

January 30, 2019

(original Japanese version published on 7 January 2019)

Recommendation

For Expansion of Sustainable Solar Power

Solar power in Japan has been steadily expanding since the Feed-in Tariff (FiT) scheme was instituted in 2012, playing a major role in reducing greenhouse gases and ensuring stable power supplies. It has also greatly contributed to increasing employment and revitalizing regional economies.

There have been these positive achievements, but in recent years cases have also been reported of large-scale solar power projects having a negative impact on the natural environment. Development projects that lead to landslides or ecological destruction must not be tolerated even in the name of renewable energy development.

Solar power is a decentralized renewable energy that can be introduced in a variety of formats. There are many cases of even large-scale power facilities being built and operated while limiting the impact on the natural environment, through use of idle land, etc. The following will provide an overview of solar power expansion in Japan and then present issues that need to be addressed in order to further expand sustainable solar power going forward.

1. Overview of Installed Solar Power Capacity in Japan

According to documents from the Agency for Natural Resources and Energy, cumulative installed solar power capacity stands at 45.97 GW (AC) as of June 2018. Of this total, the capacity of facilities (new and transitional) subject to the FiT scheme, which can be determined from the breakdown by project scale, is 45.35 GW.

The installed capacity at mega solar power plants, facilities with capacity of 1,000 kW (1 MW) or more, is 14.56 GW, accounting for 32.1% of total installed capacity subject to the FiT scheme. There are 6,207 mega solar facilities, so Japan already has over 6,000 large-scale solar power facilities. The installed capacity of residential solar power units (less than 10 kW) subject to the FiT scheme is 10.27 million kW, 22.6% of total installed capacity. The remaining amount is almost entirely non-residential solar power facilities from 10 kW to less than 1,000 kW.

Summarizing the above, over 30% of solar power facilities operating in Japan are 1,000 kW or more, over 20% are residential, and the remainder, less than 50%, are non-residential facilities with capacity of less than 1,000 kW.

In addition to the above, facilities certified for the FiT scheme but not yet in operation have a total capacity of around 26.00 GW. Adding in these facilities brings the number of large-scale power projects with capacity of 1,000 kW or more to 9,170. The figures on projects for which there are concerns over their impact on the natural environment include such facilities not yet in operation, so 9,170 will be used as the statistical parameter in the following discussion.

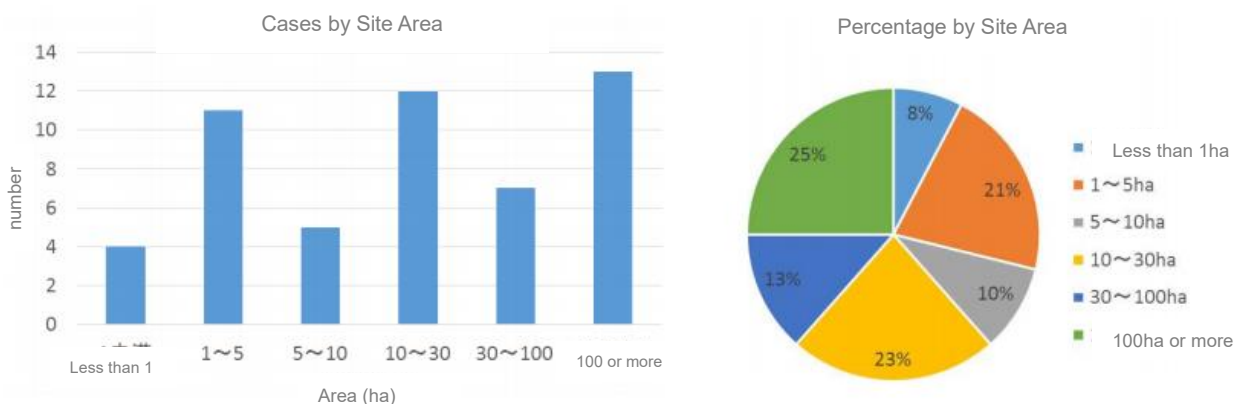
2. Scale and Site Characteristics of Problematic Projects

An overview of installed solar power capacity in Japan has been presented above. Now let's look at the extent of potentially problematic development projects, in terms of damage to the natural environment, and their site characteristics.

