SUMITOMO MITSUI TRUST RESEARCH INSTITUTE

Japanese Infrastructure Market Updates

Current Status and Issues of Investment in Renewable Energy

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Sumitomo Mitsui Trust Research Institute

Contents

I Background

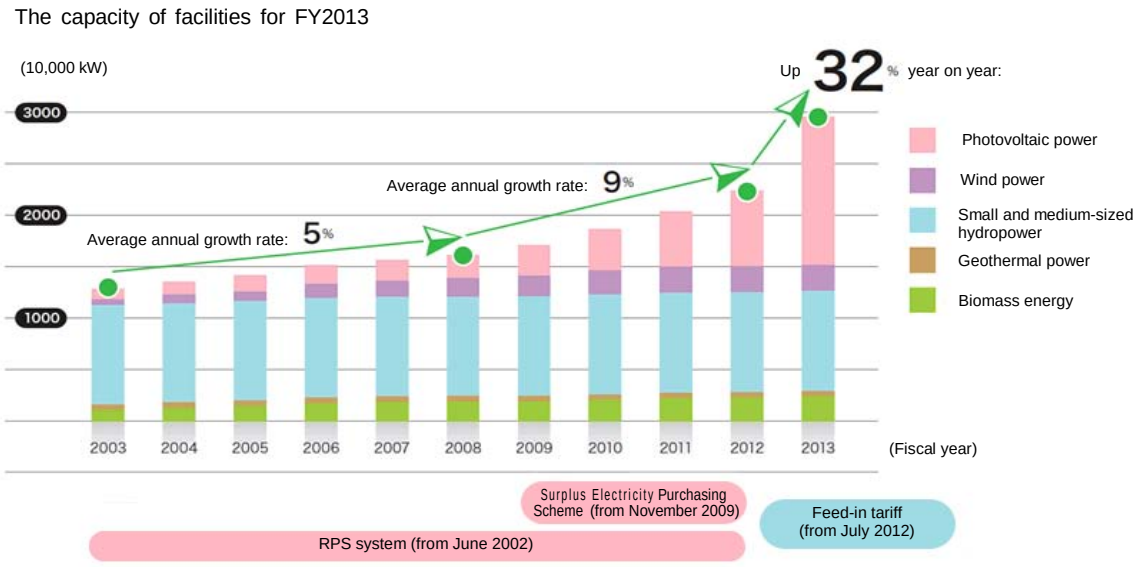
1 Renewable energy dealt with in this report

The Intergovernmental Panel on Climate Change (IPCC), which was established by the United Nations Environment Programme and another organization, defines renewable energy as any form of energy from solar, geophysical or biological sources that is replenished at a rate that equals or exceeds its rate of use. There are a number of kinds of renewable energy, including photovoltaic power, wind power, hydropower, wave power, and tidal force.

In Japan, the use of renewable energy had been discussed for some time and has recently begun to attract attention, particularly after the Great East Japan Earthquake, with the energy mix, which will be discussed later. In 2009, the Surplus Electricity Purchasing Scheme for photovoltaic power started, and in 2012, the Feed-in Tariff Scheme for photovoltaic power, wind power, hydropower, geothermal power, and biomass energy was introduced. After those events, renewable energy, especially photovoltaic power, has been promoted, and funds for power facilities have been established.

This report deals with photovoltaic power, wind power, hydropower, geothermal power, and biomass energy, which are covered by the Feed-in Tariff Scheme of Japan, as renewable energy.

Fig. 1.1 Trends in the capacity of renewable energy facilities

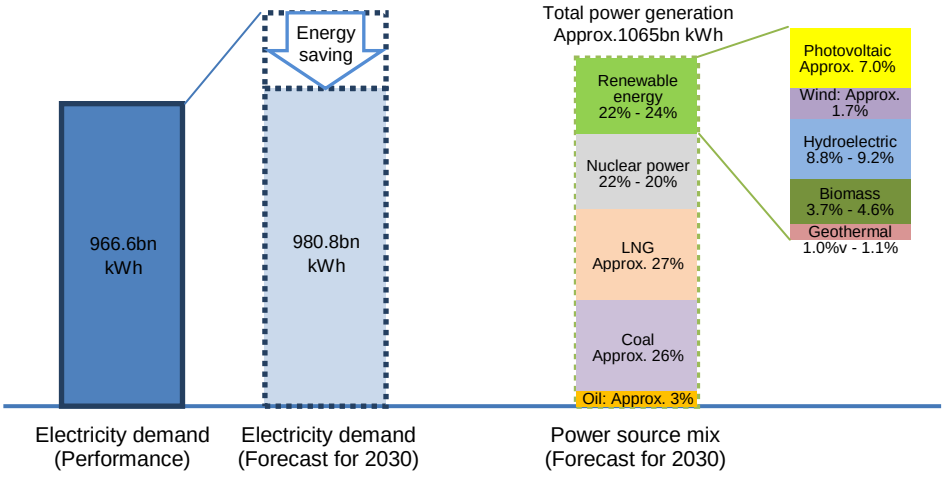


Source: “Energy in Japan 2014” of the Agency for Natural Resources and Energy

2 Outlook for long-term energy supply and demand in Japan (energy mix)

Based on the Basic Energy Plan, which was approved at a Cabinet meeting in April 2014, discussions are underway about the outlook for the long-term supply and demand of energy (energy mix) in Japan, including renewable energy, to achieve a desirable energy supply-demand structure in FY2030. Following discussions at the Long-Term Energy Supply and Demand Outlook Subcommittee (of the Advisory Committee for Natural Resources and Energy of the Agency for Natural Resources and Energy) from January 2015, the subcommittee presented its draft outlook on Japan's energy supply and demand at its tenth meeting on June 1. Public opinions on the draft are being sought until July 1. The specific policy objectives stated in the draft in relation to safety, energy security, economic efficiency, and environment (3E+S), which are considered to be basic issues in energy policy, include an improvement (to around 25%) in the energy self-sufficiency rate (the rate of primary energy necessary for life and economic activities that can be secured within the country) and a reduction in electricity costs. The draft also states its outlook for the power source mix in FY2030. It assumes that in FY2030, coal, oil, and LNG (thermal power generation) will account for around 26%, 3%, and 27% of total power generation, respectively. Nuclear energy and renewable energy are assumed to account for 20% to 22% and 22% to 24%, respectively (please refer to Fig. 1.2). The draft says that the outlook, including the outlook for the power source mix, needs to be reviewed in accordance with the Basic Energy Plan, which will be discussed every three years.

