

Report 2023

Japan

Demonstration of wind turbine blade inspection technology using a drone performed by companies participating in the GI Projects. Source: https://www.nedo.go.jp/news/press/AA5_101706.html.

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The commercial operation of large-scale offshore wind farms began in earnest, in 2022 and 2023. In 2023, a total of 158 new wind turbines (570 MW) were installed, and some aging wind turbines were decommissioned.

As of the end of 2023, Japan's wind power generation capacity has reached 5,213 MW increasing the share of wind energy in Japan's total electricity supply mix to 1.1%.

The New Energy and Industrial Technology Development Organisation (NEDO) is promoting research and development of wind power generation technology nationally and supports projects for the deployment of wind power with the aim of reducing the cost of offshore wind power. In addition, the Green Innovation Fund Projects (GI Projects) [1] that started in 2021 are progressing, with the second phase of the GI Projects starting in 2024.

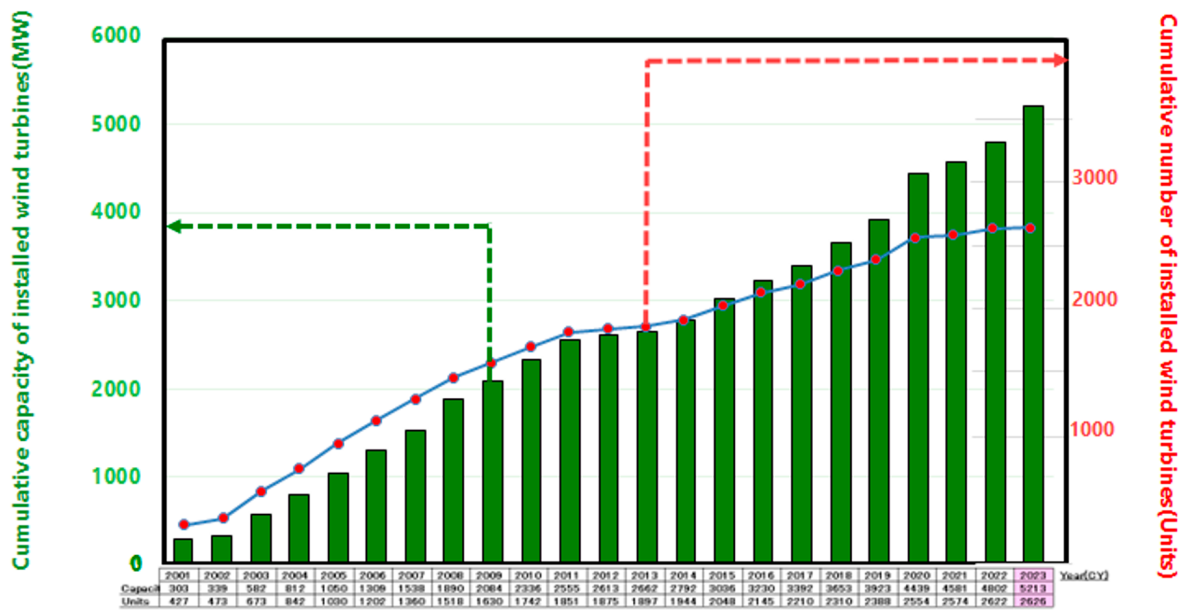


Figure 1: Deployment and installed capacity of wind power in Japan. Source: Japan Wind Power Association.

Table 1. Key Statistics 2023: Japan

Total (net) installed wind power capacity	5.21GW
Total offshore capacity	0.19 GW
New wind power capacity installed	0.57 GW
Decommissioned capacity (in 2022)	0.08 GW
Total electrical energy output from wind	9.16 TWh
Wind-generated electricity as percentage of national electricity demand	1.09%
Average national capacity factor	21.2%
Target	10 GW of wind power capacity by 2030
National wind energy R&D budget	4.48 bil. JPY; 35.8 mil. USD

Highlight(s)

- 570 MW new capacity was installed, reaching a total of 5.2 GW.
- Large-scale commercial offshore wind build-out has started with a total of 188 MW in 2022 and 2023.
- The Green Innovation Fund (GI Fund) established within NEDO provides ongoing support for companies, from research and development to demonstration to real-world social implementation.

