



Report 2022

# Japan

Inspecting wind turbine blades using a drone (demonstration test in NEDO support project).

**Author** Yoshitomo Watanabe, Offshore Wind & Ocean Energy, New Energy Technology Department, New Energy and Industrial Technology Development Organization, Japan.

**As of the end of 2022, Japan's wind power capacity will reach 4,802MW (see Figure 1). Most of the wind power introduced in Japan is onshore wind. The total number of wind turbines is 2,622, which will increase by 72 in 2022.**

The single-year introduction amount in 2022 was 110% compared to 2021. One of the topics was the start of operation of Japan's first large-scale commercial offshore wind farm. Specifically, 83.4MW of offshore wind increased in 2022. The country's capacity factor (average national capacity factor) in 2022 was 21.5%, and the proportion of wind power in Japan's total electricity supply and demand was 1.0%. These numbers

were almost the same as in 2021. In research and development, the National Research and Development Corporation New Energy and Industrial Technology Development Organization (NEDO) is conducting national projects to promote offshore wind power with the aim of reducing the cost of offshore wind power. The Green Innovation Project (GI project), which started in 2021, is progressing in earnest, and concrete results are

**Table 1. Key Statistics 2022: Japan**

Total (net) installed wind power capacity	4.80GW
Total offshore capacity	0.14 GW
New wind power capacity installed	0.23 GW
Decommissioned capacity (in 2022)	0.01 GW
Total electrical energy output from wind	8.83 TWh
Wind-generated electricity as percentage of national electricity demand	1.01%
Average national capacity factor**	21.5%
Target	10 GW of wind power capacity by 2030
National wind energy R&D budget	6.90 bil JPY; 55.1 mil USD

beginning to appear. The results are monitored by a third-party committee, which confirms the results and provides advice to project implementation companies.

## Highlight(s)

After the Green Innovation Fund (GI Fund) was established at NEDO by the government, a national research and development agency, the Green Innovation Project (GI project), wind power-related specific projects for the first phase were adopted and started by April 2022, and are now in full swing. The wind power GI project has set four themes with the goal of reducing the cost of offshore wind power. These are the development of (1) next-generation wind turbine technology, (2) low-cost technology for manufacturing and installing floating bodies, (3) offshore wind-related electrical system technology, and (4) sophistication of offshore wind operation and maintenance. It's a project. In these four areas, NEDO received project proposals from companies and selected a total of 18 projects.