To identify the problematic cases, a pioneering survey has been conducted by Noriaki Yamashita of the Institute for Sustainable Energy Policies based on an analysis of newspaper articles and other media reports. The Working Group Regarding Basic Concept on Environmental Impact Assessments Related to Solar Power Generation Facilities and others, established by the Ministry of the Environment in August 2018, also compiled survey results based on an analysis of newspaper reports.

First, Yamashita's study found that trouble had been reported for 68 projects as of August 2018, and that 52 of these cases involved facilities with capacity of 1,000 kW or more¹. The Ministry of the Environment's survey produced a similar result. At the third meeting of the above-mentioned commission held on October 12, newspaper reports from January 1, 2016 to July 11, 2018 were reviewed and 69 projects were identified. The MOE's study did not directly provide figures for the number of cases for each size of project, but there were 48 cases involving sites of one hectare or larger, which are almost entirely power facilities of 1,000 kW or more.

Figure 1 Problematic Projects by Site Area



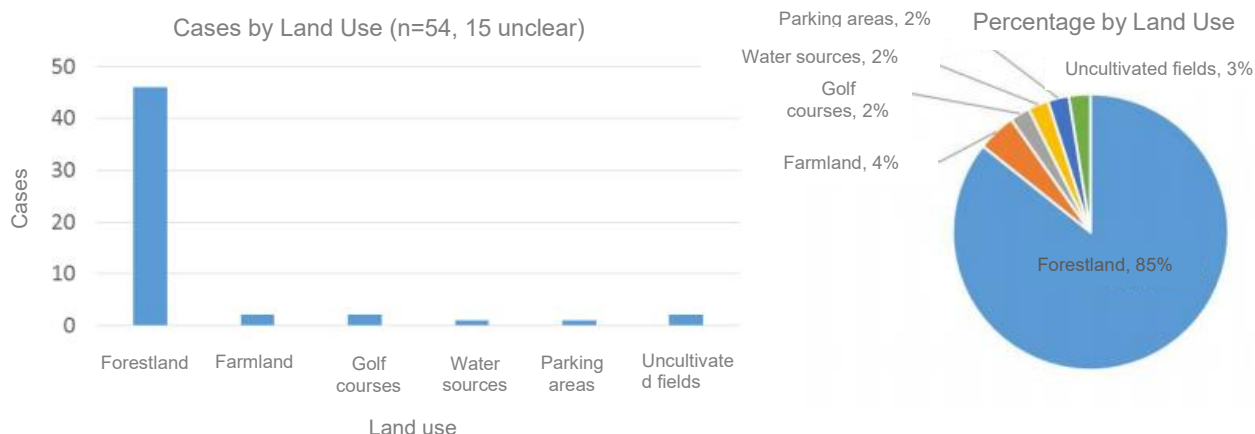
Source: Document from the Ministry of the Environment's Working Group Regarding Basic Concept on Environmental Impact Assessments Related to Solar Power Generation Facilities and others; compiled by the Ministry of the Environment in August 2018 based on newspaper reports from January 1, 2016 to July 11, 2018

In sum, in both Yamashita's and the Ministry of the Environment's studies, there were around 50 cases of development projects of 1,000 kW or more identified as problematic.

The MOE's survey classifies site locations by land use designation, and 85% of the problematic cases were located in forested areas.

¹ Yamashita, Noriaki. "Learning from Cases of Local Trouble for Promoting Solar Power in Regional Japan." *Kagaku*. Iwanami Shoten. October 2018 issue, page 1016.

Figure 2 Problematic Projects by Land Use Designation



Source: Same as Figure 1.

According to the MOE’s summary, the main problems reported related to environmental protection, were 1) Occurrence of landslides or other natural disasters, 2) Impact on scenery, 3) Occurrence of turbid water and its impact on water quality, 4) Impact on the natural environment from deforestation, and 5) Insufficient explanation to residents. The description of these problems also suggests that a majority of cases reported as problematic involved forested regions.

