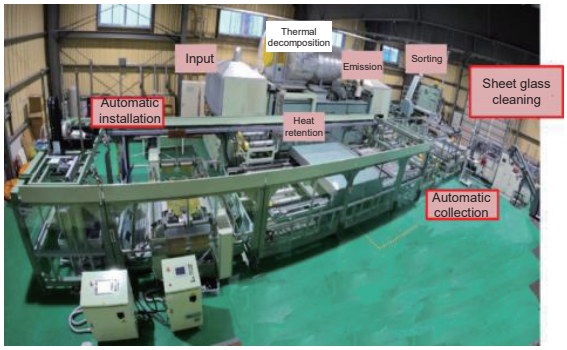
Development of technologies to promote photovoltaic power generation as a main power source Research and development item (3)

Development of Technologies for PV modules Recycle

According to the forecast of solar panel emissions by NEDO, solar panel emissions will reach its peak around 2036, at about 190,000 to 290,000 tons, or 1.7% to 2.7% of the final disposal amount of industrial waste.
The capacity of the final disposal sites for industrial waste will be used up due to the massive disposal of solar panels. To solve this problem, it is necessary to make effective use of resources, and NEDO is developing recycling treatment technologies to achieve both low cost and high resource recovery rates.



■Forecast of solar panel emissions
Source: NEDO

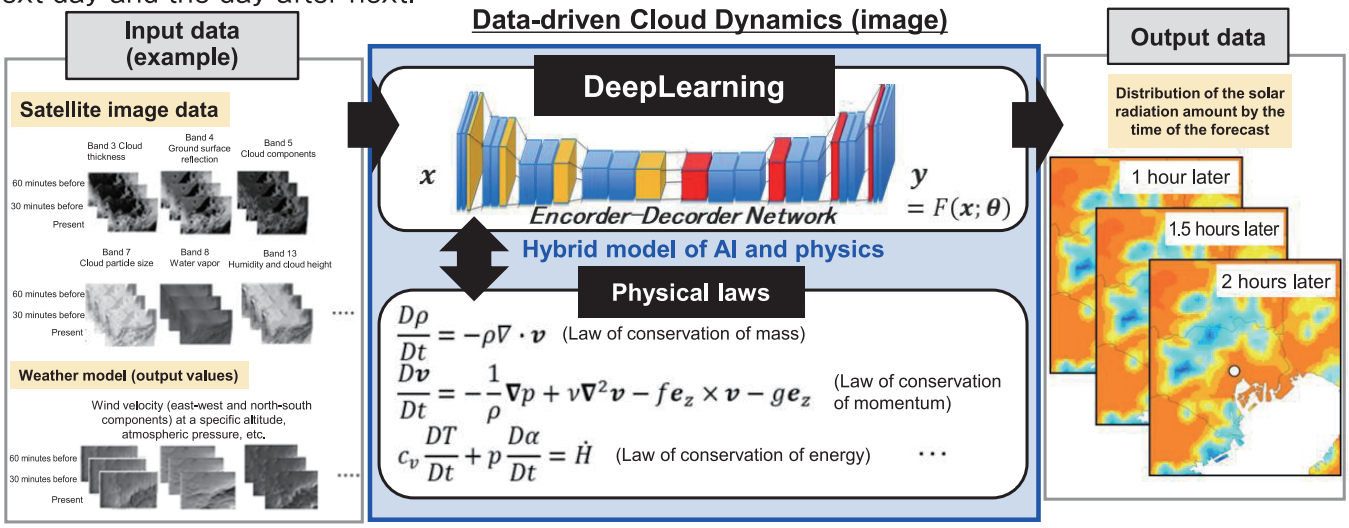


■ Development of recycling technologies for PV modules by low-temperature thermal decomposition method
Source: Tokuyama Corporation

Development of Technologies to Promote Photovoltaic Power Generation as a Primary Power Source (Item 4)

Development of solar radiation forecasting technologies for short-term forecast of the photovoltaic power generation amount

In response to changes in the market environment surrounding solar power generation, more sophisticated power generation forecasting technologies are required from the viewpoint of increasing complexity of supply and demand management and stable supply of electricity, etc. Solar power generation is a variable type of power source that depends on weather conditions, and it is important to accurately forecast the amount of power that will be generated in order to effectively utilize the generated electricity. In order to accurately forecast the power generation amount, it is necessary to improve the accuracy of solar radiation amount forecast on the spatial and temporal axes, and NEDO is developing technologies to improve the accuracy of solar radiation amount forecast of a few hours ahead up to the next day and the day after next.

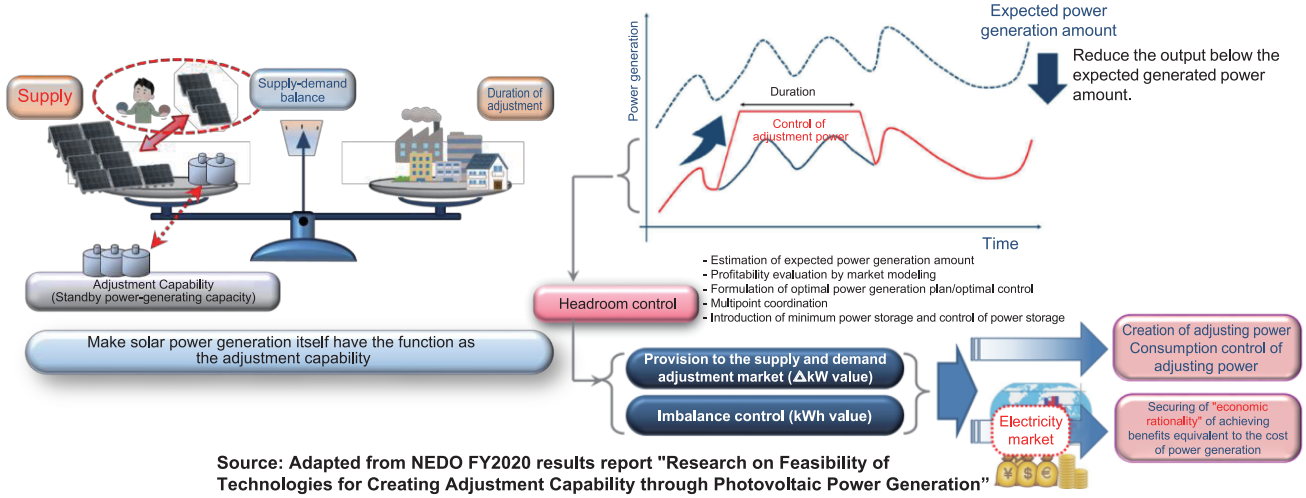


■Developed a method which combines short-time forecast using cloud distribution images from Himawari-8 data and physical forecast using weather models (Data-driven Dynamics method).
Source: Adapted from NEDO master plan for "Development of Technologies to Promote Photovoltaic Power Generation as a Primary Power Source" and NEDO FY2020 interim annual report on "Development of solar radiation forecasting technologies for short-term forecast of the photovoltaic power generation amount"