Fig. 1.2 Anticipated electricity demand and power source mix



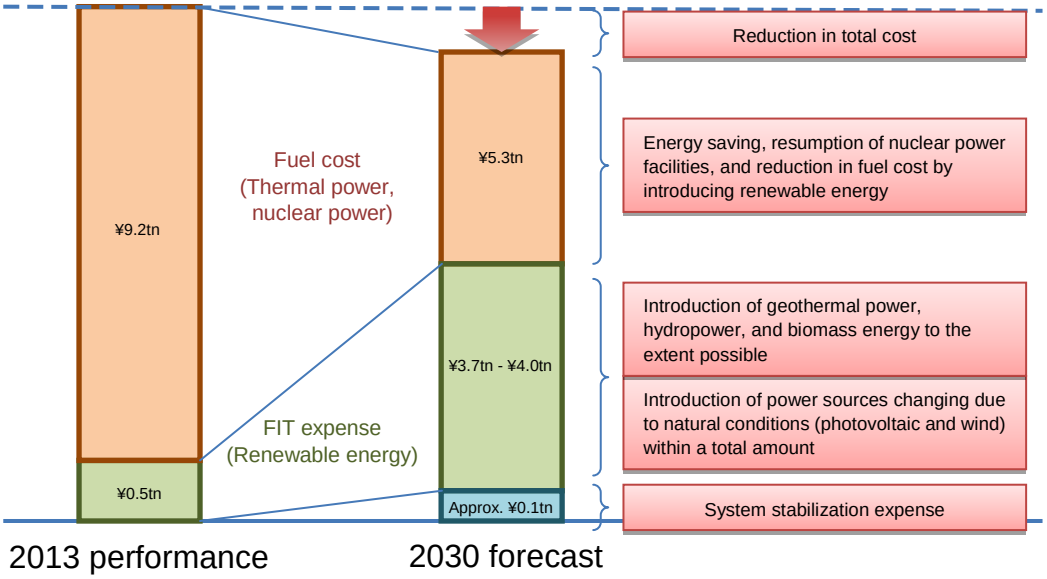
Source: Prepared by SMTRI based mainly on data of the Agency for Natural Resources and Energy

Japan has limited energy resources, such as oil and gas, and its energy self-sufficiency rate is relatively low compared with that of other advanced countries, even if nuclear power is included. Moreover, after the Great East Japan Earthquake, conventional energy, such as thermal power and nuclear power, has been facing challenges and needs to be reviewed. With all nuclear power facilities shut down, dependence on thermal power generation has increased, and electricity costs have climbed in association with rising fuel prices. In addition, greenhouse gas emissions have increased. We cannot overlook the effects of those factors on electricity users and the global environment. Meanwhile, renewable energy, which will be discussed below, is an ideal electric source, but it involves a number of challenges in terms of steady supply and electricity costs. Thus, in the energy mix, the continued use of nuclear power has to be assumed to some degree.

It is said that promoting the introduction of renewable energy requires that the “3E” conditions be met, and the introduction of (replacement of existing energy sources with) renewable energy in consideration of the characteristics of each electric source. According to this idea, for example, nuclear power as a base-load power source should be replaced by geothermal power, hydropower, and biomass energy, which are not easily influenced by natural conditions, and thermal power, which is needed as a power source whose output can be adjusted, should be replaced by photovoltaic power and wind power, whose output changes depending on natural conditions.

Electricity cost is an important factor. The introduction of renewable energy is anticipated to increase expense associated with the feed-in tariff scheme and requires initiatives related to the energy mix, including the promotion of energy saving and the resumption of operation of nuclear power facilities, to cover the increase in expense. Feed-in tariff expense, which currently accounts for around 5% of total electricity cost, is anticipated to increase to around 40% in FY2030. The continued introduction of renewable energy requires adjustments in consideration of the overall balance of energy sources. The chart below shows anticipated electricity costs (fuel cost, renewable energy feed-in tariff expense, and system stabilization cost) in FY2030.

Fig. 1.3 Anticipated electricity costs



Source: Prepared by SMTRI based mainly on data of the Agency for Natural Resources and Energy

3 Systems supporting renewable energy in Japan

3-1 Feed-in tariff (FIT)

The system that plays a central role in the promotion of renewable energy in Japan is the Feed-in Tariff Scheme for Renewable Energy (Feed-in Tariff, FIT). The first step in the direction of TIF is the enforcement of the Act on Special Measures Concerning New Energy Use by Operators of Electric Utilities (Renewables Portfolio Standard [RPS] Act) in April 2003. The RPS Act requires the use of electricity generated from renewable energy to a certain degree. With the enforcement of the Act Concerning the Promotion of Use of Non-fossil Energy Sources and Effective Use of Fossil Energy Materials by Energy Supply Business Operators (the Law Concerning Sophisticated Methods of Energy Supply Structures) in August 2009, the Surplus Electricity Purchasing Scheme started. The scheme worked from November 2009 to July 2012 and began promoting the use, albeit to a limited extent, of renewable energy.

FIT was introduced with the enforcement of the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities in July 2012. Unlike the Surplus Electricity Purchasing Scheme, which focused on photovoltaic power, FIT has expanded the scope of purchases to include wind power, hydropower, geothermal power, and biomass energy. In addition, FIT enables buyers to opt to purchase the full amount if generation capacity exceeds a certain level. FIT thus gives incentives to power producers (power sellers) and has become a major factor in the rapid increase in photovoltaic power generation.

Fig. 1.4 Purchase price and purchase period of major power sources (from April 2015 to March 2016)

Type of power	Classification of purchase (Type of biomass)	Purchase price (per kWh)	Purchase period
Photovoltaic	Less than 10 kW (excess electricity purchasing)	33 yen (no obligation to install power control equipment)	10 years
	10 kW or more	27 yen (from July 1, 2015) + consumption tax	20 years
Wind	20 kW or more	22 yen + consumption tax	20 years
	Less than 20 kW	55 yen + consumption tax	
Geothermal	15,000 kW or more	26 yen + consumption tax	15 years
	Less than 15,000 kW	40 yen + consumption tax	
Hydropower	1,000 kW or more, less than 30,000 kW	24 yen + consumption tax	20 years
	200 kW or more, less than 1,000 kW	29 yen + consumption tax	
	Less than 200 kW	34 yen + consumption tax	
Biomass	Woody biomass from lumber from thinning (less than 2,000 kW)	40 yen + consumption tax	20 years
	Woody biomass from lumber from thinning (2,000 kW or more)	32 yen + consumption tax	
	General woody biomass, remnants of agricultural produce	24 yen + consumption tax	
	General waste, other waste	17 yen + consumption tax	

Source: Prepared by SMTRI based on data of the Agency for Natural Resources and Energy

FIT plays an important role in addressing global warming and increasing the energy self-sufficiency rate, but faces a number of challenges. First, the cost of renewable energy tends to be higher than that of conventional energy. Electricity users thus pay “renewable energy surcharges” in addition to power charges.

