A Brief History of Measures to Support Renewable Energy:

Implications for Japan's FIT review obtained from domestic and foreign cases of support measures

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Summary

In Japan, a projection of long-term energy supply and demand has shown that the ratio of power generated by renewable energy sources will expand by 2030, to between 22 and 24%. A feed-in-tariff (FIT) program has been in place as a supporting measure to encourage renewable energy power generation since 2012. However, issues such as a sharp increase in purchase cost moved some to suggest reviewing the program to balance both the meeting of the target and economic soundness.

Prior to adopting FIT, Japan had the Renewables Portfolio Standard (RPS) program for electricity from renewable energy. FIT and RPS have become the main renewable energy support programs[2] in other countries and regions as well. European countries, where FIT has a long operation history, have been going through a transitional phase of trial and error in recent years, including program revisions and termination, and retroactive changes in tariffs. New measures currently being adopted are the incorporation of the Feed-in-Premium (FIP) program with a view to have renewable energy support scheme and the electric power market work together, and a bidding system in which market competition determines the level of governmental assistance.

This paper reviews the past renewable energy support (RPS and FIT) programs conducted in Japan and overseas, particularly from the standpoint of program cost and burden, and summarizes features of new support measures in Europe (FIP and competitive bidding).

RPS in Japan faced an issue, beyond a challenge to determine an appropriate target, of the rising risk to secure profitability for renewable energy producers. On the other hand, the countries that chose FIT, which focuses on investment risk reduction, including Japan, have experienced difficulties in determining appropriate tariff, and its derivative effect, controlling the amount and rate of renewable energy introduction. FIP, which is increasingly implemented in Europe at present, provides both the certainty of investment that RPS tends to lack, and better economic rationality which FIT often falls short of providing. While these new European measures are yet to be proven at present, they are expected to show effectiveness in aspects such as reducing support cost.

Japan will need to go through reconstruction of measures to support renewable energy taking into account the effect of the liberalization of an electric power market. This process will benefit from a study on the overseas cases which combines the introduction of market competition and the long-term/stable renewable energy support scheme.

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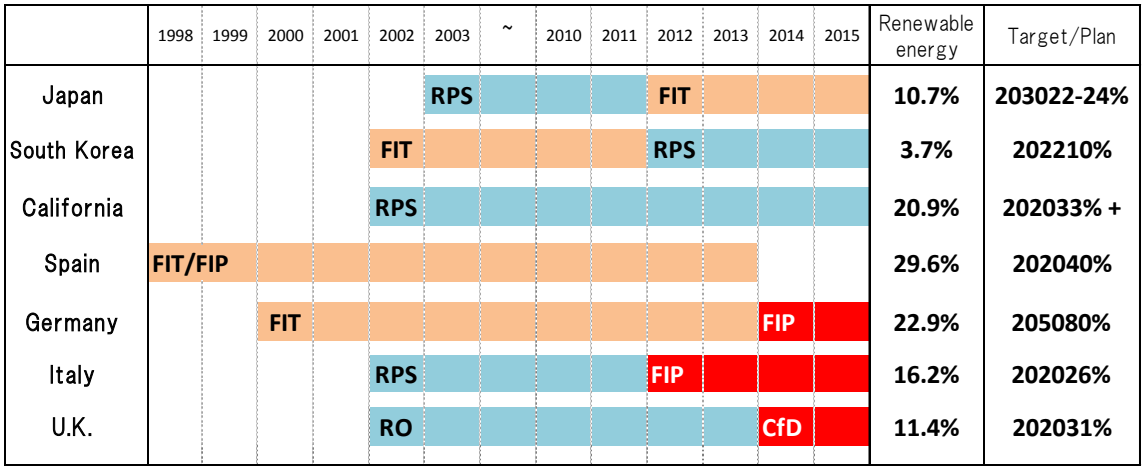
[1] Coal Group at the Fossil Fuels & Electric Power Industry Unit, and New and Renewable Energy Group at the New and Renewable Energy & International Cooperation Unit (concurrent post).

[2] Among the available support measures for renewables ranging from R&D and verification, facility installation assistance, and electricity sales support. This paper discusses the support program for electric power sales. The assistance program for electricity sales is considered operational support in comparison with facility support, through which benefits of the assistance program are received only after facility operation and electricity sales begin.