When development is conducted on one or more hectares in a forested area, under the Forest Act, forest development permission must be received. According to documents from the Forestry Agency, in the six years between 2012, when the FiT scheme was introduced, and 2017, forestland development permission for the purpose of solar power development was granted nationwide in 1,175 cases. There are 9,170 cases of certified solar power development projects of 1,000 kW or more, roughly equivalent to forestland development of one or more hectares, which shows that around 13% of large-scale solar power facilities involve deforestation.

In order to more specifically identify the site characteristics of large-scale solar power development projects, we conducted a site survey of the top 100 projects by facility capacity (DC) among approved development projects as of June 30, 2018. The largest was 480,000 kW and the smallest (100th ranked) was 46,000 kW. Of these 100 projects, 48 had forests within the development site. This percentage is significantly higher than the number of forestland development projects of one or more hectares. This shows that a fairly large number of particularly large solar power development projects, on a scale of several tens of thousands of kilowatts or larger, will be carried out going forward in forested areas. Based on the above analysis, the scale of problematic cases and their site characteristics can be summarized as follows:

- There are approximately 50 projects that have been reported in the media as problematic, less than one percent of the 9,170 large-scale solar power projects that have been approved.
- Of these problematic projects, 85% are located in forested areas.
- There are total 1,175 forestland development projects for the purpose of solar power development, and supposing that all of the approximately 50 projects reported in the media as problematic are conducted in forested areas, they would be around 4% of this total.
- Solar power development in forested areas accounts for around 13% of large-scale solar power development overall, but when the scale is further increased to over several tens of thousands of kilowatts, the percentage that includes forested areas increases.

The approximately 50 projects reported as problematic are less than one percent of the total number of approved large-scale projects and around 4% of the number of development projects in forested areas. The percentages themselves are by no means high, but the fact that projects which have an enormous impact on the natural environment exist should by no means be taken lightly. Also, it is possible that there are other projects causing a major impact on the natural environment that have not been reported in the media and it is possible that they will increase going forward.

At the same time, arguments opposing large-scale solar power development as a whole on the grounds of the existence of these problematic projects are also not valid. As grounds for criticizing these problematic projects, there are even those who deny the large role played by solar power in reducing carbon dioxide emissions.

What is needed now are strict restrictions on development projects that cause a major impact on the natural environment and active promotion of solar power in harmony with nature because of its ample potential as a decentralized power source and the large role it will play in averting catastrophic climate change.

3. Background of Problematic Projects in Forested Areas and Direction of Response

(1) Background of problematic projects in forested areas

Large-scale environmental destruction in forested areas has been repeated with each development boom, including that in golf courses or resorts. The purpose of the Forest Act, which applies to forest areas, is “to promote sustained forest cultivation and forest productivity and contribute to the protection of the nation’s land and development of the national economy” (Forest Act, Article 1). It states “development of the national economy” with a primarily focus on both forest preservation and development.

Moreover, the forestland development permission system (Forest Act, Article 10.2) stipulates that prefectural governors must permit development of privately owned forests subject to a regional forest plan if technical standards are met. Even supposing development on an unprecedented scale or the existence of an entirely new set of concerns, there is no rule for judging such cases separately.

Japan’s land use regulatory scheme is generally seen as being characterized as “not strict, but rigid.” Based on the City Planning Act, Forest Act, Cropland Act and other laws, region and zone designations are made and limited regulations are applied in line with the purpose of the individual laws. While some needed regulations may not be established on the basic idea that owners are free to use their land as they choose, in other cases, such as with the Cropland Act, rigid regulations are in place.

Japan’s land use regulations are particularly lenient in forested areas, which leads to large-scale solar power projects being located in forestland; the same problem is occurring that was previously seen with the rampant development of golf courses and resorts.

In addition, solar power development project has its specific factor. Solar power facilities are not used with people present at all times; they are characterized by the fact that they can be established on even very steep slopes as long as they are exposed to sunlight. For this reason, land that could not be used for past residential or resort development gets chosen as the sites for large-scale development projects.