Development of Technologies to Promote Photovoltaic Power Generation as a Primary Power Source (Item 5)

Experimental study on technologies for creating adjustment capability through photovoltaic power generation

In the operation of a power grid, the principle is to maintain a strict balance between supply and demand, so that the amount of electricity supplied is always equivalent to the amount demanded. There is a concern that if solar power generation whose output fluctuates with the weather increases significantly in the future and flows into the power grids, it will be difficult to adjust supply and demand for the balancing. which will hinder the stable supply of electricity.
To address these issues, NEDO is developing technologies to mitigate the impact on the grids by providing more flexible output control on the photovoltaic power generation side.



Source: Adapted from NEDO FY2020 results report "Research on Feasibility of Technologies for Creating Adjustment Capability through Photovoltaic Power Generation"

Green innovation fund Project/Development of next-generation solar cells

NEDO aims to introduce photovoltaic power generation systems in places where they cannot be installed by existing technologies, by early practical application of perovskite solar cells toward the realization of carbon neutrality by 2050.

In Japan, where most land is not flat, one of the possible ways to secure suitable locations for photovoltaic power generation is to install 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 conventional silicon solar cells in terms of performance.

In this project, NEDO aims to achieve a power generation cost of 14 yen/kWh or less by 2030 through the following research and development activities (1) to (3), in order to develop base technologies for next-generation solar cells (perovskite solar cells) and establish individual element technologies for various manufacturing process to scale up products.

★Check the website of this project★

■ Research and development item

Research and development item (1)

Project for fundamental technology development of next-generation solar cells (budget amount: 8 billion yen)

Implementation period: FY2021-2025

- Development, analysis, and evaluation of common base technologies for perovskite solar cells.
- Development of technologies which contribute to improvements in durability, conversion efficiency and cost reduction.
- Collaboration with the company side for development item 2.

Research and development item (2)

Project for practical realization of next-generation solar cells (budget: 12 billion yen)

Implementation period: FY2021-2025

- Establishment of a technology to fabricate practical-size modules (900 cm^2 or larger) of perovskite solar cells.
- Development of elemental technologies to achieve a power generation cost of 20 yen/kWh or less under certain conditions.
- Establishment of elemental technologies for manufacturing process to scale up products.

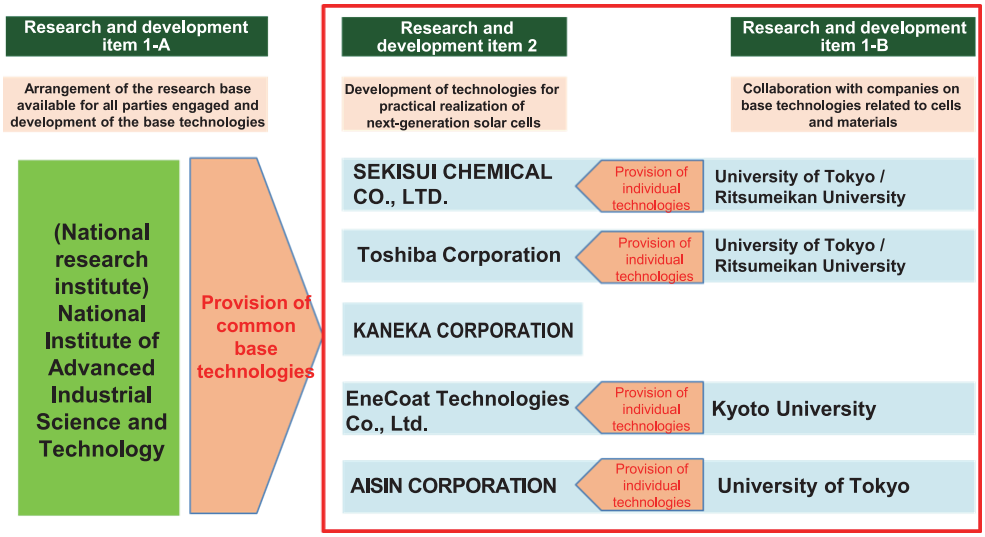
Research and development item (3)

Project for demonstration of next-generation solar cells (budget: 29.8 billion yen)

* *Public solicitation is planned to be performed, checking the progress of 1 and 2 .*

- Aim to achieve a power generation cost of 14 yen/kWh or less through field demonstration of the production process established in Research and development (2).
- Develop technologies to achieve high throughput and high yields.
- Verify the performance including installation and construction methods which take advantage of lightweight and flexibility.

■ Implementation structure



■ Implementation structure for the development of next-generation solar cells
Source: NEDO

■ Examples of modules being developed

■ Film type

Source: SEKISUI CHEMICAL CO., LTD.

■ Glass-type

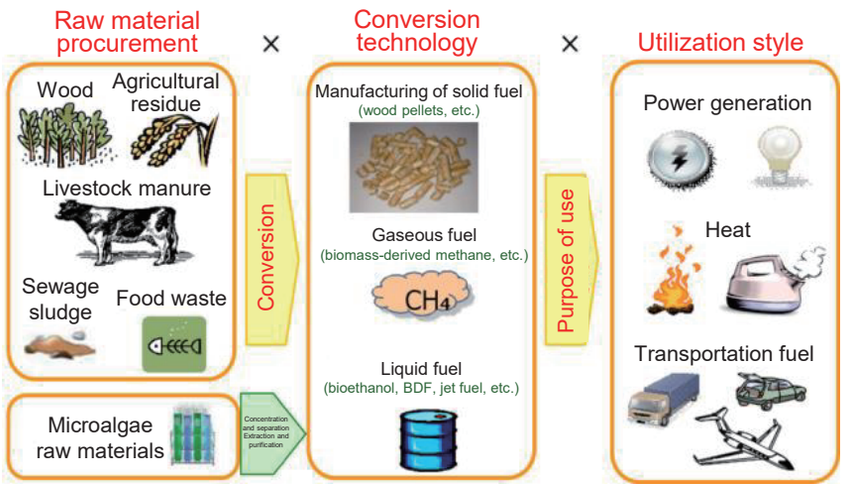
Perovskite solar cell sub-module (mock-up)
Dimensions: 100 cm x 30 cm (size of a building-integrated solar cell)

Source: KANEKA CORPORATION

Overview of the utilization of biomass

Biomass energy is used as electricity, heat, and transportation fuel through procurement of raw materials and conversion to fuel.