1. Overview of implementation of measures to support renewable energy in Japan and abroad

The chart below describes how the measures to support renewable energy have been implemented in major countries and regions. Each measure features certain strengths that an individual country or region has selected to meet its policy target and circumstances. Although each system is multifaceted, evaluation of renewable energy operations should place emphasis on aspects that profitability risks and liability are based on.[3] Such characteristics and challenges associated with this point will be discussed in the following sections.

Figure 1 Implementation of measures to support renewable energy in major countries and regions



Note: Main support measures for a large-scale facility are listed. RPS: Renewables Portfolio Standard, RO: Renewables Obligation, FIT: Feed-in-Tariff, FIP: Feed-in-Premium, CfD: Contract for Difference. FIP in Spain is voluntary. Italy adopted FIP (2005–2011) and FIT (2012) for photovoltaic power while RPS was also in place.
Source: Based on various reference materials. The renewables ratio for Spain, Germany, Italy, the UK, South Korea, and Japan shown are based on the 2012 values (IEA Data (2014) 2012), and for California on the 2013 value (CPUC documents).

2. RPS

2-1. Characteristics of RPS

RPS is a system which mandates electric power resellers to have a fixed percentage of power sold from their targeted renewable energy sources (hereafter, RPS electricity), to strategically create demand for renewable energy for system roll-out. It also contains punitive provisions such as a penalty for not meeting a quota. Although policy targets determine the total amount and allocation amount for power companies, market transactions work to decide power sources, providers, price, and conditions selected by each mandated company in general. The system also customarily issues a

[3] Main risks associated with renewable energy electric power business may include: (1) technology (probability of constructing a power generation facility and generating power as assumed), (2) profitability (probability of electric power sale at the assumed pricing and period), and (3) other factors (policy-related risks, trend in the electric power market, and other changes in socio-economic conditions, etc.).

Renewable Energy Certificate (REC) for eligible renewable energy power generation. It makes it possible to maintain a certificate trading system and help fulfill the obligations of REC market trading which is independently operated from the physical aspect of a power supply system.[4] These characteristics often position RPS as a market-mechanism-type measure to advance progressive introduction starting from lower-cost renewable energy generation methods.[5]

2-2. RPS in Japan

In Japan, RPS had been implemented for approximately nine years from April 2003.[6] The initial target value at the time of system introduction was 12.2 billion kWh (approx. 1.35% of power sales) [7]for FY2010, later revised to 13.43 billion kWh for FY2014.[8] During the program period (to June 2012), the amount of renewable energy electricity (referred to as electric power from renewable energy sources under the RPS Law) implemented by the eligible companies exceeded the governmental goal. However, with respect to a strategic policy tool to expand renewables, its results showed that the following areas in particular were to be addressed:

The first point relates to how to determine a target value. Japan's RPS target values were set upon considering ways to balance renewable energy expansion and its economics. Although it requires multilateral evaluations, it became apparent shortly after system implementation that the standard was not set at a stringent level. According to the RPS Law Evaluation Subcommittee[9], a carryover from the previous year (2.1 billion kWh) as of FY2005 fulfilled over 50% of a yearly mandate (3.83 billion kWh) at the beginning of the fiscal year. The Subcommittee also indicated the trend might continue to the point where yearly carryover exceeded the following year's mandate by FY2008.[10] While these factors led to a revision of the original obligation amounts for FY2006 to FY2009 in the 2006 system revision, it was decided to maintain the 2010 target at the same level.[11] This decision was made "considering possible difficulties that are forecast in meeting the conditions on wind power installation locations and biomass resource procurements, thus still requiring maximum

4 EPA website: http://www.epa.gov/greenpower/gpmarket/rec.htm

5 Keiji KIMURA, "Theories on renewable energy portfolio standard and its designing challenges." Ritsumeikan International Studies. Vol. 20. No. 2 (2007).

6 Renewable Portfolio Standard (RPS) Law (RPS Law), June 2002

7 A report (draft) by the RPS Law Evaluation Subcommittee at the New and Renewable Energy Subcommittee of the Advisory Committee on Energy and Natural Resources, May 26, 2006.