Another factor spurring forestland development is high purchase prices in the initial period of the FiT scheme. If a high purchase price is guaranteed, there is a strong likelihood a project will be profitable even if it involves engineering work that alters the existing natural landscape on a large scale, such as with large-scale embankments and slope cutting.

(2) Direction of response

In order to prevent large-scale solar power facilities from causing ecological destruction, landslides and other major problems, central, prefectural and local governments need to cooperate in introducing and adjusting necessary systems.

At the level of the central government, the Ministry of the Environment is currently considering putting solar power projects under the jurisdiction of the Environmental Impact Assessment Act. Also, the Ministry of Economy, Trade and Industry is reviewing technical standards related to slope establishment for solar power facilities in order to limit landslides and is making considerations in the direction of expanding the range of slopes subject to these standards. Such technical standards focused on land form and nature are also effective at ensuring appropriate sites are selected and should be considered as soon as possible. Further, in addition to such measures, it is necessary to review the provisions and enforcement of the Forest Act and Cropland Act to ensure that high renewable energy installations are made while protecting the natural environment.

At the same time, revisions to the FiT scheme in 2016 made it possible to revoke approval for projects in violation of local ordinances in order to facilitate greater harmony with local communities. Local government bodies are expected to take active initiatives based on these revisions. Specifically, as an example, the following types of initiatives can be envisioned:

1) Site adjustment

- Establish ordinances that stipulate rules for site-related notifications and site adjustments, etc.
- Incorporate local opinions and reduce environmental impact through environmental assessment procedures

2) Site guidance

- Zoning to guide projects to appropriate sites
- (• Revisions to Cropland Act and Forest Act)

3) Prevent damage to natural environment when projects sited

- Revise nature protection ordinances and related regulations, guidelines, etc. (applicable scale, green space standards, technical standards, etc.)
- Revise standards for forestland development approval (ratio of remaining green space, restoration obligation, etc.)

4 Expanding Solar Power: Future Directions

(1) Expansion of solar power using rooftops

RTS Corporation, one of Japan's leading solar power consulting companies, announced in February 2018 its projection for 150 GW of installations to be possible in 2030 ("Recommendation for development of the PV industry (PV150) A standard-bearer 'PV power generation' in the era of great energy transition -Aiming to achieve 150 GW installation in Japan in 2030-"). According to this projection, with solar power expanding going forward, the biggest category will be facilities less than 10 kW and next will be 10-50 kW facilities. By location, the majority are expected to be installed on the rooftops of buildings, including houses, office buildings and warehouses. As shown by RTS' projection, rooftop solar power will likely play a central role in sustainable installations going forward.

(2) Installation of solar power on unused or low-use land

The large-scale solar power projects established thus far have often utilized former golf course and factory sites, so there are few cases of new environmental damage. Figure 3 shows the top 15 projects by size from among already-installed solar power facilities of 1,000 kW or higher. This shows that many projects have been developed on former factory or golf course sites.

For example, Oita Solar Power (82 MW) was constructed on idle land along the ocean, and Kagoshima Nanatsujima Mega Solar Power Plant (72 MW) was built on the former site of a heavy industry factory facing the ocean. The two mega solar plants in Fukushima Prefecture were built on the former site of a village destroyed in the tsunami and on land where salt damage has made farming near impossible. At Renatosu Soma Solar Park, local companies participate in repair and maintenance activities. In addition, with Minamisoma Mano Migita Ebi Solar Power Plant, Minamisoma City itself played a leading role in consolidating land and leasing it to the operator in order to achieve its renewable energy installation goal. The two projects were conducted under special circumstances, namely the extensive damage done by the tsunami, but in both cases the projects were connected with local contribution and revitalization.