CO_2 generated by biomass combustion is the one absorbed from the atmosphere during the plant growth process, and positioned as a renewable energy source with carbon neutrality.



NEDO's initiatives

Develop technologies for transportation fuel and stable supply of woody biomass for power generation

(1) Biojet fuel production technology development project (FY2017-2024)

Work to establish a supply chain model for the practical application of SAF (Sustainable Aviation Fuels) by around 2030.

(2) Energy forest demonstration project (FY2021-2028)

Work to explore the new fuel potential, etc. to secure stable supply and utilization of domestic woody biomass fuel even after the end of the FIT period.

Major outcome -First SAF used for regular flights in Japan-

SAF that we manufactured through an integrated process from woody biomass or microalgae was the first to be used for regular flights in Japan

SAF that we manufactured by the gasification FT synthesis technology that synthesizes liquid fuel after gasification of solid woody biomass and the hydro-refining technology for purification of oil derived from microalgae was supplied for regular flights from the Tokyo International Airport.

Fueling of SAF (Tokyo International Airport, June 17, 2021, JAL515 & ANA031)

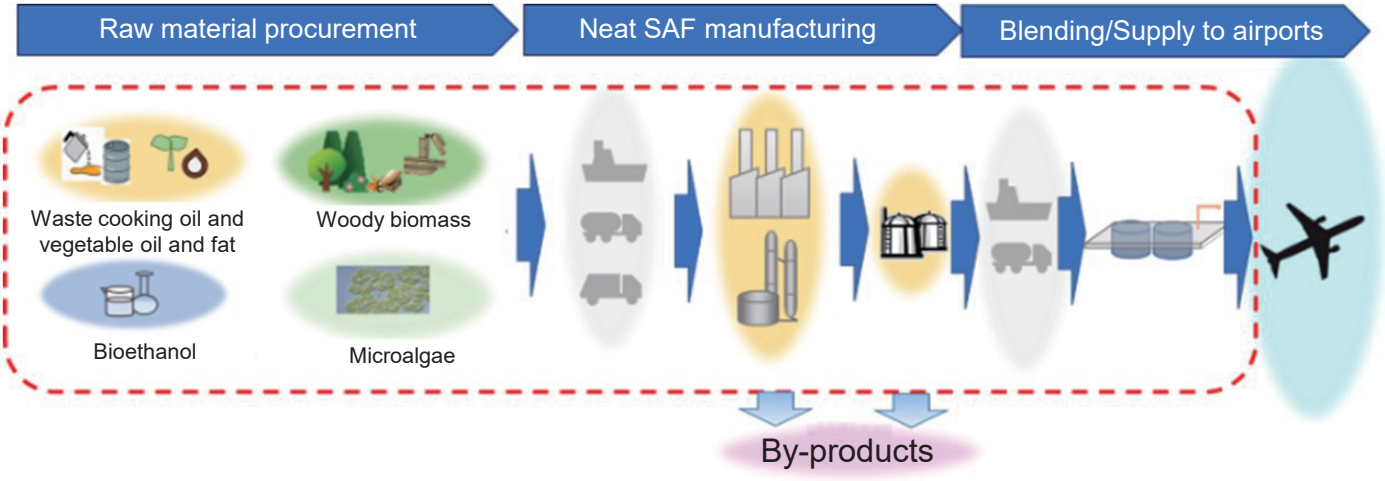
Biojet fuel production technology development project

NEDO aims at practical application of SAF (Sustainable Aviation Fuel) by around 2030.

Establishment of a supply chain model through demonstration

NEDO will develop technologies to establish a supply chain up to manufacturing and supply of SAF, aiming at practical application by around 2030.

NEDO has worked on establishment of a supply chain toward the practical application of SAF, from the procurement of diverse raw materials such as waste cooking oil, vegetable oil and fat, bioethanol, woody biomass, and microalgae, to the demonstration of each conversion process to neat SAF, securing of fuel quality until delivery to airports, and establishment of a supply system.



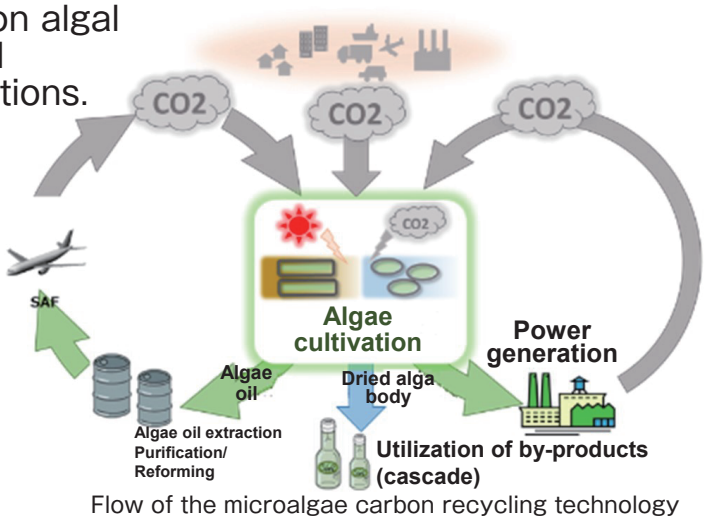
Development of the microalgae base technology

NEDO aims to set the standard conditions for cultivation and analysis and establish stable mass cultivation technologies for microalgae, which are used as raw materials of SAF and in a carbon recycling technology.

NEDO is working on mass cultivation demonstration for the selection, breeding, and diverse cultivation methods of microalgae.
In addition, NEDO has established a research center which can acquire empirical data on algal species and cultivation conditions and will standardize cultivation and analysis conditions.


