



Development of Technology to Promote Solar Power as a Main Energy Source

NEDO's Projects

To further expand the implementation of solar power generation, we are developing module and system technologies, technologies to ensure safety and reliability, module recycling technologies, and common infrastructure technologies.

【 Overview 】

- ◆ Project Period: 2020 to 2024
- ◆ Budget (2024): 3.2 billion yen

【Theme】

Research and Development Items (I) Development of New Market-Creating Technologies for Solar Power Generation

- (i) Development of film-type ultra-lightweight solar cells
- (ii) Development of wall-mounted solar power generation system technologies
- (iii) Research and development of solar cells for mobile applications
- (iv) Development of solar cells targeting multi-junction types, etc.

Research and Development Items (II) Development of Technologies for Long-Term Stable Power Supply from Solar Power Generation

- (i) Development of technologies to ensure safety and reliability
- (ii) Development of technologies for separation and material recycling of solar cell modules
- (iii) Study and demonstration of technical issues contributing to mitigation of grid impacts

Research and Development Items (III) Development of Advanced Common Platform Technologies

Research and Development Items (IV) Trend Surveys, etc.



R&D (I): Development of Next-Generation Solar Cells for New Markets

We are developing technologies such as improving power generation efficiency, reducing weight, conforming to curved surfaces, and lowering costs for locations where it was difficult to install solar power systems with conventional technology, aiming to maximize the amount of installations.

(i) Weight-restricted roof



Developed lightweight solar cells for installation on roofs with weight restrictions.

(ii) Walls and windows



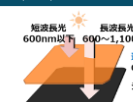
Develop a solar power generation system that improves the cost-effectiveness, durability, and design quality required when applied to walls.

(iii) For mobile use



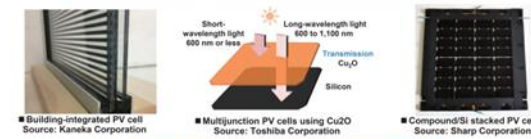
We are developing technology aimed at achieving both high efficiency and low cost. In the long term, we also aim to expand its application to aviation uses such as UAV.

(iv) Tandem



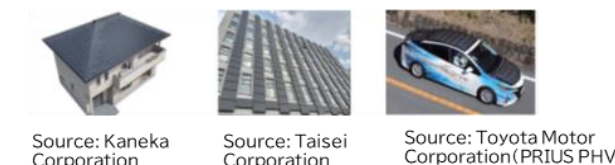
We aim to develop solar cells, such as multi-junction solar cells, that provide high conversion efficiency even with a small area, intended to replace existing solar cells.

Research and development of modules to create new markets



Expanding solar power generation market

Roof Window/Wall Moving object



Source: Kaneka Corporation

Source: Taisei Corporation

Source: Toyota Motor Corporation (PRIUS PHV)



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R&D (II) Development of technologies to ensure the safety and reliability of solar power generation

NEDO has published the "Ground-Mounted Design Guidelines (formulated in 2017, revised in 2019)" and the "Design Guidelines for Solar Power Generation Systems with Special Installation Forms (Slope Installation, Agrivoltaic, Floating Installation) (formulated in 2021, revised in 2023)." In addition, to further improve applicability to various installation forms, reflecting the results of various demonstration experiments, the "2025 Edition of Design Guidelines for Solar Power Generation Systems with Special Installation Forms (Slope Installation, Agrivoltaic, Floating Installation)" has been formulated and published. Furthermore, the "2025 Edition of Design and Construction Guidelines for Building-Installed Solar Power Generation Systems," corresponding to conventional solar power systems installed on building roofs and walls, has also been formulated and published.

	Law and regulations	Standards	Guidelines
Installation of structures and buildings	Electricity Business Act Ministerial Ordinance of Establishing Technical Standards for Electric Equipment	JIS C 8955:2017	(3) Building installation type (Planned 2025) (1) Design Guidelines for Ground-mounted Type Handbook of the Japan Association for Wind Engineering
Structural equipment	Ground-mounted Slope-mounted Farming On-water		(2) Design and implementation guidelines for solar power generation systems (Slope-mounted, farming, and on-water)
Electric equipment	Solar cell module Peripheral equipment	JIS C 8962, 8954, 8951 JIS C 8980, 8961 JIS C 8907, 8953	JPEA Direct-current safety guide and technology information JPEA Design and Construction Ver. 5 JPEA Maintenance and Inspection Guidelines Plan Formulation Guidelines of METI
Construction management	General		
Maintenance management	Power generation capacity safety equipment maintenance		

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

Guideline (2025)