Figure 3 Top 15 Installed Large-Scale Solar Power Plants

Name	Location	Output (MW)	Site
Setouchi Kirei Mega Solar Power Plant	Setouchi City, Okayama Pref.	235	Former salt marsh site
Eurus Rokkasho Solar Park (Takahoko site, Chitosedaira North site)	Rokkasho Village, Aomori Pref.	148	Forestland, uncultivated field
SoftBank Tomatoh Abira Solar Park	Abira Town, Hokkaido	111	Pastureland or uncultivated land
Hosoe Mega-solar Project	Miyazaki City, Miyazaki Pref.	96	Golf course site, planned
Oita Solar Power	Oita City, Oita Pref.	82	Reclaimed land (idle)
Kagoshima Nanatsujima Mega Solar Power Plant	Kagoshima City, Kagoshima Pref.	72	Former factory site
Kamikita Rokkasho Solar Power Plant	Rokkasho Village, Aomori Pref.	71	Forestland
Minamisoma Mano Migita Ebi Solar Power Plant	Minamisoma City, Fukushima Pref.	60	Disaster site
Furukawa Mega Solar Plant	Osaki City, Miyagi Pref.	57	Golf course
Former Shin Mine Country Club Solar Power Plant	Mine City, Yamaguchi Pref.	56	Golf course
Niigata Yotsugoya Power Plant	Niigata City, Niigata Pref.	56	Golf course site, planned
Hitachi Juo SolarPower Plant	Hitachi City, Ibaraki Pref.	56	Golf course, forestland
Renatus Soma Solar Park	Soma City, Fukushima Pref.	52	Disaster site
Orix 51M Tsu Mega Solar Power Plant	Tsu City, Mie Pref.	51	Golf course
Tahara Solar Wind Power Plant	Tahara City, Aichi Pref.	50	Factory site, planned

Source: Prepared by REI with reference to MOE's "List of Existing Large-Scale Solar Power Projects," prepared by the Renewable Energy Institute with reference to Document 3-4, for the fourth meeting of Working Group Regarding Basic Concept on Environmental Impact Assessments Related to Solar Power Generation Facilities and others. (November 11) and other sources.

(3) Promoting use of agricultural land

Development on agricultural land has major potential going forward. Japan has 420,000 hectares of abandoned farmland (previously cultivated land not cultivated for at least one year in the past and not expected to be cultivated again in the next several years), equivalent to 10% of the country's total farmland. Just in terms of ruined farmland, farmland not thought to be restorable in the future, there is around 180,000 hectares of such land. By appropriately using agricultural land that had already been used for farming through human labor, it will be possible to establish large-scale solar power facilities without making any new modifications to the natural environment.

An increasingly popular format for use of farmland is solar sharing, in which sunlight is used for both farming and solar power for the purpose of farming management. Facilities in this format are already being installed throughout Japan. Solar power facilities, including large-scale facilities, are being built on farmland that has not been effectively used in regions where depopulation and aging are progressing. There are cases of farmland where crops could not be cultivated, providing a new source of income through solar sharing.

To promote solar power development on such farmland going forward, it will be necessary to rationalize land use regulations related to agricultural land. Land use regulations under the Act on Establishment of Agricultural Promotion Regions (Agricultural Promotion Act) and Cropland Act are extremely strict and conversion to power project use is not easy. Enforcement of the Act on Promoting Generation of Electricity from Renewable Energy Sources Harmonized with Sound Development of Agriculture, Forestry and Fisheries, which was established in May 2014, made it possible under certain conditions to convert type 1 agricultural land which had not been permitted previously, but the regulations on farmland conversion under the Agricultural Promotion Act, applied to 90% of total farmland, remain as they are; this situation needs to be addressed.

(4) Restrictions on extra-large-scale development in forested areas

Among solar power development projects planned for forested areas, there are particular concerns over the serious impact on the natural environment by extra-large-scale projects, projects with development sites of nearly 100-200 hectares and capacity of several tens of megawatts. With such extra-large-scale projects, it is difficult to eliminate the concerns of residents that even if environmental protection measures are taken as required under the forestland development permission system, the project will still cause landslides or a major impact on the ecosystem. Unless consensus is formed through deliberations and adjustments with local government bodies and community residents, the rationality of promoting extra-large-scale development on forestland cannot be found.

As a renewable energy, solar power offers various benefits—it greatly reduces greenhouse gases, helps ensure power supply stability, and contributes to regional economies—and along with wind power it will play a large role in expanding renewable energy in Japan going forward. Primarily through utilizing rooftops and various types of unused land, low-use land and agricultural land, there is sufficient possibility for achieving large-scale expansion of solar power.