Second, connections to the power system networks (power grids) of electric power companies pose a problem. It has been pointed out that instability in the output of photovoltaic power generation, which is ahead of other renewable power sources, creates concern over the stability of power grids (such as concern over power outages due to excess supply). If supply exceeds the connection capacity, that concern is likely to grow. Rules on power control (continuous stop) have therefore been introduced. In principle, the rules stipulate power control up to 360 hours annually without compensation. However, electric power companies are permitted to expand the 360-hour upper limit if supply exceeds their connection capacity. This makes it more difficult to assume operating revenues for business operators that have photovoltaic power facilities or are considering installing facilities, as well as for investors and financial institutions that provide financing for or invest in photovoltaic power facilities,

and increases investment risk.

The present FIT authorizes electric power facilities meeting certain requirements. Some media reports say that the Ministry of Economy, Trade and Industry is considering introducing as early as 2017 a registration system that will require business operators to conclude a contract with an electric power company. The purpose seems to avoid any bias in favor of photovoltaic power generation, but the system can be considered to effectively set an upper limit. In addition, maintenance requirements are being considered. Expenses to be incurred by business operators may increase, and attention needs to be paid to changes in the system.

3-2 Green Investment Tax Break

In addition to FIT described above, a system intended to provide tax breaks directly for investment in electric power facilities has been introduced. First, a taxation system for promoting investment in the reform of the energy supply and demand structure (Energy Reform Tax System) was introduced. The system has evolved into a taxation system for promoting a reduction in energy's environmental impacts (Green Investment Tax Break).

Specifically, if business operators directly buy facilities to which the Green Investment Tax Break applies (such as energy saving facilities) and use the facilities for their business within a year, they are allowed to claim a special depreciation of 30% (an immediate depreciation of certain facilities) or a tax credit of 7% (only small and medium-sized enterprises) of the acquisition price. The facilities to which the tax break applies are general renewable energy facilities, that is, (i) photovoltaic power facilities, (ii) wind power facilities, (iii) facilities using new energy (small and medium-sized hydroelectric facilities), as well as (iv) carbon dioxide emission control equipment (including electric vehicles) and (v) energy use control facilities (building energy control systems).

An immediate depreciation of photovoltaic power facilities is permitted only for facilities purchased by March 31, 2015, but an immediate depreciation of wind power facilities is still allowed. If the taxation system for promoting capital expenditures for improving productivity under the Industry Competitiveness Enhancement Act is applied, an immediate depreciation of photovoltaic power facilities is presumed to be allowed until March 31, 2016, depending on their specifications and the response of the relevant government ministries and agencies.

II Renewable energy investment market

1 Current status

The Japanese renewable energy investment market is in its infancy. From 2000, community-based private placement bonds and citizen funds emerged to invest in some wind power generation facilities and hydropower generation facilities, but they did not evolve into ordinary investment products. Following the introduction of FIT described above, photovoltaic power increased, and for financing, the market for private placement funds for institutional investors and corporate investors has been gradually expanding.

On April 30, 2015, the Tokyo Stock Exchange established a listed infrastructure fund market. The market is expected to play an important role in attracting investors, including individual investors. Because of legal constraints, among other factors, the main investment destinations are anticipated to be photovoltaic power facilities. Pass-through status has significant meaning in the context of tax regulations. In the case of investment companies similar to J-REITs, the requirements for pass-through status set out in the Act on Special Measures concerning Taxation are met effectively only by schemes where renewable energy power facilities are leased. Moreover, the lease period is limited to ten years or less. In the case of investment trusts, domestic publicly offered investment trusts are assumed to be able to avoid double taxation. However, closed-end investment trusts set out in the listing regulations face a number of practical challenges, including a lack of financing sources. If investment trusts are used, coordination with the trustee, among other arrangements, will take some time. To solve these problems, a cross listing scheme, including listing on the Tokyo Stock Exchange, using business trusts in Singapore, among other possibilities, is considered an option.

Fig. 2.1 TSE infrastructure fund market and J-REIT market

<table>
<tr><th></th><th>Infrastructure fund market</th><th>REIT market</th></tr>
<tr><td>Outline of listed fund</td><td>■Core assets (assets equivalent to holdings of infrastructures) account for 70% or more of the total assets of the fund.
■Core assets, peripheral assets (assets reflecting returns from infrastructures to some degree), cash and deposits, etc. account for 95% or more.</td><td>■Core assets (assets equivalent to holdings of real estate) account for 70% or more of the total assets of the fund.
■Core assets, peripheral assets (assets reflecting returns from real estate to some degree), cash and deposits, etc. account for 95% or more.</td></tr>
<tr><td rowspan="2">Outline of listing requirements</td><td colspan="2">■Financial requirements (total assets of ¥5.0 billion or more, net assets of ¥1.0 billion or more)
■Distribution and liquidity requirements (number of investment units: 4,000 or more; number of unitholders (excluding major unitholders): 1,000 or more)
■Sustainable distributions are expected.</td></tr>
<tr><td>■Formulation of policy for the selection of operators</td><td></td></tr>
<tr><td rowspan="2">Disclosure</td><td colspan="2">■Disclosure of information on the issuer (investment company etc.), asset manager, assets under management, etc.</td></tr>
<tr><td>■Disclosure of information on operators</td><td></td></tr>
</table>

Source: Prepared by SMTRI based on literature of the Tokyo Stock Exchange

Pass-through status is very important for investors' tax efficiency, but it should be noted that in terms of holding and managing assets, pass-through status could reduce flexibility. Photovoltaic power facilities, which are authorized by FIT, are income-type products. They are similar to J-REITs effectively specializing in rental real estate business, and discussion about their meeting pass-through requirements is appropriate. However, for assets whose operational performance is reflected in investment performance, including renewable energy facilities that are outside the scope of FIT and economic infrastructure, you could accept the listing of a taxable vehicle, while using the dividend exemption system and tax credits for dividends like listed companies rather than waiting for uncertain tax revisions.

2 Size of the investment market (focus on photovoltaic power)

The first fund in the infrastructure fund market described above is expected to be listed in late 2015 at the earliest, and it is difficult now to predict the future market size. It is also difficult to determine the situation of private placement funds. We will thus estimate the market size based on the current capacity of electric power facilities. We will focus on photovoltaic power, which is ahead of other types of renewable energy due to the relative ease of introducing photovoltaic power facilities in FIT. The table below shows the actual capacity and authorized capacity of facilities by type of power. The lack of balance among different types of power is a challenge to be addressed. The table shows that photovoltaic power facilities are far ahead of other facilities.