Microalgae base technology research center Provided by the Institute of Microalgal Technology, Japan

Algae-based carbon recycling

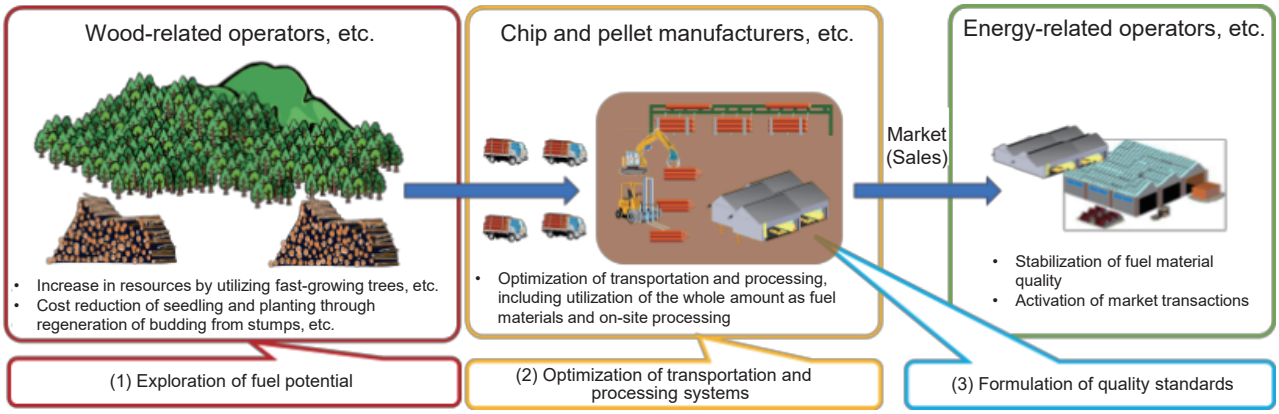


Flow of the microalgae carbon recycling technology

Energy forest demonstration project

NEDO aims at the cost reduction, stabilization, etc. of the quality of domestic woody biomass fuel toward the end of FIT.

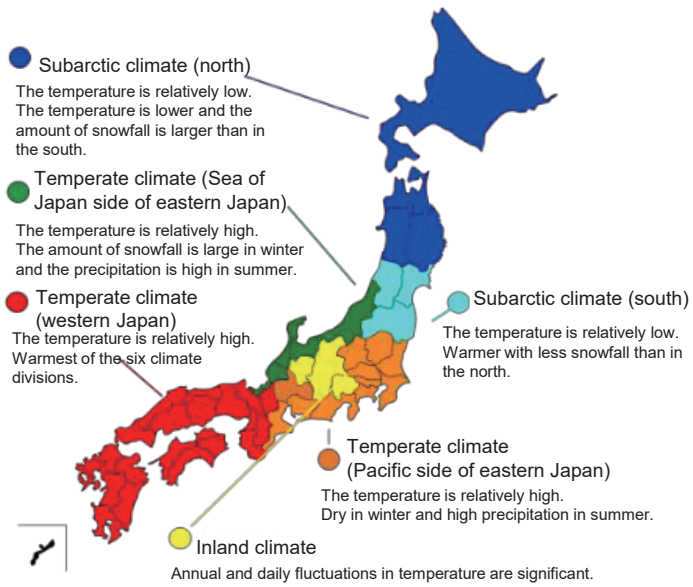
(1) Exploration and promotion of the usage of new fuel potential through the utilization of fast-growing trees, unused broadleaf trees, etc.
(2) Establishment of stable and efficient manufacturing and transportation systems for wood chips and pellets
(3) Formulation of quality standards to activate market transactions and improve power generation efficiency



Exploration of fuel potential

NEDO is working on planting, afforestation, etc. of multiple tree species in six climate divisions in Japan.

Subarctic (north), Subarctic (south), Temperate eastern Japan (Sea of Japan side), Temperate eastern Japan (Pacific side) Temperate western Japan, NEDO aims to establish technologies which can be widely used in Japan by selecting trees suitable for afforestation in inland climate and selecting methods for planting, afforestation, logging, and transportation suitable for each region.



Climate classification	Operator/Demonstration site	Tree species
Subarctic climate (north)	JFE Engineering Corporation /Yunicho, Yubari, Hokkaido	Clean larch and willow
	SHIBATA Industry Co., Ltd./ Ichinohecho, Ninohe, Morioka, Iwate	Willow, poplar, Japanese big leaf magnolia, Tulip poplar, Japanese alder, Empress tree, and Oak
Subarctic climate (south)	JCOAL, Tonokosan Corporation, Furukawa Ringyo Co., Ltd./Iwaki, Fukushima, and Shichikashukumachi, Karita, Miyagi, etc.	Chinese fir, Tulip poplar, and Nepali hog plum
Temperate climate (Pacific side of eastern Japan)	Eco-Green Holdings Co., Ltd./Tomisato, Sammu, and Otakicho, Isumi, Chiba, etc.	Eucalyptus, Chinese fir, Tulip poplar, and Chinaberry
	Environmental Pollution Analysis Center Co., Ltd./Haga, Tochigi, etc.	Early empress tree
	Green Earth Institute*/Otakicho, Isumi, Chiba	Willow
	Biomass Power Technologies*/ Odaicho, Takicho, Taki, Matsuzaka, Mie, etc.	Chinaberry and Oaks
Temperate climate (Sea of Japan side of eastern Japan)	Sakai Forest Union/Awara, Fukui	Chinese fir
Temperate climate (western Japan)	Biomass Power Technologies*/Gojo and Asukamura, Takaichi, Nara, and Ryujinmura, Tanabe, Wakayama	Chinaberry, Oaks, and Willow
	Tokushima Regional Energy/Takarazuka, Hyogo	Regeneration of budding of broadleaf trees
	Japan Investment Adviser Co., Ltd./Sayocho, Sayo, Hyogo, and Kumakogencho, Kamiukena, Uwajima, Ehime	Eucalyptus
	Green Earth Institute*/Tunocho, Koyu, Miyazaki	Willow
Inland climate	Kita-alps Forest owner's Association/Omachi, Nagano	Regeneration of budding of broadleaf trees, Jolcham oak, Chestnut, and Japanese big leaf magnolia

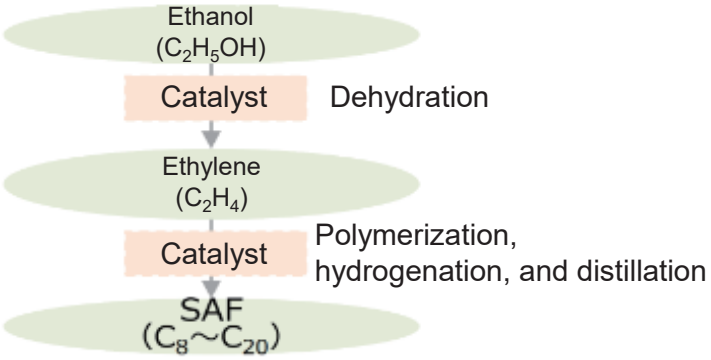
* Green Earth Institute and Biomass Power Technologies performed demonstration in two climate divisions