## Market Development

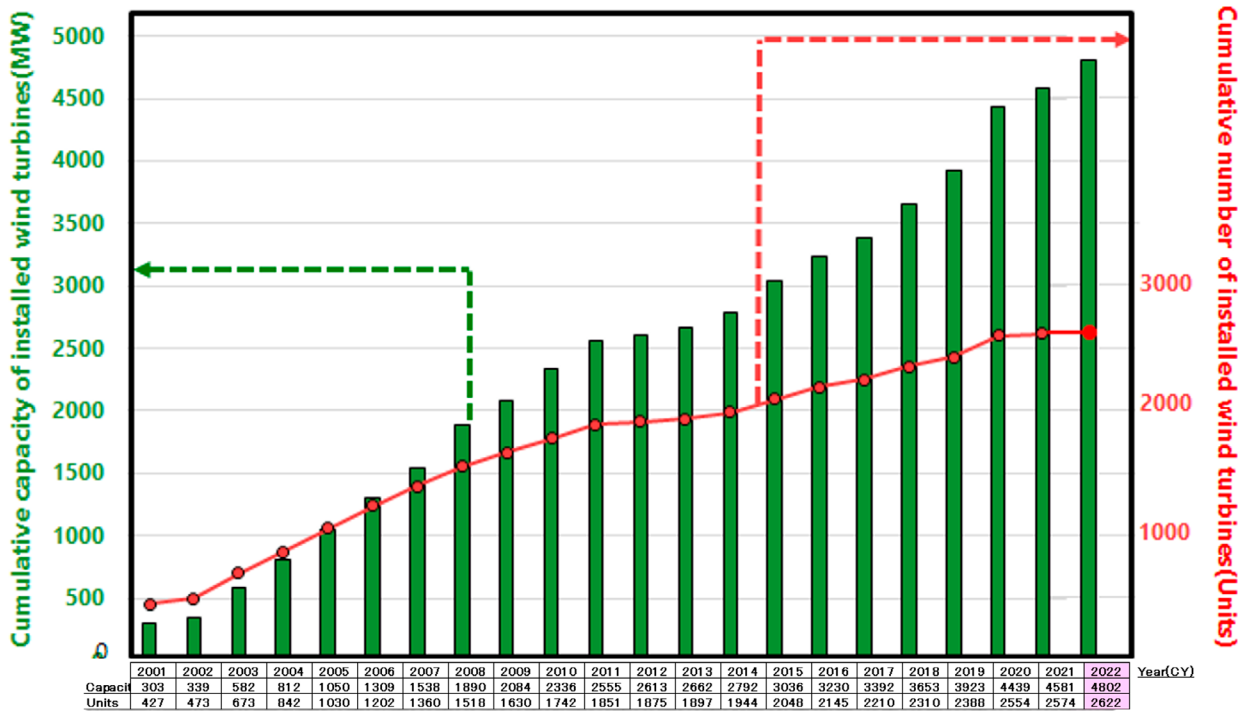
### Targets and Policy

The Japanese government has established the "GI Fund" at NEDO. This is to create a "virtuous cycle of economy and environment" toward the 2050 carbon-neutral goal. When companies, etc. carry out long-term initiatives with an eye toward social implementation in priority areas for which implementation plans have been formulated in the Green Growth Strategy, which is an industrial policy, it is important to continue from research and development and demonstration to social implementation. NEDO supports this. (See Reference 1). Offshore wind power is one of the priority areas, and implementation is in line with the offshore wind industry vision discussed by the public-private council for strengthening the industrial competitiveness of offshore wind power, and the technology development roadmap drawn up by the public-private council and NEDO. The government has approved a publicly solicited occupancy plan submitted by a business operator selected through a public solicitation for the promotion area off the coast of "Goto City, Nagasaki Prefecture", which is graded "Offshore renewable energy power generation facility development pro-

motion area" based on the Renewable Energy Sea Area Utilization Act, in April 2022. In addition, in the same way, for "Oki of Noshiro City, Mitane Town, and Oga City, Akita Prefecture", "Oki of Yurihonjo City, Akita Prefecture", and "Oki of Choshi City, Chiba Prefecture", each submitted by business operators selected through public recruitment. The publicly solicited occupancy plan has been approved (December 2022). As a result, the schedule for applying for FIT certification and commencing onshore and offshore construction has begun.

### Progress and Operational Details

Japan installed 233 MW of new wind power capacity in 2022. Cumulative wind power capacity at the end of 2022 reached 4,802 MW with 2,622 turbines. Of this, offshore wind power capacity was 135MW. Offshore wind increased by 83.4MW compared to 2021. This is because full-scale commercial wind farms in Japan have started operating (Figure 2). Commercial offshore WF operations are scheduled to begin in the future. In 2022, the total amount of electricity generated by wind power generation was approximately 8.83TWh, or 1.01% of the national electricity demand of 872.2TWh.



Source: Japan Wind Power Association

Figure 1: Deployment and installed capacity of wind power in Japan.



Figure 2: The first large-scale commercial offshore wind farms in Japan. Photo Credit: Akita Port Wind Farm.

## Matters Affecting Growth and Work to Remove Barriers

A “Green Growth Strategy” was formulated to support Japan’s “2050 Carbon Neutrality”, and the “GI Fund” was established at NEDO in connection with this Green Growth Strategy. Project proposals for research plans and social implementation using GI funds for offshore wind power were received from companies in line with the roadmap submitted by NEDO at a public-private council. An important outcome is that many concrete projects were proposed through close communication between the public and private sectors. The projects selected from among these will realize the development of wind-related elemental technologies identified from the perspective of strengthening industrial competitiveness and reducing costs. Also, due to the “the Act of Promoting Utilization of Sea Areas in Development of Power Generation Facilities using Maritime Renewable Energy Resources” established by the government, progress is being made in realizing windfarm that has gained the understanding of local communities and wind power industry, in the “Ocean Renewable Energy Power Generation Facility Development Promotion Area”.