Market Development

Targets and Policy

The large-scale offshore wind farms operating in Japan as of 2023 have been located in port areas. The Port Act governs this wind farm installation. Due to the large-scale development of offshore wind farms, a law governing wind farms in general sea areas, the Act on Promoting the Utilisation of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities, was passed and came into effect in April 2019. On the 12th of March, 2024, this law was amended to expand the scope of application and allow long-term installation of offshore wind power generation facilities in exclusive economic zones (EEZs). Project implementers were selected through public solicitation based on the act. In December 2021, during Round 1, four locations were select-

ed, and in Round 2, three locations were selected and announced in December 2023, with one location added in March 2024 (Figure 2).

A feature of the upcoming Round 2 is the adoption of the FIP (Feed in Premium) system. Round 1 was based on the FIT system, but FIP is based more on market principles, so Round 2 is characterised by providing further support for the independence of the wind farm industry. The Green Innovation Fund (GI Fund), established within NEDO by the government, shares ambitious and specific goals between the public and private sectors. It provides ongoing support for companies tackling these goals, from research and development to demonstration to real-world social implementation. The 18 projects in the four fields of the first phase of the wind power GI Project were accepted and began in April 2022. The next projects will start in 2024.

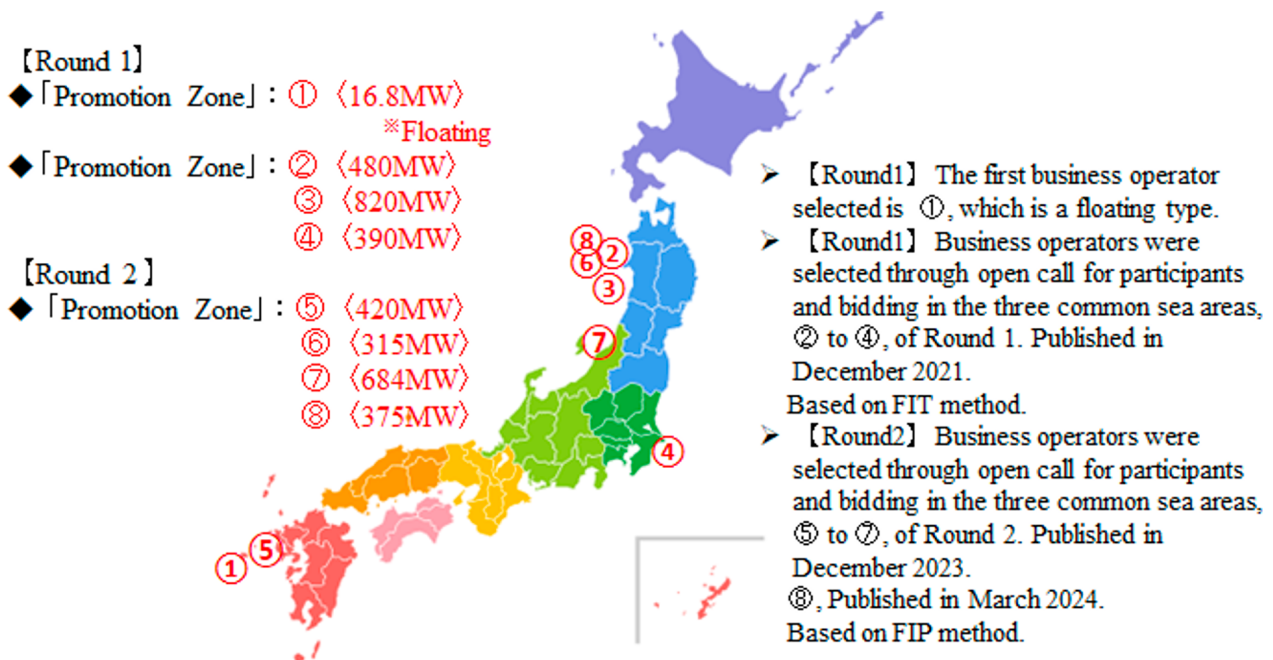


Figure 2: Selection status of operators in promotion zones based on the Act on Promoting the Utilisation of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities.

Progress and Operational Details

Japan installed 572 MW of new wind power capacity in 2023. Wind power deployment increased by 8.5% in calendar year 2023 compared to 2022. Cumulative wind power capacity at the end of 2023 reached 5,213 MW with 2,626 turbines. Of this, offshore wind power capacity was 188 MW. Offshore wind power increased by 52.7 MW compared to 2022, when the first large-scale commercial wind power plant in Japan became operational. It is expected that commercial offshore wind farm build-out will continue. Japan's capacity factor (national average) in 2023 was 21.2%, fairly flat compared to FY2022. In 2023, the total amount of electricity generated by wind power was approximately 9.16 TWh or 1.09% of the national electricity demand of 844.4 TWh.

Matters Affecting Growth and Work to Remove Barriers

The Japanese government's Green Growth Strategy aims to achieve both carbon neutrality and economic growth through the deployment of large amounts of renewable energy.