8 In response to the introduction of "The New Purchase System for Solar Power-Generated Electricity" (a program to buy back surplus residential solar generated power) in FY2009, the original 2014 target value excluding photovoltaic (13.4 billion kWh) that was set in FY2007 has been revised to add the increase from the solar generation purchase system (3.915 billion kWh). This photovoltaic power driven increase (3.915 billion kWh) is not regarded as a mandate for electric power companies but a governmental implementation goal; thus the official target for the RPS eligible companies has been agreed at 13.43 billion kWh. This amount has been calculated by adding the 2014 target published in FY2007 (13.4 billion kWh) excluding photovoltaic power to the non-FIT-eligible photovoltaic generated power (0.015 billion kWh, however a decision made in March 2007 revised the counting method for solar power to double, resulting in a calculated total of 0.03 billion kWh).

9 Established in November 2005. The committee members, consisting of experts such as those with relevant knowledge and experience, representatives from electric power companies and new renewable energy producers, examines operations of the RPS system. http://www.meti.go.jp/committee/gizi_8/8.html

10 A report (draft) by the RPS Law Evaluation Subcommittee at the New and Renewable Energy Subcommittee of the Advisory Committee on Energy and Natural Resources, May 26, 2006. Although the carryover from the previous year did not actually exceed a yearly mandate, the carryover amount for FY2007 reached 5.66 billion kWh compared with the 6.07 billion kWh target for the year.

11 A report (draft) by the RPS Law Evaluation Subcommittee at the New and Renewable Energy Subcommittee of the Advisory Committee on Energy and Natural Resources, May 26, 2006.

combined efforts from both public and private sectors to meet the target value for FY2010." Compliance by eligible companies to meet these goals exceeded the mandates over the entire course of the program (refer to Supplement 1 at the end of document), yet it remained uncertain whether the RPS itself effectively had worked to promote the strategic policy of renewal energy expansion more than that of "BAU" by the operators.

The second point was the fact that excessive focus on the economical aspect of renewable energy introduction resulted in inadequate measures to promote investment. In Japan, the New and Renewable Energy Subcommittee of the Advisory Committee on Energy and Natural Resources in 2001 examined system selection of FIT or RPS based on how each system had been implemented and operated in other countries. The study led to the conclusion that the RPS system was superior, including the REC certification program, from the viewpoint of having flexibility to select a power source to fulfill the obligation, and the use of cost-reduction incentive programs.[12]

On the other hand, there are more issues related to promoting investment in renewable energy generation and they have become more apparent following the launch of the program. Specifically, the issues which have been brought to light include: the eight-year target (2003 to 2010) is short and considered a risk by renewable energy producers in a business in which the time required to recover the investment is expected to be around 10 years[13]; as the process of RPS power procurement mainly depends on relative contracts concluded through individual negotiations among the parties concerned, having no clear price index for newly participating companies makes it difficult to develop a business plan.[14]

The government voluntarily conducts and publishes its studies on RPS electricity trading prices annually. It was 10.0 to 11.8 yen/kWh for wind power, 7.2 to 9.0 yen/kWh for hydropower, and 7.2 to 9.4 yen/kWh for biomass power generation. These RPS trading prices fluctuated only in a small range in comparison with the average Japan Electric Power Exchange (JEPX) trading price for the period and recent power-generation cost calculations.[15] As mentioned earlier, in an environment in which the renewable energy target is moderate with no forecast for a drastic demand expansion in sight, some argue that the contract pricing for RPS electricity could not have had the potential to reach the level to induce further investment.

It is believed that other areas also had an influence that led to maintaining lower pricing on RPS electricity. These include the fact that there were no clear rules associated with how RPS electricity procurement cost is shared over the whole of society, and the possibility and appropriateness of cost transfer to consumers of electricity.

The RPS system in Japan has fulfilled the purpose of the program from the standpoint of expanding renewable energy implementation without imposing a significant increase of burden on electric power companies. On the other hand, from the perspective of expanding investment in renewable energy, it lacked measures to tighten supply-demand such as by restricting rising future targets, or carryovers. It proved to be a system which expected renewable energy producers to bear the profitability risk.