## RD&D Activities

### National Research Initiatives and Results

A technology development project related to “lowering the cost of offshore wind power generation” has begun using the “GI Fund” toward the 2050 carbon neutral goal. The first phase (2021-2024 or 2025) will address the following four areas. (Figure 3)

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

In January 2022, 18 themes were selected in 4 areas. The specific development of these technologies will begin in 2022. In principle, Phase 1 is a maximum of 5 years (Area 1) or

3 years (Area 2, 3 and 4). The total budget for the entire period (10 years of Phase 1 and Phase 2) of this “Cost Reduction of Offshore Wind Power Generation” project is scheduled to be 119.5 billion yen.

METI and NEDO have also used the traditional budget framework (METI to NEDO grants) to develop and manage the major wind power research and development programs in Japan. The offshore wind power generation technology research and development program (2018-2022) is focused on the following technology areas:

- Barge-type floater: NEDO developed and demonstrated a floating wind turbine that can be installed in seawater over 50 meters or deeper. In 2019, installation was completed at a depth of 50 meters, 15 km off the coast of Kitakyushu City, and a demonstration operation was started. Demonstration operation has just been carried out in FY2022.
- Newly designed floating body: NEDO has been working on the development of new elemental technology for floating offshore wind power generation systems. A survey was conducted in the

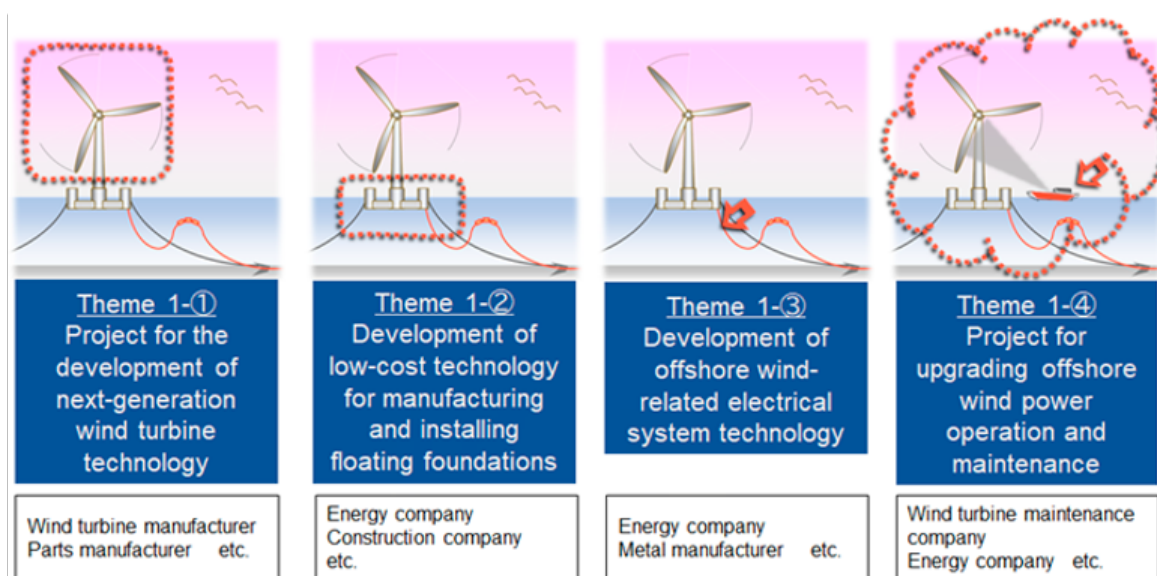


Figure 3: Green Innovation Fund (Phase 1)/Project to Achieve Lower Costs for Offshore Wind Power.

latent sea area and various designs were drawn up using advanced elemental technologies. NEDO also conducted a feasibility study to determine the content of the demonstration experiment and worked on the production of the demonstration turbine. The newly designed floating body aims to reduce the power generation cost after 2030 to 20 yen/kWh (0.16 EUR/kWh, 0.18 USD/kWh). This phase has just ended in FS 2022.

- Research and development on advanced operation of power turbines: NEDO has developed advanced operation support technology for wind turbines. The purpose is to reduce domestic wind turbine downtime by increasing wind turbine utilization rate to over 97%. To that end, NEDO is developing a wind turbine operation and maintenance support system that can be used by domestic wind power generation companies.
- Fixed-bottom offshore wind power plant low-cost construction technology development: NEDO has developed low-cost construction technology for fixed-bottom offshore wind power generation. Under the joint industrial program, based on a feasibility study on the development of cost-reduction technology for foundation work, NEDO conducted a sea area selection survey and designed and produced equipment for demonstration in the test sea area. This project has just ended in FS 2022.
- NEDO supports the installation of fixed-bottom type offshore wind power generation. Support in the harbour sea area began in 2013. NEDO has also been carrying out a feasibility study project for offshore wind power generation in the general common sea area. In this project, basic surveys of the seafloor, weather, sea conditions, and so on,

necessary for installing offshore wind power generation facilities in general common sea areas (multiple actual sea areas) are being conducted. The results of these surveys will be published and will be made widely available to the public.