Fig. 2.2 Capacity of facilities by type in FIT (January 2015)

Type of power	Classification of purchase	Capacity of facilities generating power (kW)	Capacity of facilities authorized (kW)
Photovoltaic	Less than 10 kW	2,950,935	3,519,442
	10 kW or more	13,307,813	68,102,029
Wind	–	255,722	1,566,129
Geothermal	–	2,901	15,055
Hydropower	1,000 kW or more, less than 30,000 kW	32,400	327,805
	200 kW or more, less than 1,000 kW	7,217	35,983
	Less than 200 kW	4,499	14,177
Biomass	–	151,563	1,492,289

Source: Prepared by SMTRI based mainly on data of the Agency for Natural Resources and Energy

Within the scope of FIT, the capacity of authorized photovoltaic power facilities (including facilities whose capacity is less than 10 kW) was 71.62 million kW as of

January 2015. The capacity is more than the capacity of nuclear power facilities nationwide, 40 million to 50 million kW, and the permitted output of Tokyo Electric Power Company (TEPCO), approximately 65.05 million kW at the end of FY2013. However, the capacity of facilities that are actually generating power is 16.26 million kW (22.7% of the authorized capacity) and there is a large gap between the authorized capacity and the actual capacity. There are a number of factors explaining the gap, including the time needed for land development work and connections to power grids and business operators looking for the opportunity to commence operation at lower cost. In any case, we can say that there is a large amount of potential power-generating capacity.

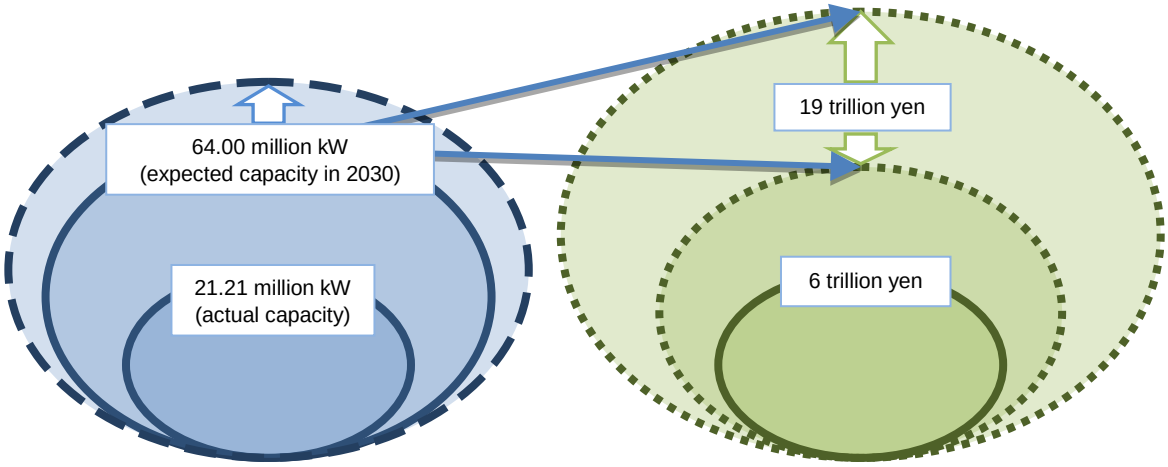
The total purchase price of photovoltaic power in FIT stood at 391.7 billion yen (output was 9.1 billion kWh) in FY2013 (including purchases of power from facilities whose output is less than 10 kW) and 660.3 billion yen (output was 15.7 billion kWh) in FY2014 (up to January 2015). The Agency for Natural Resources and Energy anticipates that in the energy mix, the FIT total purchase price of photovoltaic power will be 2.30 trillion yen (output: 74.9 billion kWh; capacity: 64.00 million kW) in FY2030. In January 2015, the total purchase price is around 29% of the anticipated total price in FY2030, and the output is around 21%. Although there are a number of variable factors, including the rescission of authorization, a decline in start-up cost and operating cost, an improvement in the capacity factor, and a reduction in the purchase price of electricity, if the current authorized capacity (71.62 million kW) is used to the full, the expected purchase price may be achieved.

The average start-up cost—the system cost used by the Agency for Natural Resources and Energy, including the cost of panels of photovoltaic power facilities, the cost of power conditioners, and construction cost—of new facilities of less than 10 kW built in the October-December quarter of 2014 was 364,000 yen/kW. It decreased 15% in two years from 427,000 yen/kW in the October-December quarter of 2012. The average start-up cost of facilities of 1,000 kW or more was 286,000 yen/kW (from October to December, 2014), down more than 5% from 303,000 yen/kW two years ago.

For the FIT calculation for FY2015, suppose the system cost for photovoltaic power facilities is 294,000 yen/kW (for facilities of 1,000 kW or more; land development expenses are taken into consideration) and the total capacity of facilities is 21.21 million kW, which is the sum of 16.26 million kW (capacity in FIT) and 4.95 million kW (capacity before FIT), then the amount of investment in photovoltaic power facilities (excluding land prices; depreciation is not taken into consideration) in the existing market is approximately 6 trillion yen. Estimating future investment is difficult given such factors as the aging and replacement of existing facilities as well as changes in cost, as mentioned above. If the capacity of facilities is the anticipated capacity in the energy mix in FY2030, namely 64.00 million kW, the amount of investment will be around 19

trillion yen assuming that the investment is made at present.

Fig. 2.3 Estimated amounts of investment in photovoltaic power facilities



Source: SMTRI

3 Funds

The main renewable energy funds in Japan are private placement funds for photovoltaic power facilities (hereinafter photovoltaic power funds) because a listed infrastructure fund market was established only recently and photovoltaic power funds sit well in FIT as described above. The following is an overview of major fund management companies.

3-1 Tokio Marine Asset Management, Mitsui & Co.

Background

In 2011, when the introduction of FIT was expected, Tokio Marine Asset Management and Mitsui & Co. started to consider jointly setting up photovoltaic power funds. In August 2012, they set up their first fund, the TM Nippon Solar Energy Fund 2012 Limited Partnership. They set up funds of the same type in 2013 and 2014. They are believed to manage around 30.0 billion yen (based on capital commitments). The management of the third fund has been transferred from Mitsui & Co. to Mitsui & Co. Plant Systems, a wholly owned subsidiary of Mitsui & Co.

Instead of treating photovoltaic power facilities only as investment products, the companies indirectly return part of the additional electricity charges to electricity users chiefly through investors in domestic pension funds and work to play a part in promoting clean energy. They are expected to set up funds of the same type and take steps in areas of renewable energy other than photovoltaic power.