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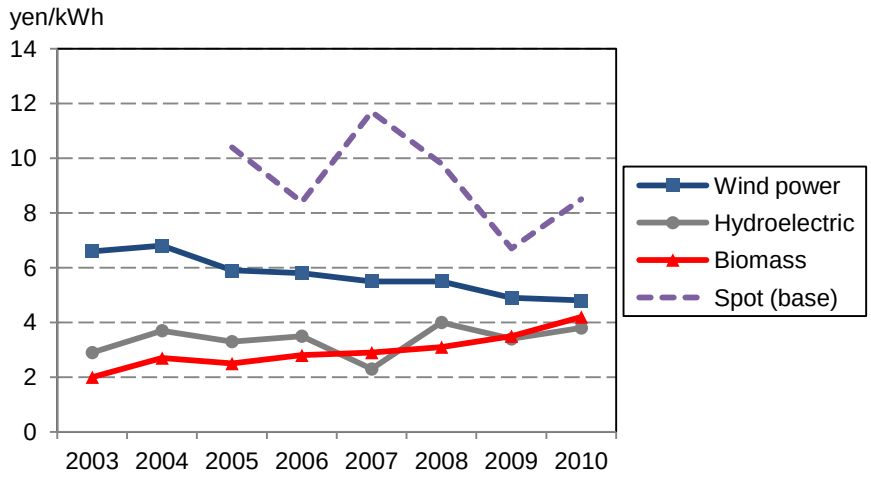
[12] A report (draft) by the RPS Law Evaluation Subcommittee at the New and Renewable Energy Subcommittee of the Advisory Committee on Energy and Natural Resources, May 26, 2006.

[13] A report (draft) by the RPS Law Evaluation Subcommittee at the New and Renewable Energy Subcommittee of the Advisory Committee on Energy and Natural Resources, May 26, 2006.

[14] A report (draft) by the RPS Law Evaluation Subcommittee at the New and Renewable Energy Subcommittee of the Advisory Committee on Energy and Natural Resources, May 26, 2006.

[15] Refer to the calculations done by the Cost Evaluation Committee (December 2011) and the Evaluation Working Group on Power Generation Cost (April 2015).

Figure 2　Survey result on RPS trading prices



Note: There are 27 companies for the 2006 survey and 36 companies for the 2011 survey that responded.
Source: The Institute of Energy Economics, Japan (IEEJ)
Agency for Natural Resources and Energy. RPS electricity trading price "regarding electricity trading price survey results on new energy sources under the RPS Law." September 22, 2006 and July 25, 2011.
Spot price: From Japan Electric Power Exchange (JEPX)

2-3.　RPS in Other Countries

RPS has currently been adopted by 29 states and regions in the United States (one example is California (introduced in 2002) and South Korea (introduced in 2012). The UK and Italy had also used the system before discontinuing it.[16]

Similar to Japan, which has their original RPS rules, there are diverse rules in other countries and regions. This makes it difficult to summarize RPS abroad. RPS is generally positioned as a system with a high introduction-cost efficiency, being realized by entrusting the price-discovery function of renewable energy generation. However, the actual implementation cases have shown that strategical policies and governmental management also play a large role. One example of this is the UK's RO system in which a certificate issuance coefficient for individual renewable energy sources has been set strategically to successfully promote the initial development of offshore wind power generation with a larger weighting coefficient.[17] In California, the authorities granted a certain level of superiority to renewable energy power generation by conducting economics examinations based on gas-fired power generation cost as its benchmark with regard to RPS electricity procurement trading price, while reflecting the relevant expenses needed to counter greenhouse effect into the benchmark.

While these measures help to reduce profitability risk in the renewable energy power generation business, some argue that such entrusting of power to determine the electricity resale price and

[16] Both introduced in 2002, repealed in 2012. Called Renewables Obligation (RO) in the U.K.