For this reason, a particular focus is placed on research, development, and system design in hopes of lowering the cost of renewable energy and strengthening the competitiveness of the wind industry. R&D and real-world social implementation using the GI Fund for offshore wind power have been ongoing since 2022, to projects proposed by the private sector. The progress and results were confirmed through monitoring by a third-party committee, which evaluated bottlenecks and provided advice and solutions. These will be utilised in the development of Phase 2 of the GI Projects, which begins in 2024. The Cabinet approved amendments to these laws on the 12th of March, 2024, and they are under deliberation in the Diet as of the 15th of April, 2024. The law expands the scope of application and allows long-term installation of offshore wind power generation facilities in EEZs.

RD&D Activities

National Research Initiatives and Results

During the first phase of the GI Projects, 18 projects began in 2022 in the following four fields using the GI

Fund to develop technology related to lowering the cost of offshore wind power generation:

1. Projects for the development of next-generation wind turbine technology.
2. Development of low-cost technology for manufacturing and installing floating foundations.
3. Development of offshore wind-related electrical system technology.
4. Projects for upgrading offshore wind power operation and maintenance.

A third-party committee conducted a project evaluation throughout 2022 and 2023. Multiple proposals have been adopted and research and development are being carried out on technologies that are expected to have wide-ranging applicability. Some projects completed Phase 1 in FY2023. The first example is a demonstration of blade inspection technology using a drone (Opening photo), an example of one of the advanced operation and maintenance technologies. The second example is the result of a study on



Photo 1: Exterior view of floating foundation mock-up.

Source: <https://www.tokyo-gas.co.jp/news/press/20240126-01.html>

manufacturing methods for floating foundations. A mock-up of the floating foundation was produced (Photo 1). These concrete results will contribute to the development in Phase 2 of the GI Projects.

In addition, the Ministry of Economy, Trade and Industry (METI) and NEDO are also supporting major national wind power RD&D programs in Japan using the traditional budget framework of grants from METI to NEDO. RD&D related to offshore wind power was carried out in the following areas.

1. Technical research and development for offshore wind power generation.

NEDO conducted demonstration research and elemental technology development on a low-cost floating offshore wind power generation system that targets water depths of 50 to 100 metres, which is relatively shallow for floating offshore wind power generation. NEDO will conduct a feasibility study, including a selection of technical issues and cost evaluation, with an eye on the commercialisation of floating offshore wind power generation.