Outline of the funds

The companies have set up three funds. All are limited partnerships that invest in large photovoltaic power facilities (mega solar power plants of 1 MW (1,000 kW) or more) to earn stable revenue from sales of electric power using FIT. The funds mainly target institutional investors and domestic pension funds and actually accept investments from a wide range of investors, including regional banks, life insurance companies, and Shinkin banks.

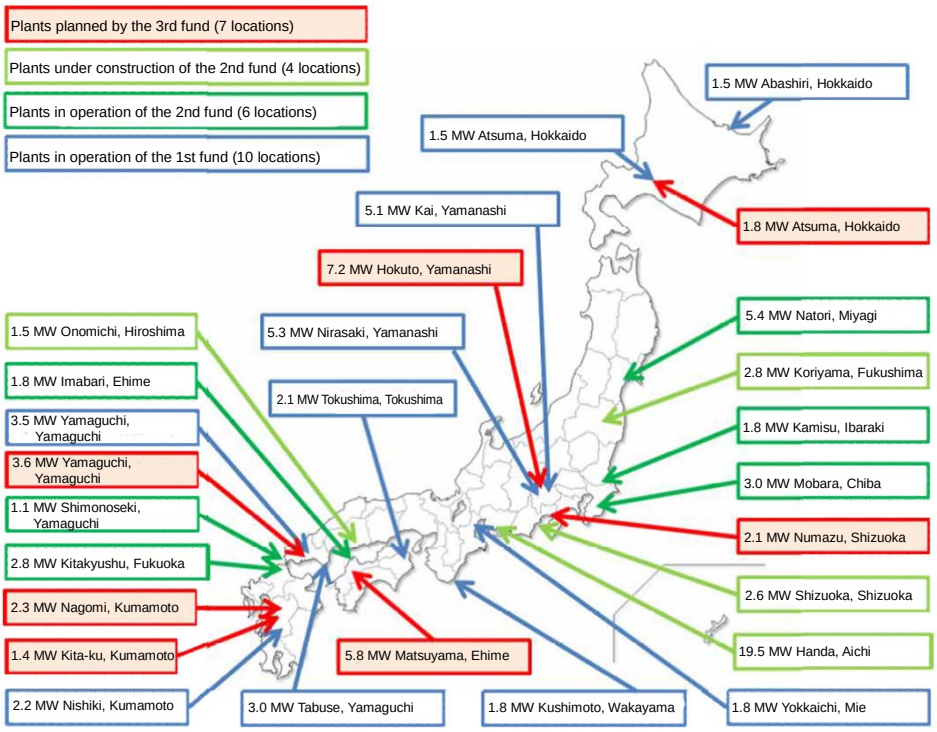
Fig. 3.1 Outline of the funds of Tokio Marine Asset Management and Mitsui & Co.

	TM Nippon Solar Energy Fund 2012	TM Nippon Solar Energy Fund 2013	TM Nippon Solar Energy Fund 2014
Established	August 2012	August 2013	August 2014
Fund structure	Limited partnership	Limited partnership	Limited partnership
Size of fund	9.0 billion yen (Capital commitment)	13.5 billion yen (Capital commitment)	7.7 billion yen (Capital commitment)
Generation capacity	28 MW (10 locations)	43 MW (10 locations)	24 MW (7 locations)
Operator	Mitsui & Co. Group	Mitsui & Co. Group	Mitsui & Co. Group

Source: Prepared by SMTRI based on data of Tokio Marine Asset Management and Mitsui & Co.

The third fund is said to have cancelled the plan to invest in a project in Kumamoto Prefecture because of a problem with the connection to the power grid, noted above. Funds to be set up in the future may need to consider distributing investments to address the same problem.

Fig. 3.2 Locations and generation capacity of power plants of Tokio Marine Asset Management and Mitsui & Co.'s funds



Source: Tokio Marine Asset Management (August 29, 2014)

3-2 SPARX Asset Management (SPARX Group)

Background

Like other companies, the SPARX Group is investing mainly in photovoltaic power facilities, but considers its photovoltaic power business to be part of its renewable energy business, which it considers a part of its infrastructure business. In June 2012, SPARX Asset Management was chosen to be the asset manager of a public-private partnership infrastructure fund that the Tokyo government planned and would invest in (it was commissioned to manage a second fund in October 2014). The SPARX Group seems to manage other private placement funds as well. The group established SPARX Green Energy & Technology to manage and provide consultation for investments in August 2012 and discloses information on investments.

The group's assets under management in the renewable energy business as of

December 31, 2014 was 50.0 billion yen. The group has been expanding its business into fields other than photovoltaic power generation. In May 2015, the group invested in wind power generating facilities (generation capacity: approximately 18 MW; total project cost: 12.0 billion yen) in Aomori Prefecture through the second public-private partnership fund of Tokyo. The group is expected to play a central role in the renewable energy fund field, including the listed infrastructure fund market.

Outline of the funds

The group seems to have set up a number of funds. The major funds that have been disclosed are SPARX Public-Private Partnership Green Energy Investment Limited Partnership, the first public-private partnership fund of Tokyo, SPARX Public-Private Partnership Renewable Energy Investment Limited Partnership (lump-sum paid-in type), the second public-private partnership fund of Tokyo, and Mirai Green Energy Investment Limited Partnership in which Sumitomo Mitsui Banking Corporation, NEC Capital Solutions, and Maeda Corporation invest. Except for the second public-private fund, these funds mainly invest in photovoltaic power generation. The table below shows an outline of the funds and their investments. The expected return on the first public-private partnership fund is an IRR of 10% (from October 2012 to January 2018).