Accidents on steep slopes



PV for sloping land



PV for Agriculture



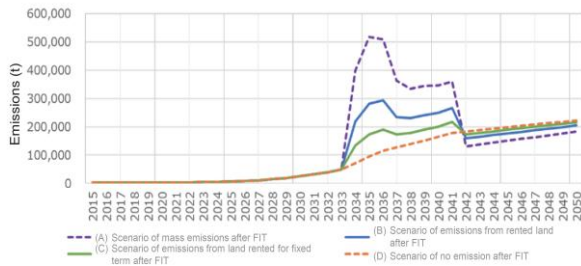
Float type PV



PV for buildings

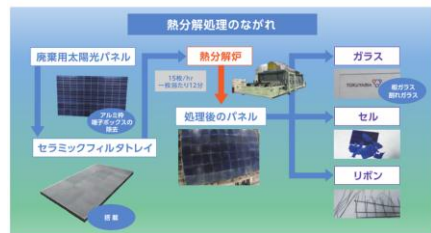
Development of material recycling technologies for solar cell modules

According to the estimate 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. **(Final target for 2024: recycling cost of 3 yen/W or less, expected to achieve a resource recovery rate of 80% more)**



■ Estimate of solar panel emissions
Source: NEDO

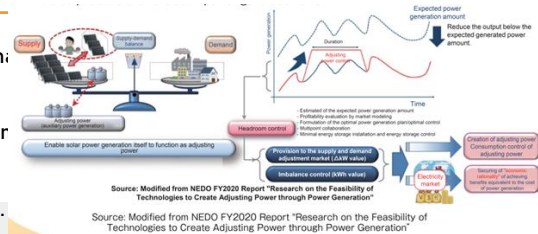
リサイクル工程の開発 Development of recycling process



■ Development of recycling technology for solar cell modules by low-temperature pyrolysis method
Source: Tokuyama Corporation

Experimental study of technologies to create adjusting power by solar power generation

In power system operation, the amount of electricity supplied should be constantly kept equivalent to the demanded amount. There is a concern that if solar power generation systems, whose output fluctuates with the weather conditions, increase significantly in the future and flows into the power system, it will be difficult to adjust the balance of supply and demand which may hinder a stable supply of electricity. To address these issues, NEDO is developing technologies to mitigate the impact on the system by providing more flexible output control on the solar power generation side.



Source: Modified from NEDO FY2020 Report "Research on the Feasibility of Technologies to Create Adjusting Power through Power Generation"
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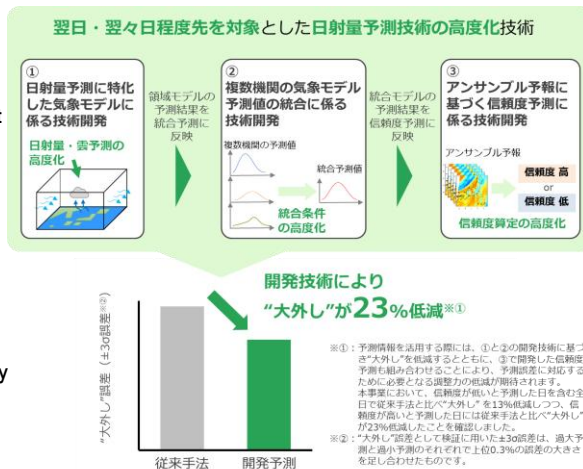
R&D (III) Development of Advanced Common Infrastructure Technologies

Development of solar radiation forecast technology for the next day and the day after

With changes in the market environment surrounding solar power generation, there is a growing need to advance power generation prediction technology in terms of supply-demand management complexity and stable electricity supply. Solar power generation is a variable power source affected by weather conditions, and it is important to accurately predict the amount of power generated to make effective use of the electricity produced. When solar radiation forecasts are significantly off, so-called 'major misses,' they can have a significant impact on the power system.

By combining the forecasting technologies developed this time, we verified their effect in reducing 'major misses' and confirmed that compared with conventional methods, 'major misses' could be reduced by 23%. The estimated cost for procuring adjustment capacity to cope with renewable energy fluctuations is expected to be around 30 billion yen in fiscal 2025, highlighting the need for further cost reductions.

NEDO is developing technology to improve the accuracy of solar radiation forecasting from several hours ahead to the next day and up to the day after next, aiming to expand the adoption of solar power and contribute to the stabilization of the power grid.



Development of power generation forecasting technology for new market (in-vehicle) introduction

Use cases have a significant impact on the power generation performance of solar cell-equipped mobile devices and other devices. Estimation of power generation in various use cases considering these influences is important for estimating the effect of solar cell-equipped mobile devices on the market. Therefore, NEDO will establish a technology to estimate the effect of solar power generation, such as power generation on an annual level, and develop a technology that can determine the suitability for the assumed market (vehicle etc.).