[17] This is called banding in the U.K. Regarding the renewable energy under the RO system, it works to adjust the number of ROC certificates being issued according to the cost and its potential penetration. The basic ROC issuance unit was defined at 1 ROC/MWh for all types of applicable renewable energy power generation, in comparison to the ROC issuance coefficient of 1.5 ROCs/kWh for offshore wind power generation set under the Renewable Obligation Order 2009. Italy and South Korea also regulate their certificate issuance coefficient. Photovoltaic power generation in Japan was set to double-count in 2007.

conditions (duration) to the market will ultimately result in higher renewable energy introduction costs than that from a fixed pricing system, due to the risk premium required in financing.[18]

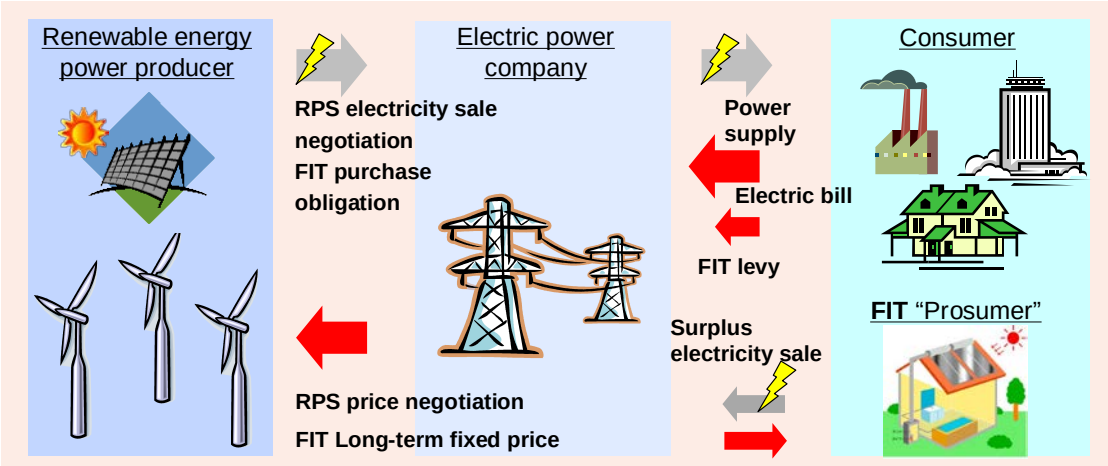
In South Korea, it was observed that penalty payments became extensive when the eligible companies failed to meet the introduction targets.[19] Considering these circumstances, it seems to suggest that an effectively working market mechanism requires diverse choices/players (potentially) in the market.

3. FIT

3-1. Characteristics of FIT

FIT is a system which mandates electric power companies to purchase renewable energy electricity at a fixed price (tariff) for a specific period. A policy governs the determining of its tariffs and conditions based on profit added to power generation cost, and generally it has open investment opportunities with no preset introduction limit. Unlike RPS, it does not require power generation companies to conduct any individual negotiations over electricity sale pricing and conditions. This system approach thus enhances profit certainty and stability for the renewable energy power business with a view to reducing operators' profitability risk.

Figure 3 Schemes to support renewable energy under FIT and RPS



Note: A prosumer is a body which is involved in both *production* and *consumption* of renewable energy electricity.

Source: by Author

[18] Is there a route to a U.K. Feed in Tariff for renewable energy? Dr. Robert Gross, Imperial College, October 2010

[19] The relevant target operators under obligation were not able to meet the target in 2012 or 2013, resulting in a penalty payment for two consecutive years. The total penalty payment amounted 23.7 billion won for 2012, and 49.8 billion won for 2013.

On the other hand, the cost-effectiveness of this system becomes a topic of discussion because of the fact that this system forces consumers to cover the difference between the purchase expense and the conventional power generation cost as a surcharge on the electric bill. This occurs whether or not the policy target is met at an appropriate level for the burden incurred. The policy target ranges from improved energy self-efficiency to countermeasures to the greenhouse effect, industry development, employment creation, and regional revitalization; they are the effects that are anticipated to be attained as renewables diffuse regardless of the chosen system. A goal unique to FIT is establishing a technology and market with its quickly expanding installation amount in a short period to benefit from an early learning effect in the relevant type of power generation being purchased. It then reduces the tariff in phases, with a view to achieving a reduced renewable energy generation cost.[20]

3-2. FIT in Japan

While RPS has been in use in Japan since 2003, there was rising momentum for an approach to a low carbon society together with the heightened attention on development of the renewable energy industry. This formed a backdrop to introducing "the excess electricity purchasing scheme for photovoltaic power" (November 2009). This was a shift from the Japanese government's previous cautious stance toward implementing FIT,[21] leading to the launch of FIT which mandates[22] purchasing the entire amount of renewable energy beside photovoltaic power over a long term in July 2012[23] (refer to Supplement 2 at the end of document for the FIT tariff/duration).