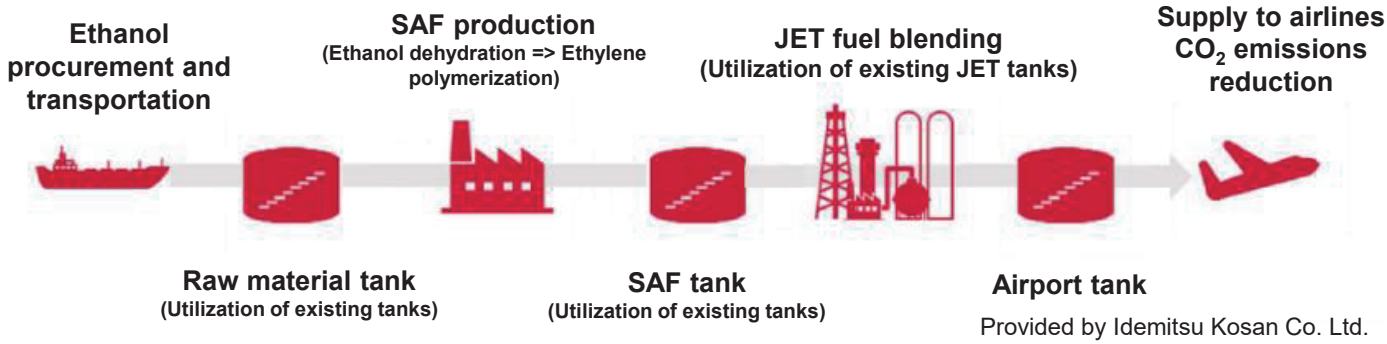
Green innovation fund project/Development of Technology for Producing Fuel Using CO_2, etc. -Development of technology for producing sustainable aviation fuels (SAF)-

NEDO will establish the ATJ (Alcohol to Jet) technology to produce SAF from ethanol, aiming to produce 100 thousand kL of SAF per year and supply it as fuel for aircrafts.

NEDO will develop the ATJ (Alcohol to Jet) technology to produce SAF by ethylene production through ethanol dehydration and polymerization of ethylene, and establish a production process which enables mass production aiming to achieve a neat SAF yield of 50% or higher from ethanol.
NEDO will achieve stable operation of the cutting-edge ATJ demonstration facility and establish a supply chain by around 2026.

Image of the manufacturing process of SAF

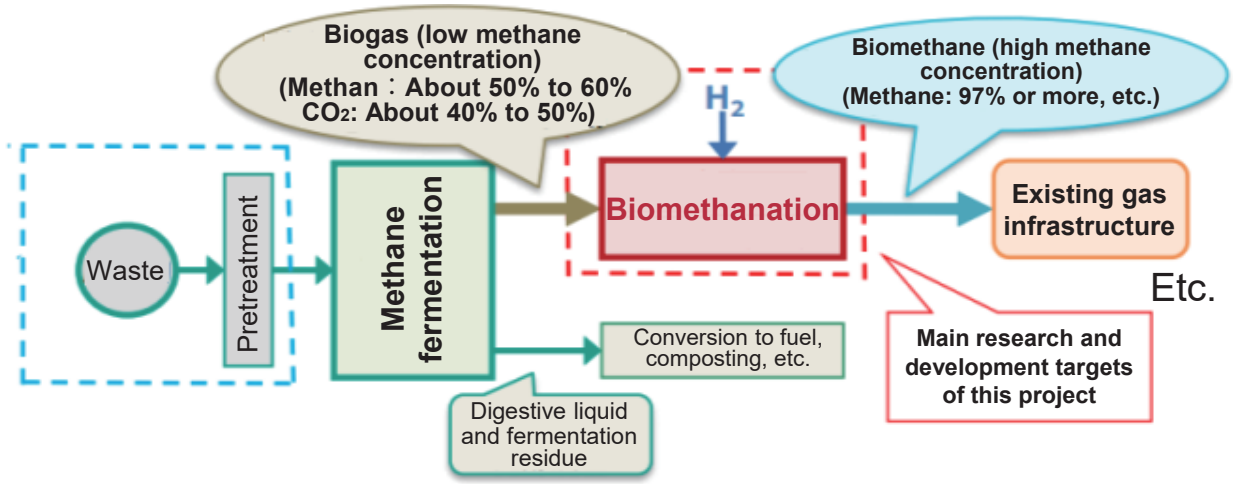




Provided by Idemitsu Kosan Co. Ltd.

Green innovation fund project/ Realization of carbon neutrality in the fields of waste and resource circulation -Development of high-efficiency conversion technologies for biomethane, etc.

Through direct methanation of methane fermentation gas derived from food waste, NEDO aims to achieve a methane concentration of 97% or higher by converting CO_2, which accounts for about 40% to 50% of the volume.



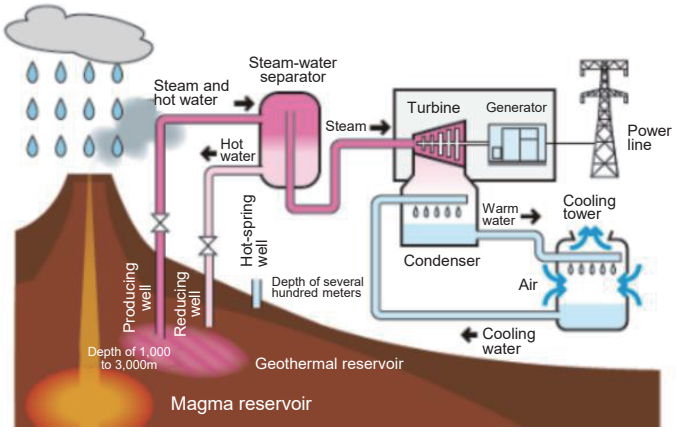
Geothermal power generation in Japan

Geothermal power generation has been attracting attention again as a renewable energy baseload power source.

Geothermal power generation is a stable style of power generation which is not affected by climate or weather and does not rely on imports.

Japan has the world's third richest geothermal resources (over 20 million kW) and is expected to expand the utilization of such resources.