- NEDO has engaged in two research and development projects. One is the research and development of advanced wind turbine maintenance technology, and the other is the research and development of advanced wind turbine components technology. The purpose of the first research and development project is to develop technology that reduces downtime leading to a more stable electricity supply. This will contribute to enhancing the competitiveness of industries related to the maintenance of offshore wind turbines. The purpose of the second research and development project is to develop technology that will improve the technology available to domestic wind turbine components manufacturers, thereby improving the rate offshore wind turbines are installed in Japan. These projects have ended in FS 2022.

### Collaborative Research

Japan participated in the following eight IEA Wind TCP tasks in 2022. Task 40 Downwind Turbine Technologies, in which Japan serves as OA and Co-OA, began in 2018, the phases were summarized in 2021, and a report was prepared and completed in the spring of 2022.

- Task 11 Base Technology Information Exchange.
- Task 25 Design & Operation of Energy Systems with Large Amounts of Variable Generation.
- Task 28 Social Science of Wind Energy Acceptance.
- Task 30 Offshore Code Comparison Collaboration, Continued, with Correlation (OC6).

- Task 31 WAKEBENCH: Benchmarking of Wind Farm Flow Models.
- Task 44 Farm Flow Control.
- Task 52 Large-Scale Deployment of Wind Lidar.
- Task 53 Wind Energy Economics.

Japan also participates in many maintenance teams, project teams, and working groups as part of the IEC TC 88.

## Impact of Wind Energy

### Environmental Impact

The amount of CO<sub>2</sub> reduced by wind power generation in 2022 was about 4.0 million tons of CO<sub>2</sub>, which is equivalent to 0.38% of Japan's energy-derived CO<sub>2</sub> emissions. Last year it was 0.39%, Last year it was 0.39%, so the contribution was almost the same. Japan aims to reduce its energy-derived CO<sub>2</sub> emissions by 25% compared to 2013 by 2030, so further contributions from wind energy are expected.

### Economic Benefits and Industry Development

Many of the environmental measures that have been made in the past have been regarded as costs for the companies and organizations that are working on them, which leads to growth constraints. However, in the Carbon Neutrality by 2050 initiative, a change of mindset is mentioned, 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.

To realize carbon neutrality, it is necessary to drastically change conventional business models and company strategies, and the like. However, there are hurdles to realizing carbon neutrality by 2050. To overcome these hurdles, the government must present as concrete a vision as possible, set high goals, and

create an environment where private companies can easily take on challenges. Therefore, the Green Growth Strategy outlines 14 fields that are expected to grow in the future, sets ambitious goals to be aimed at in each field, and at the same time mobilizes all policy tools such as budget, tax, regulation/standardization, and private fund guidance. The Japanese Government will do its utmost to support companies' efforts. Through these efforts, Japan anticipates an annual economic boost of approximately 140 trillion yen in 2030 and approximately 290 trillion yen in 2050. (This part is reposted from 2021AR).

## Next Term

Wind power deployment increased by 10% in calendar year 2022 compared to 2021. Japan's total power generation capacity is expected to increase steadily in the coming years as onshore wind power projects steadily come online and commercial offshore wind farms are also expected to continue opening and operating. There will also be an impact on the economy. Furthermore, to develop and grow the domestic wind power generation industry in the future, measures are being taken to strengthen Japan's industrial capabilities in offshore wind power development. Additionally, many offshore wind projects are in the pipeline. Regarding offshore wind power, publicly solicited occupancy plans submitted by businesses were approved in the promotion areas (4 areas).

NEDO recognizes that reducing the cost of offshore wind is key to implementing offshore wind projects. Research and development for the GI fund phase 2 projects are scheduled to be considered after the phase 1 projects have progressed. NEDO will also consider projects from the next phase FY2023 under the existing budget framework. This way, NEDO will promote research and

development and the revitalization of domestic-related industries.

## References

[1] NEDO, Green Japan, Green Innovation.

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