The amount of added facility capacity from the start of FIT to the end of December 2014 was 15.82 million kW (of which 15.41 million kW was photovoltaic), bringing the cumulative facility capacity from renewable energy sources to a total of 36.43 million kW.

FIT has helped to increase the facility installation amount particularly in photovoltaic sources. By the end of December 2014, the facility capacity (including past installments)[24] that has been recognized under this program reached 74.01 million kW.[25]

This sharp increase also had negative effects. As mentioned earlier, FIT works to expand short-term system introduction, but the remaining challenge is to balance the amount and cost of introduction. Japan's total FIT surcharge[26] has already increased from approximately 130 billion yen (first year) to approximately 1.3 trillion yen (2015 project)[27], as well as surcharge unit of consumers of earlier

[20] The Japanese government aims to lower the cost of photovoltaic power generation to 14 yen/kWh by 2020 ("Photovoltaics (PV) Roadmap Toward 2030 (PV2030+)" by the New Energy and Industrial Technology Development Organization, June 2009).

[21] Kaori KONDO. Economy, Trade and Industry Division. "Trend of photovoltaic power generation in Japan." National Diet Library. Issue Brief Number 683. (2010.6.10).

[22] However, residential photovoltaic power less than 10kW in the facility capacity remains for surplus purchase only.

[23] The Act on Special Measures Concerning Procurement of Renewable Energy Sourced Electricity by Electric Utilities established in August 2011; RPS was repealed following a transition allowance period.

[24] It is a renewable energy power generation facility for FIT application which was confirmed and recognized by the government as fulfilling the requirements under the Act. An effective pricing at the time of facility certification applies as FIT's tariff for individual power generation facility.

[25] In addition to a newly introduced facility under FIT, there is a transferring 8.81 million kW facility capacity from previous measures (RPS and PV surplus purchase system) to FIT system, making for a combined FIT-eligible facility capacity total of 24.63 kW. The current maximum facility capacity is approximately 94 million kW after combining it with the pre-FIT cumulative facility capacity (approx. 20 million kW).

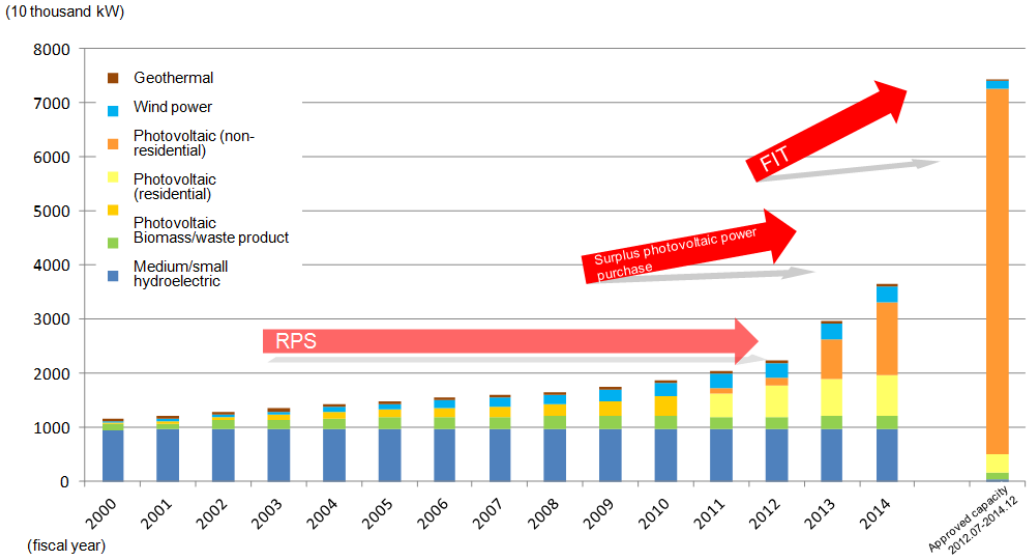
[26] The amount obtained by deducting avoidable cost from the tariff. The avoidable cost consists of the expenditure avoided when electric companies purchase renewable energy electricity and cancel part of their planned power generation.