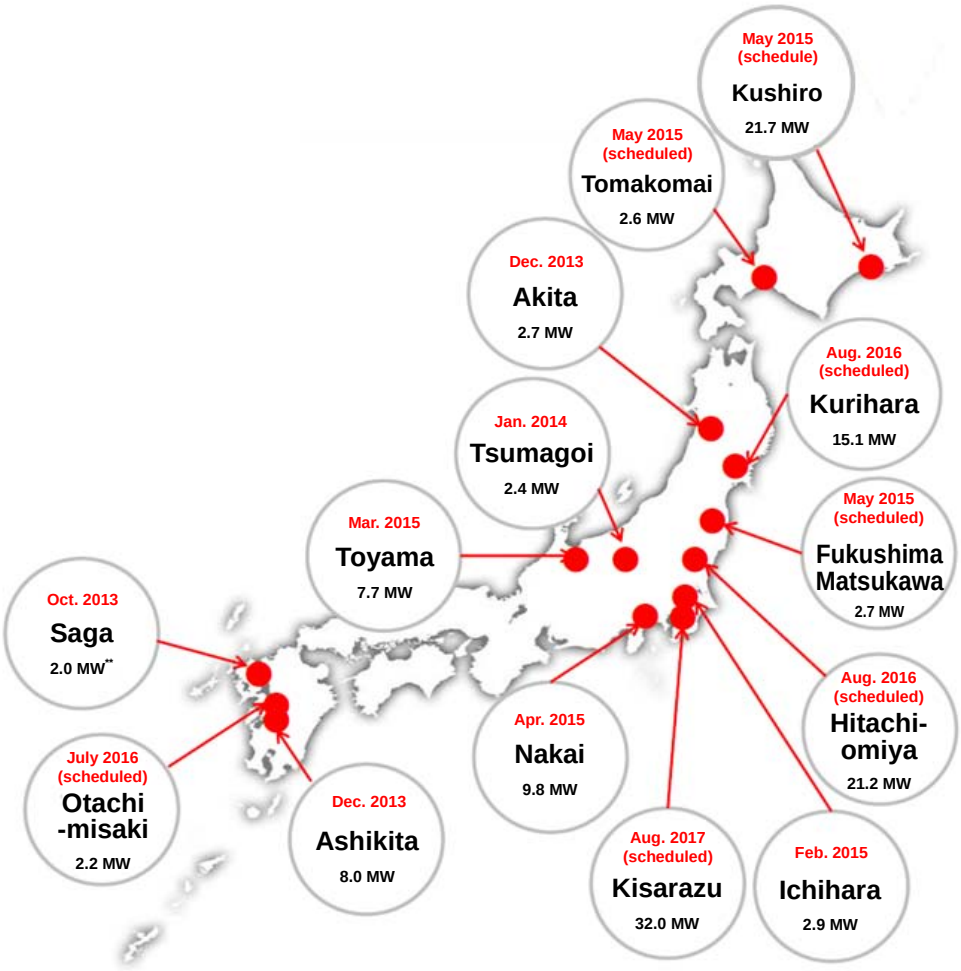
Fig. 3.3 Outline of funds of the SPARX Group

	SPARX Public-Private Partnership Green Energy Fund*	Mirai Green Energy Fund	SPARX Public-Private Partnership Renewable Energy Fund (lump-sum paid-in type)*
Established	October 2012	February 2015	February 2015
Fund structure	Limited partnership	Limited partnership	Limited partnership
Size of fund	7.6 billion yen (Total project cost: 27.0 billion yen)	5.0 billion yen maximum	–
Generation capacity	74.5 MW (Photovoltaic power; 10 locations)	–	18 MW (Wind power; 1 location)
Operator	SPARX Green Energy & Technology	SPARX Green Energy & Technology	SPARX Green Energy & Technology

* Information on SPARX Public-Private Partnership Green Energy Fund and SPARX Public-Private Partnership Renewable Energy Fund (lump-sum paid-in type) is based on disclosed information as of June 30, 2014 and May 26, 2015, respectively.

Source: Prepared by SMTRI based mainly on data of the SPARX Group and the Tokyo metropolitan government

Fig. 3.4 Locations and generation capacity of power plants of the SPARX Group's funds



Source: Analyst meeting presentation material of the SPARX Group for the fiscal year ended March 31, 2015

3-3 Takara Asset Management (Takara Leben)

Background

The core business of Takara Leben is the development of condominiums, mainly in the Kanto area. It has expanded into real estate management and has more recently expanded into the photovoltaic power generation business. Takara Leben has been strong in the development of condominiums equipped with (rooftop) photovoltaic facilities. As of March 31, 2015, it has supplied 34 condominiums (3,865 units) with photovoltaic facilities. In 2014, it supplied the largest number of condominiums with photovoltaic facilities in Japan for the fourth consecutive year. Based on its track record in this field, it has expanded into the photovoltaic power business, albeit later than the competition. In August 2013, Takara Leben started to operate Leben Solar (LS) Shioya

(generation capacity: 3 MW) power plant and made a full-scale entry into the business. As of March 31, 2015, the capacity of facilities in operation was 16 MW, and that of facilities that had yet to be operated was 63 MW. According to its medium-term business plan, which was updated in May 2015, the company aims to expand its capacity of photovoltaic facilities to 130 MW by the fiscal year ending March 31, 2019. The plan also says that the company will promote infrastructure fund management through Takara Asset Management, its subsidiary, aiming to be listed on the TSE infrastructure fund market at an early stage.

Fig. 3.5 Main photovoltaic power projects of Takara Leben

	Former golf course in Tochigi Prefecture	LS Shioya power plant	LS Chiba Wakaba-ku power plant	LS Chikusei power plant
Location	Nasu-gun, Tochigi	Shioya-gun, Tochigi	Chiba, Chiba	Chikusei, Ibaraki
Scale	Site: approx. 40 ha	Site: approx. 3.7 ha	Site: approx. 0.6 ha	Site: approx. 1.9 ha
Generation capacity	Approx. 15 MW	Approx. 3 MW	Approx. 0.5 MW	Approx. 1.1 MW
EPC	Hitachi Zosen	–	–	–

Source: Prepared by SMTRI based mainly on literature of Takara Leben

3-4 Other renewable energy funds

As described above, the market of funds for renewable energy, including photovoltaic power, has just begun. Since the introduction of FIT, however, a number of funds have been set up by financial companies and real estate companies, and many of them have successfully raised money. The table below lists some funds that have been set up in the past six months or so (including individual projects that have brought in multiple investors). Fund Creation, which also engages in asset (securities and real estate) management, is involved in a large-scale business, including projects that were launched before 2014 and earlier in 2014. The total generating capacity of its facilities in operation is approximately 7.3 MW, and that of facilities that have yet to be operated is approximately 42.0 MW (as of April 28, 2015).

Fig. 3.6 Other renewable energy funds

	GII	N-REIF1	UDS Clean Energy 2014	(1) CNPV Japan Nishiki (2) CNPV Japan Tsunagi (3) RS Ibusuki	(1) Mie Geino Solar F (2) Tochigi Mashiko Solar F (3) Kumamoto Meitoku Solar F
FM, AM	AMP Capital Investors	Sumitomo Mitsui Trust Investment, ITOCHU ENEX	Sumitomo Mitsui Asset Management	–	Fund Creation
Sponsor	Mitsubishi UFJ Trust and Banking	Sumitomo Mitsui Trust Bank	Sumitomo Mitsui Banking Corporation, Development Bank of Japan	SBI Securities, SBI Money Plaza	–
Established	March 2015	May 2015	December 2014	February – March, 2015	February 2015
Investment destination	Photovoltaic facilities, wind power facilities, small and medium-sized hydropower facilities, etc.	Mainly photovoltaic facilities as well as biomass power facilities, wind power facilities, etc.	Photovoltaic facilities etc.	Photovoltaic facilities	Photovoltaic facilities
Fund structure	GK (trust beneficiary rights)	Limited partnership	Limited partnership	SPC (silent partnership)	GK (silent partnership)
Size of fund	–	5.0 billion yen (initial capital commitment)	4.5 billion yen (target assets)	3.0 billion yen (total investments of three funds)	1.7 billion yen (total investments of three funds)
Generation capacity	–	–	–	(1) Approx. 2.2 MW (2) Approx. 1.5 MW (3) Approx. 3.4 MW	(1) Approx. 1.1 MW (2) Approx. 1.7 MW (3) Approx. 1.4 MW

* Information at the time of disclosure

Source: Prepared by SMTRI based mainly on literature disclosed by each company

4 Renewable energy companies

Apart from renewable energy funds described above, a number of companies engage in power generation. Those companies may potentially be involved in the fund business and comprise an important category in the overall investment market.