Recently, the Wasabizawa geothermal power plant, the first large-scale geothermal power



[Mechanism of geothermal power generation] Source: Website of JOGMEC

Policy for early realization of an increase in geothermal power generation

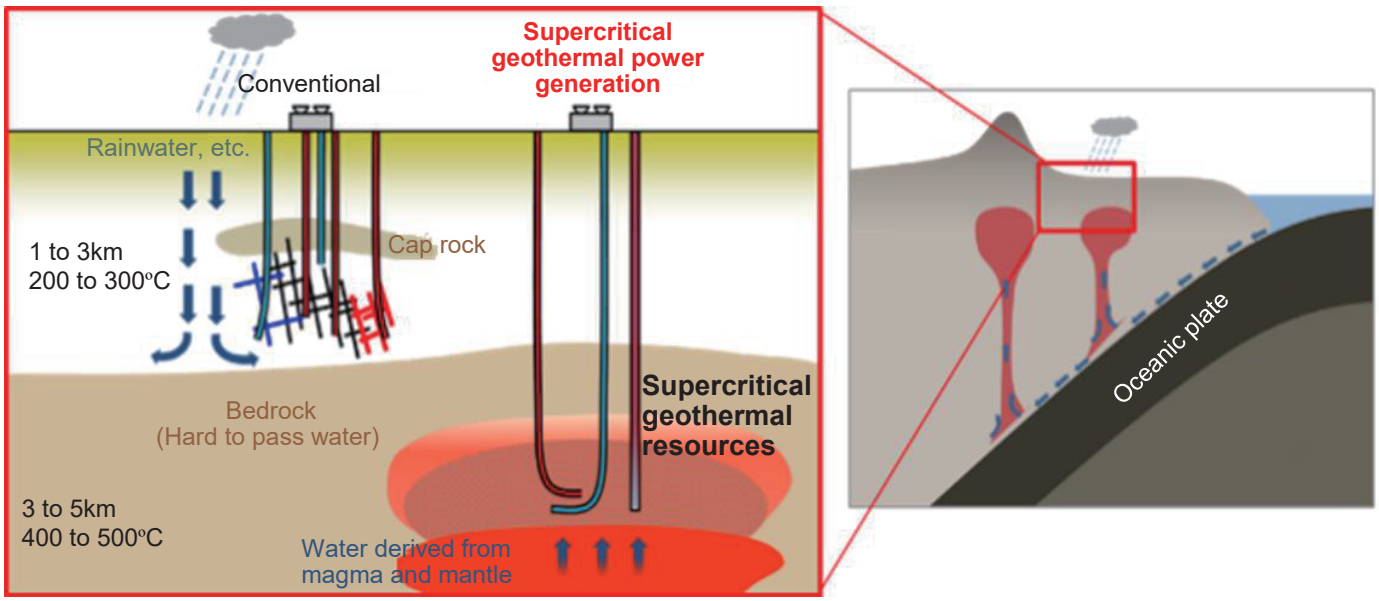
NEDO is engaged in technology development with (1) to (3) as the priority items.

Expansion of geothermal resource potential	Reduction of power generation costs	Local symbiosis and environment preservation
⇩	⇩	⇩
(1) Supercritical geothermal resources	(2) Sophistication of utilization	(3) Environment preservation measures

(1) Overview of supercritical geothermal resources

Next-generation geothermal power generation, which utilizes new resources, to achieve carbon neutral by 2050.

Ilt is considered that water derived from seawater drawn underground as a result of the movement of oceanic plates exists as a supercritical geothermal resource above the magma reservoir. Utilization of this new conceptual geothermal resource is expected to dramatically increase geothermal power generation capacity, and resource amount evaluations are currently being conducted in four regions.



[Concept of supercritical geothermal resources and difference from conventional geothermal resources]

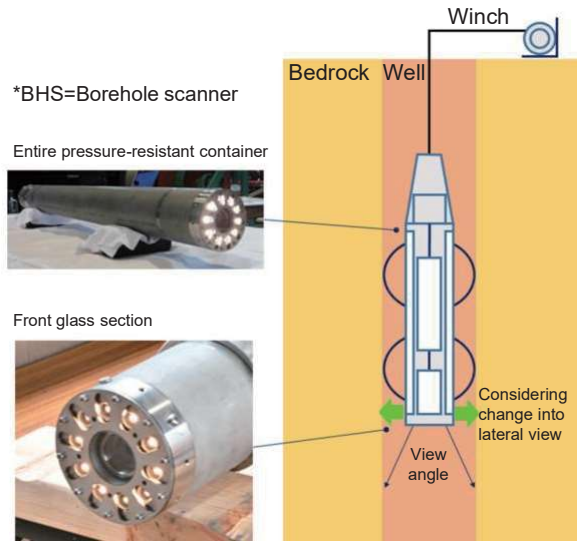
(2) Example of sophistication of utilization: Heatproof borehole scanner (BHS)

Accurately confirm the condition of damage to wells used for geothermal power generation, etc.!

As wells used for geothermal power generation are deep and hot, they cannot be inspected visually, and it is difficult to grasp their internal conditions.

Therefore, as shown in the right figure, a heatproof camera connected to an optical-fiber composite cable is lowered into wells using a winch to visualize casing damage and scale adhesion conditions.

Image sharpening processing and AI-based diagnosis contribute to early improvement of factors of a decrease in steam production.