[27] Purchase price of 1.837 trillion yen, avoidable cost of 514.8 billion yen. (New and Renewable Energy

0.22 yen/kWh (66 yen per month for a standard household) to 1.58 yen/kWh (474 yen per month). The possible impact on consumers is a matter of concern as the estimated surcharge when all the capacity recognized by the end of June 2014 is assumed to begin operation is 2.7 trillion yen annually, assuming a surcharge unit of 3.18 yen, and a cost of 935 yen for a standard household[28].

The current law does not specify maximum measures to control FIT's facility installation amount or purchase cost. However, the government indicated an upper limit essentially in the plan to 2030 for the nation's energy sources where FIT's purchase cost is set at 3.7 to 4.0 trillion yen annually, and 2.3 trillion yen of this is for photovoltaic power generation (64 million kW installation amount) including the past facility certification (projected capacity from estimated operation).[29] A review is also planned on a method to determine tariff and system rules related to facility certification in the future.[30]

Figure 4　Changes in renewable energy power generation capacity in Japan



Note: Photovoltaic power before FY2010 combines residential and non-residential values.
The capacity from FY2011 to FY2014 is FIT-eligible.
FY2014 value is for the end of December.
"Certified capacity" is the cumulative value after FIT launch (including past installments).
"Biomass" reflects actual status more accurately by multiplying the facility capacity by the biomass fuel ratio.
Source: Compiled by The Institute of Energy Economics, Japan (IEEJ) based on "EDMC/Handbook of Japan's & World Energy & Economic Statistics 2015" by the Institute of Energy Economics, Japan (IEEJ)/The Energy Data and Modelling Center (except geothermal/medium-to-small hydropower during FY2000 to FY2010), Electricity Business Handbook (FY2000–2010 geothermal) by the Japan Electric Power Civil Engineering Association, Hydroelectric Power Plant Database (FY2000–2010 medium-to-small hydropower) by the Agency for Natural Resources and Energy, FIT public information website (after FY2011).

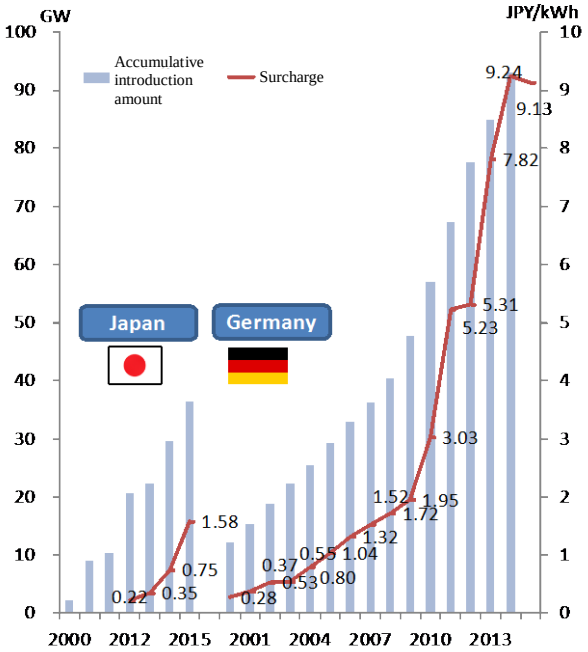
Subcommittee of the Advisory Committee on Energy and Natural Resources (10th) meeting reference material 5 "FY2015 Procurement Price and Levy Unit," March 19, 2015).

[28] The 4th New and Renewable Energy Subcommittee, Agency for Natural Resources and Energy reference material, September 30, 2014.

[29] (The Long-Term Energy Supply and Demand Outlook Subcommittee of the Advisory Committee on Energy and Natural Resources (10th) meeting reference material 2 "Long-Term Energy Supply and Demand Outlook related materials," June 2015).

[30] The 12th New and Renewable Energy Subcommittee, Agency for Natural Resources and Energy reference material, June 24, 2015.