4-1 Marubeni

Background and business summary

Of trading companies, Marubeni, in particular, has been actively involved in the electricity business, including business overseas. As of March 2014, the total capacity of power facilities owned by Marubeni (including facilities overseas and facilities other than renewable energy facilities) was 34,000 MW (capacity in proportion to equity contribution is 10,000 MW).

Marubeni entered the renewable energy business early. Since 2000, it has expanded its renewable energy business combined with its wholesale power business. The company has participated in different types of renewable energy projects in different areas. In the field of wind power generation, it has participated in projects in Gangwon, South Korea (generation capacity: approx. 98 MW), the Hallett 4 Project in Australia (approx. 132 MW), and the Raleigh Project in Canada (approx. 78 MW). It has also been involved in a geothermal power project in Miravalles, Costa Rica (approx. 27 MW). Marubeni's involvement in offshore wind power projects in Europe in recent years is well known. In the Gunfleet Sands project (approx. 172 MW) in the United Kingdom in 2011, Marubeni cooperated with DONG Energy (Denmark) and Siemens (Germany) to install 48 turbines of 107 meters in diameter 7 km off the coast. In 2014, the company participated in the Westermost Rough project (approx. 210 MW) in the U.K. Marubeni plans to develop its business in the field of offshore wind power, which is expected to expand, especially in Europe, engaging not only in power generation but also in the EPC supply chain.

Marubeni is actively involved in photovoltaic power generation in Japan. Its main facilities in operation include Oita Solar Power, one of the largest solar power facilities in Japan. Other major projects are shown in the table below. It is involved not only in photovoltaic projects but also in a wind power project (Nishiuwa-gun, Ehime; generation capacity: approx. 20 MW) and in small and medium-sized hydropower projects (Nagano Prefecture etc.; total capacity: approx. 34 MW). In the Fukushima Recovery/Floating Offshore Wind Farm Experimental Project (including two 7 MW floating offshore wind power generation plants), the first experiment of its kind in the world, Marubeni aims to establish a new business model as the leader of the consortium.

Fig. 3.7 Marubeni's main photovoltaic projects in Japan

	Oita Solar Power	Kisosaki Polder Mega Solar	Iwanuma Rinku Mega Solar
Location	Oita, Oita	Kisosaki, Mie, etc.	Iwanuma, Miyagi
Commencement of operation	March 2014	December 2014	April 2015
Business scale	Site: approx. 105 ha Project cost: —	Site: approx. 78 ha Project cost: approx. 16.0 billion yen	Site: approx. 43.6 ha Project cost: approx. 7.0 billion yen
Generation capacity	Approx. 82 MW	Approx. 49 MW	Approx. 28 MW
EPC	Hitachi Group	—	Hitachi Group
Operator/O&M	Hitachi Group	—	—

Source: Prepared by SMTRI based mainly on literature of Marubeni

4-2 NTT Facilities

Background and business summary

NTT Facilities was established as a company that would engage in the construction business of the NTT Group. Using its communications technology, the company has been expanding its business as a system integrator for the energy business, especially photovoltaic power generation (providing planning, design, construction work, and maintenance) in recent years. NTT Facilities has engaged in photovoltaic power generation since NTT was the Nippon Telegraph and Telephone Public Corporation (in 1962, the company introduced solar cells as standalone power facilities for a public phone system on an isolated island on Genkainada in Fukuoka Prefecture). The company's track record in this business is at the highest level. One of its features is that it has established a system to continually test and assess leading-edge technologies. It has established F Solar Research Park in Yamanashi Prefecture as a verification test site for evaluating solar cell modules and testing frames, design technology, and smart business.

NTT Facilities has photovoltaic power generation systems for customers at 1,190 locations (approx. 309 MW), including systems in the planning stage (as of March 2014) and photovoltaic power generation systems for business use at 60 locations (approx. 168 MW) (as of September 2014). It plans to invest 80 billion yen in photovoltaic power facilities (350 MW) for business use up to FY2016. As an engineering company, the company is expected to expand the use of efficient photovoltaic power generation. The table below shows its main photovoltaic facilities in operation for its own use.

Fig. 3.8 NTT Facilities' main photovoltaic projects

	Yoshinogari Mega Solar	F Kitaura Solar Station	F Asahi Solar Station
Location	Kanzaki, Saga	Namegata, Ibaraki	Asahi, Chiba
Commencement of operation	July 2013	June 2014	December 2013
Business scale	Site: approx. 16 ha	Site: approx. 8.4 ha	Site: –
Generation capacity	Approx. 12.1 MW	Approx. 6.5 MW	Approx. 5.2 MW

Source: Prepared by SMTRI based mainly on literature of NTT Facilities

4-3 Kokusai Kogyo, JAG Energy (Japan Asia Group)

Background and business summary

Kokusai Kogyo is a pioneer in the field of aerial surveys in Japan and is providing mainly geospatial information consulting (geospatial information technology service (including business support using GIS) and construction consulting, etc.). The company's technologies are used in urban development and national land conservation, and as an extension of this, the company has expanded its green energy business, including renewable energy. The company has begun to provide research and consulting when renewable energy power generation facilities are introduced and participates in photovoltaic power generation and small and midsize hydropower generation projects. The green energy business is run mainly by JAG Energy in Japan Asia Group. Kokusai Land & Development in the same group is responsible for EPC and O&M. In this way, Japan Asia Group aims to provide a one-stop service for photovoltaic power generation.

Japan Asia Group has a good track record in the renewable energy business. The group has been involved in the business since before the introduction of FIT, including a photovoltaic power project (approximately 1.0 MW) at Miyazaki Solar Way, in which it participated in 2009. In the same year, the group acquired Geosol, which operates a photovoltaic power business in Europe. It is now promoting overseas operations and is also involved in the fund business. In February 2015, it set up a public-private partnership fund jointly with the Tokyo metropolitan government (T-JAG Green Energy Fund).