NEDO has also carried out technology development and demonstration projects related to advanced foundation structures and construction technologies that will contribute to lowering the cost of offshore wind power generation systems.

2. Support project for the deployment of wind power generation.

NEDO has conducted a review of wind conditions related to the deployment of offshore wind farms, performed ocean surveys and environmental impact assessments, and overseen designs and construction methods for wind turbines, foundations, submarine cables, substations, etc., in addition to looking at the actual state of wind turbine failure. Based on this, NEDO has compiled materials and fundamental data re-

lated to power generation costs that will contribute to the commercialisation of offshore wind farms.

Collaborative research

Japan participated in the following nine IEA Wind TCP Tasks in 2023:

- Task 11. Wind Strategy, Collaboration & Outreach on Urgent Topics of Wind Energy Research (SCOUT).
- Task 25. Design and Operation of Energy Systems with Large Amounts of Variable Generation.
- Task 28. Social Acceptance of Wind Energy Projects.
- Task 44. Wind Farm Flow Control.
- Task 46. Erosion of Wind Turbine Blades.
- Task 49. Integrated Design on floating wind Arrays (IDEA).
- Task 52. Large-Scale Deployment of Wind Lidar.
- Task 53. Wind Energy Economics.
- Task 54. Cold Climate Wind Power.

Japan also participates in many maintenance teams, project teams and working groups as part of IEC TC 88. Japan is a member country of IC8: Renewable and Clean Hydrogen - Mission Innovation [2] and wind RD&D also contributes to that mission.

Impact of Wind Energy

Environmental Impact

Wind power generation led to a reduction of about 4.0 million tons of CO₂ in Japan in 2023. This is equivalent to 0.40% of Japan's energy-derived CO₂ emissions and continued

the trend from the previous year, which saw a reduction of 0.38%. Japan aims to reduce its energy-derived CO₂ emissions by 25% of the 2013 amount by 2030, so further reductions from the use of wind energy are expected.

Economic benefits and industry development

In the past, many of the initiatives to counter environmental issues and use renewable energy have been regarded as costs for the companies and organisations working on them, which led to economic growth constraints. However, the Carbon Neutrality by 2050 initiative suggests a change of mindset, stressing the need to see these efforts as growth opportunities rather than costs. Proactive measures will bring about changes in industrial structure and social economics, and will lead to future growth. The Green Growth Strategy outlines 14 fields that are expected to grow in the future and sets ambitious goals to be met in each field. At the same time, it mobilises all policy tools such as budgeting, taxation, regulation/standardisation, and private fund guidance. The Japanese government will do its utmost to support companies' efforts because, through them, Japan anticipates an annual economic boost of approximately JPY 140 trillion (USD 932.9 billion) in 2030 and approximately JPY 290 trillion (USD 1.932 trillion) in 2050.

Next Steps

Japan's total power generation capacity is expected to increase steadily in the coming years as onshore wind power projects come online and commercial offshore wind farms continue opening and operating, with a corresponding effect on Japan's economy. Furthermore, with the aim of promoting the domestic wind power generation industry in the future, measures are being taken to strengthen Japan's industrial capabilities in offshore wind power

development. Many offshore wind projects are in the pipeline as publicly solicited occupancy plans submitted by businesses were approved in the promotion zones (eight zones).

NEDO recognises that reducing the cost of offshore wind is key to implementing offshore wind projects. Research and development for the Phase 2 projects is scheduled to be considered after the Phase 1 projects have progressed further. NEDO will also consider projects for FY2024 under the existing budget framework. This way, NEDO will promote research, development and the revitalisation of related domestic industries.

References

[1] NEDO, Green Japan, Green Innovation.

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

[2] IC8: Renewable and Clean Hydrogen - Mission Innovation.

<https://www.mission-innovation.net/our-work/innovation-challenges/renewable-and-clean-hydrogen/>