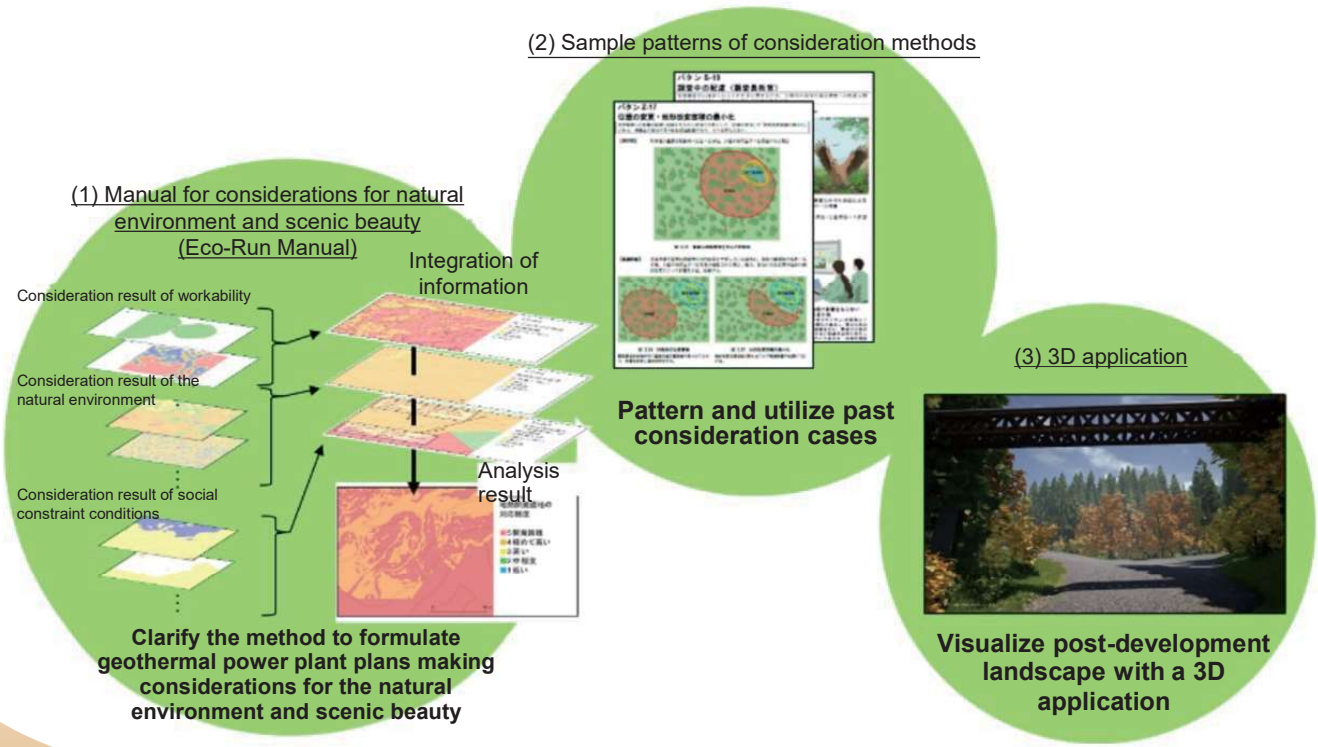


(3) Example of an environmental preservation measure: Eco-Run Set

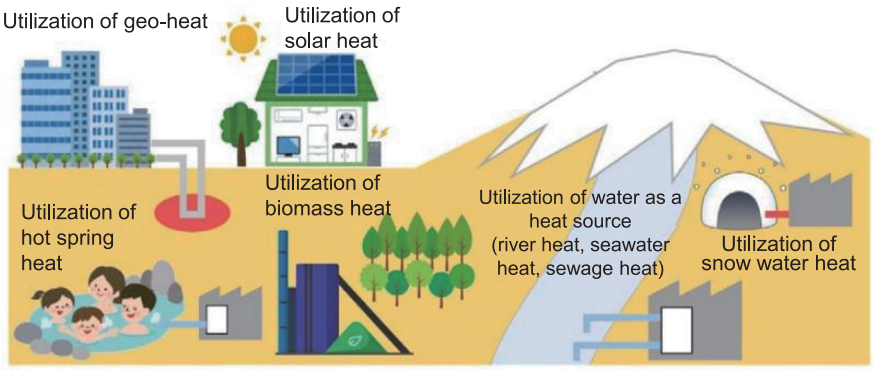
NEDO developed a set that is effective in "consensus building with the local community," which is important in geothermal development.

NEDO developed a design support set (so-called "Eco-Run Set," see Figures (1) to (3) below) which incorporates methods to minimize the impact on the natural environment, scenic beauty, and the use of parks to clarify and visualize the planning method.

This set contributes to initiatives to form good practices in geothermal development, encouragement of communication with stakeholders, and consensus building, as it enables visual sharing of images of the design and completion of environment-friendly power plants.



What is renewable heat



Non-electric purposes, mainly utilization for heat, account for a majority of energy consumption purposes in Japan.
For improvement in energy efficiency, heat must be used efficiently without conversion to

"Do you know " Chibasemiota" of renewable heat ?"
NEDO channel (youtube)

NEDO's initiatives

From the past to the future!! Since 2011, NEDO has been working on projects related to renewable heat for the realization of decarbonized society

(2011-2013 Measurement technology) **Demonstration of measurement technologies for utilization of heat as renewable energy**

(2014-2018 Elemental technology) **Research and development for utilization of heat as renewable energy**

For the material of the "outcome report meeting of the previous year," see the website of NEDO

For the material of the "preliminary evaluation sheet," see the website of the Ministry of Economy, Trade and Industry

(2019-2023 Cost reduction technologies)
Research and development for total cost reduction of heat utilization as renewable energy

(2024-2028 Area-wide utilization)
Research and development for the construction of systems for area-wide utilization of heat as renewable energy

2030

Development of cost-reduction technologies for systems for the utilization of geothermal heat (Subsidy projects) 4 projects

- Japan Groundwater Development Co., Ltd., Zeneral Heatpump Industry Co., Ltd.
- YBM Co.,Ltd., Showa Manufacturing Co., Ltd.
- Hokkaido University, Hokkaido Electric Power Co., Inc., M's Industry Co., Ltd., INOAC Housing & Construction Materials Co.,Ltd., etc.

Development of advanced technologies for systems for the utilization of solar heat, etc. (Subsidy projects) 2 projects

- Zeneral Heatpump Industry Co., Ltd., Kajima Corporation, etc.

Development of common base technologies for sophistication and cost reduction (consigned project) 2 projects

- Hokkaido University, Akita University, National Institute of Advanced Industrial Science and Technology
- Gifu University, Tokai National Higher Education and Research System

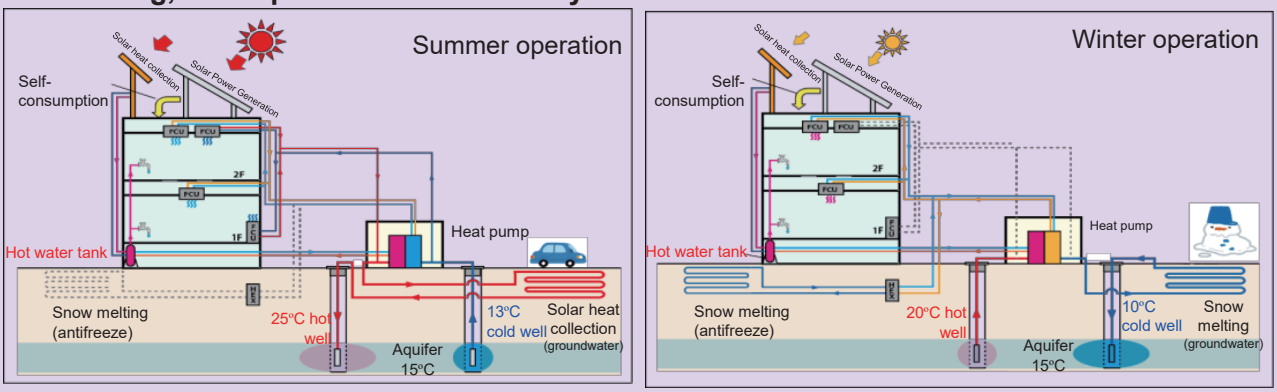
Subsidy rate

- Subsidy projects: Within 1/2 of the budget for subsidies (Upper limit of the subsidy amount: 100 million yen per year)
- Consigned projects: 100%