Japan Asia Group has mega solar operations in four European countries: Germany, Spain, Italy, and the Czech Republic. In Japan, the group is involved in power facilities (the capacity of facilities in operation or completed being approximately 58.8 MW as of March 2015), mainly mega solar facilities. In addition, it is participating in projects whose total capacity is approximately 66.8MW. It has large potential generation capacity. The group has recently developed rooftop facilities, including a solar system at the Fuji City Western Purification Center water treatment building (approximately 1.2

MW) and Itabashi Rooftop Solar Way (approximately 37 kW). The needs for rooftop facilities may increase, especially in the areas covered by Tokyo Electric Power Company, where the power system network can accept more connections.

Fig. 3.9 Main photovoltaic projects of Kokusai Kogyo and JAG Energy

	Ashigara Oi Solar Way	Gyoda Solar Way	Joetsu Kakizaki Solar Way
Location	Oi, Ashigarakami-gun, Kanagawa	Gyoda, Saitama	Joetsu, Niigata
Completion	March 2015	March 2015	January 2015
Business scale	Site: approx. 14.3 ha	Site: approx. 3.2 ha	Site: approx. 4 ha
Generation capacity	Approx. 13 MW	Approx. 2.4 MW	Approx. 2.3 MW
EPC	Toko Electrical Construction	Toko Electrical Construction	Tokyo Energy & Systems

Source: Prepared by SMTRI based mainly on literature of JAG Energy

4-4 Tokyo Century Leasing, Kyocera

Background and business summary

In August 2012, Tokyo Century Leasing and Kyocera jointly entered the photovoltaic power business. They established Kyocera TCL Solar LLC and in July 2013 started to operate the Takamatsu Ikushima Mega Solar Plant in their first project. By March 2015, Tokyo Century Leasing and Kyocera have invested in 20 plants (12.0 billion yen) in operation, mainly using Kyocera TCL Solar LLC. In addition, more than 50 projects (120.0 billion yen) are in progress. They have considerable potential generation capacity. In June 2015, the two companies announced a new joint project, in which Koyo Electric will participate. Operations through KCT Koyo LLC are expected (construction of power plants of a total of 25 MW or more in the next three years).

In joint projects, companies with strength in leasing, investments and loans associated with leasing, the manufacture of panels using semiconductor and electronic device technologies, EPC, O&M, and energy saving are expected to generate synergies. In this way, Tokyo Century Leasing and Kyocera are developing unique operations. Their operations involve ordinary mega solar power plants for installation on the ground and those for installation on water. The Hyogo Kasai Sakasamaike Floating Mega Solar Power Plant, completed in May 2015, is the world's largest solar power plant installed on water that has been completed. The companies are also developing large mega solar power plants installed on the ground. The Kanoya Osaki Solar Hills Solar Power Plant, the joint development of which with Gaia Power and Kyudenko was announced in May, is expected to be one of Japan's largest solar power plants.

Apart from joint initiatives with Tokyo Century Leasing, Kyocera is involved in a number of other projects. Ukujima Mega Solar Park (tentative name; located on agricultural

land; generation capacity: 430 MW) project, on which Kyocera and other companies reached a basic agreement in June 2014, has attracted note as the world's largest solar power project on agricultural land.

Fig. 3. 10 Main photovoltaic projects of Tokyo Century Leasing and Kyocera

	Hyogo Kasai Sakasamaike Floating Mega Solar Power Plant	Takacho Yasudago Mega Solar Power Plant	Kanoya Osaki Solar Hills Solar Power Plant
Location	Kasai, Hyogo	Taka, Taka-gun, Hyogo	Kanoya City and a town, Kagoshima
Commencement of operation (scheduled)	June 2015	November 2016	In 2017
Business scale	Water surface: 8 ha	Site: approx. 62 ha	Site: approx. 200 ha Investment: 35.0 billion yen (estimate)
Generation capacity	Approx. 2.3 MW	Approx. 14.5 MW	Approx. 92 MW

Source: Prepared by SMTRI based mainly on materials from Tokyo Century Leasing and Kyocera

III Outlook and issues for the renewable energy investment market

Diversification of types of power, and innovation in each power

The review of the energy mix and the distribution of investments in renewable energy in Japan and the introduction of FIT have led to a rapid expansion in photovoltaic power facilities, and as described above, at some electric power companies, supply exceeds connection capacity. To address the issue and to alleviate the concentration of investments in photovoltaic power, initiatives for renewable energy other than photovoltaic power, such as wind power, geothermal power, and biomass power, should be considered. There are expectations of growing investment in wind power generation, which has a relatively good track record in Japan, through funds and other means, depending on purchase prices in FIT. In the areas covered by Tokyo Electric Power Company, the connection capacity has comparatively sufficient scope, and although available land is limited, a range of possibilities, including rooftop photovoltaic facilities and photovoltaic facilities for installation on water, should be pursued.

Stabilizing and strengthening connections to power grids

For power whose supply changes with natural conditions (particularly photovoltaic power and wind power), connections to power grids are a significant challenge. Large-capacity storage batteries are likely to be able to help stabilize supply. In association with storage batteries, a subsidy for the urgent need to suspend connections of renewable energy (support for the introduction of electricity storage systems for renewable energy power generation operators) has been introduced. Some projects, including the Mifune Tokunoshima Solar Power Plant (Kagoshima Prefecture; generation capacity: 1.99 MW), do not depend on any subsidies. Large-capacity storage batteries, with hydrogen conversion and storage systems, among other systems, should help expand the market in the future, depending on the costs of the storage batteries.

Enhancing existing power grids and electric power transmission across wider areas should also continue to be considered. For example, if electric power is transmitted to Honshu efficiently from Kyushu, believed to have an advantage in photovoltaic power generation, or from Hokkaido, which has high potential in wind power generation, optimal use of electricity will become possible. Although some problems, including costs, have been pointed out in association with the enhancement of power grids, it should still be considered, as the separation of power production from power transmission and technology progresses, from a long-term perspective.

Bringing a better understanding to investors as electricity users

There have been a number of initiatives, including the establishment of the TSE infrastructure fund market noted above, to attract investors in infrastructure, including renewable energy infrastructure. Expanding the investment market is a positive step, and we need to get investors to understand infrastructure as users. Since domestic infrastructure markets were not liberalized, Japanese investors do not have much experience in infrastructure investing. Building the necessary understanding of the characteristics of each infrastructure is a significant challenge. The mechanism of investment in electricity is believed to be relatively easy to understand if clear information is disclosed. We have expectations that participants, including FM, AM, and operators, will play an important role in this as well as in expanding the investment market.

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