Major outcome

(1) Development of a total heat supply system using aquifer thermal energy storage

[Implemented by Japan Groundwater Development Co., Ltd., Zeneral Heatpump Industry Co., Ltd.]
By storing cold and warm exhaust heat in the aquifer and unifying multiple heat sources (geothermal and solar heat), We developed a total heat supply system which provides air conditioning, hot water supply, and non-sprinkled snow melting. As a result of introduction in an actual building, it was proven to be extremely effective for conversion to ZEB.



▲ Aquifer thermal energy storage system

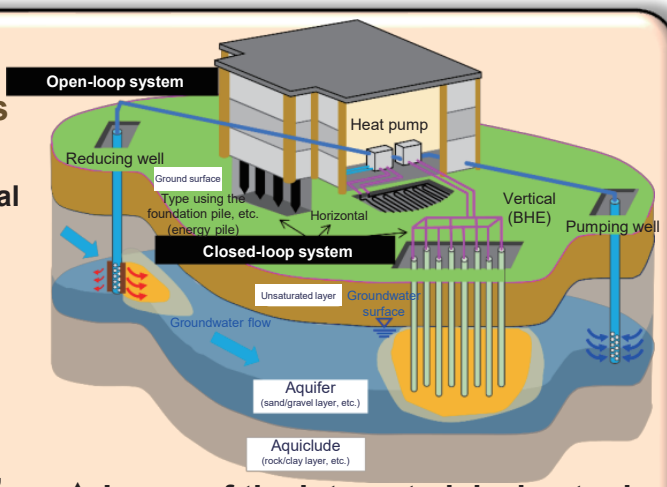
(2) Development of low-cost, high-efficiency, unit-type heat pump systems

[Implemented by Kajima Corporation
Zeneral Heatpump Industry Co.,Ltd.,]
We developed a low-cost, high-efficiency, unit-type Sky Source Heat Pump (SSHP®) system which met multipurpose heat demand such as air conditioning and hot water supply using a heat pump which collects and radiates geothermal and solar heat, etc., and is currently examining its effect in actual buildings.

▲ Heat pump demonstration system

(3) Development of the integrated design tool for geothermal heat pump systems

[Implemented by Hokkaido University, Akita University, National Institute of Advanced Industrial Science and Technology]
We is developing and standardizing methods for estimating apparent thermal conductivity and simplified thermal response test methods (TRT), which are essential for geothermal heat pump system design, and developing the integrated design tool adding open-loop system design capabilities to the closed-loop system design tool, which is currently the mainstream.



▲ Image of the integrated design tool

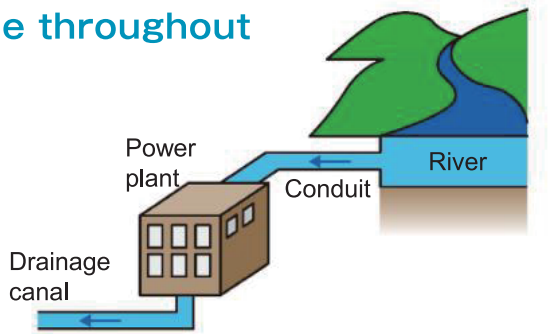
Overview of small hydro power generation
- Environment surrounding small hydro power generation in Japan -

Expected as an energy source with local symbiosis

The expansion of hydro power generation is considered to be an effective means of achieving carbon neutrality by 2050. The Sixth Basic Energy Plan of the Agency for Natural Resources and Energy also states that hydro power generation is "a purely domestic source of energy which can be utilized long-term with excellent stability of supply which is not affected by weather conditions, except drought problems and also expected to expand its role as an energy source with local symbiosis."

Effectively utilize the potential widely available throughout Japan with the "run-of-the-river" method

Among the hydro power generation methods, small hydro power generation mainly uses the "run-of-the-river" method, in which water flowing into rivers, agricultural water, water supply and sewerage systems, etc. is taken directly without being stored in dams, and the energy of the water is used to turn waterwheels. Though not strictly defined, small-scale power generation systems with an output of 1,000kW or less are often collectively referred to as "small hydro power generation". The potential for introduction exists widely throughout Japan and is expected to be utilized effectively.



Small hydro power generation with the run-of-the-river method
Source: NEDO Renewable Energy Technology White Paper, 2nd Edition

NEDO's initiatives

The "New Energy Demonstration Program for Future " is part of NEDO's "Technology Research and Development Project for Exploration and Commercialization of New Energy Seeds" which promotes cross-sectional support in the field of renewable energy. Through this program, NEDO is implementing projects to support companies that are working on research and development, and technology demonstration that contribute to lower cost and higher efficiency in new development and replacement of small hydro power facilities and its existing facilities as well.

Introduction of the project

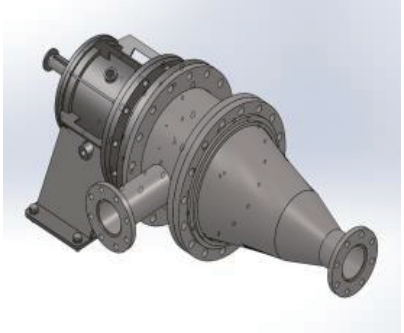
1) Non-electric garbage removers to be installed in small hydro power generation plants

The aim of this project is to develop sustainable and cost-effective products which contribute to improvements in competitiveness of small and medium-sized operators through technology demonstration of non-electric garbage removers using water flow in headrace.

Non-electric garbage remover
Source: Aratani Civil Engineering Consultants Co., Ltd.

2) Development of a submerged impulse hydroturbine for electric power generation at high head and small flow

The aim of this project is to clarify issues and develop products rapidly by grasping the applicable head upper limit and power generation performance, evaluating durability, and pursuing convenience in operation of water supply business.



Shape of submerged impulse hydroturbine
Source: Ebarashoji Co., Ltd.

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MUZA Kawasaki Central Tower 1310 Omiya-cho, Saiwai-ku, Kawasaki city, Kanagawa 212-8554
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