Figure 5　Changes in FIT Surcharge (Japan/Germany)



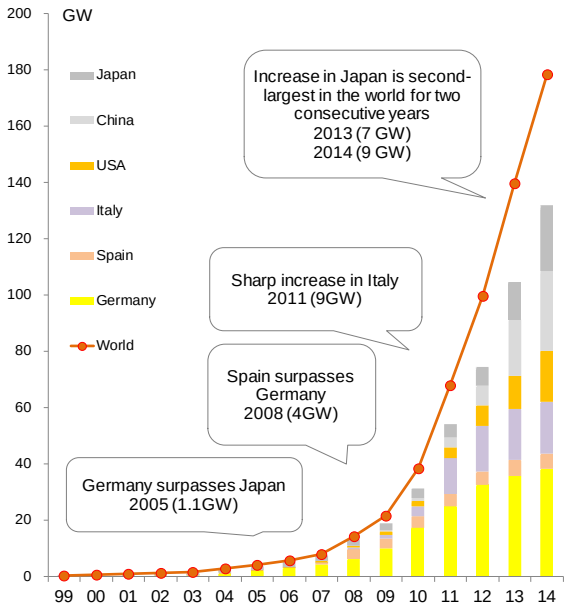
Source: Based on BMWi Germany and the Agency for Natural Resources and Energy

3-3.　FIT in Other Countries

In Europe, FIT was adopted in the late 1990s in countries such as Germany and Spain. A significant increase was observed in renewable energy power in the FIT- participating countries, with the 2005 total installation amount of photovoltaic generation in Germany surpassing Japan to take the top place in the world. On the contrary, introduction amounts in countries with RPS-type measures such as Japan and the U.K. fluctuated at a low level. Against this background, the European Commission (the E.U.'s policy enforcing body) took a stance of highly regarding FIT.[31]

[31] The Support of electricity from renewable energy sources, European Commission, SEC (2008) 57, 23.1.2008 The European Commission has continuously compared FIT and RPS, or the appropriateness of enforcing a uniform policy over the entire region. (The support of electricity from renewable energy sources, European Commission, COM (2005) 627,7.12.2005, etc.) As discussed later, it has changed its view on FIT.

Figure 6　Changes in photovoltaic power generation capacity in the world



Source: Data to 2013 from Trends 2014 in Photovoltaic Applications by IEA PVPS, for 2014 from A Snapshot of Global PV 1992–2014 by IEA PVPS

This changed around 2009 as FIT's issues started becoming apparent in Germany and Spain, relating to cost burden, and challenges to build infrastructure that make it possible to incorporate increasing renewable energy electricity into the grid system. Responses to this new development included a drastic reduction of the tariff or program coverage, followed by revisions to FIT such as establishing new system operation rules.

One example was an energy transfer policy (*Energiewende*) which featured a gradual termination of atomic power generation and expansion of renewable energy, announced in June 2011. Contrary to Chancellor Merkel's view that FIT's surcharge "would not exceed the current level"[32] (the surcharge in 2011 was 3.53 euro cent/kWh), the surcharge continued to rise subsequently (refer to Figure 5 in the earlier section). The German government revised the system as an emergency measure in April 2012. The revision involved placing an upper limit on photovoltaic power introduction set at 52 GW, setting a newly established annual target, and making a change in the conventional method that fluctuated depending on the cost-based calculation every year to a mechanism that adjusts pricing frequently in response to introduction status (refer to Supplement 3 at the end of this document).

While such refinement of system design made it essential for business operators to manage the introduction amount and cost, it requires administration costs, and if the system becomes too complicated/unstabilized, business risk can increase and this can possibly impede investment. In fact,

[32] Spiegel, October 10, 2012

investment in renewable energy in Europe is weakening after peaking in 2011[33], and Germany has not reached the annual base target of domestic photovoltaic power generation amount since the above measures were taken (refer to Supplement 3 at the end of this document).

Spain essentially abolished FIT in 2012, and is facing disputes that stem from its subsequent changes to retroactively reduce the tariff for already operating facilities. Italy [34] has also decided to lower the photovoltaic electricity tariff retroactively, and this caused strong opposition from power generation companies.[35]

4. New measures

4-1 Reviews on measures to support renewable energy and system change in Europe

An active trend in Europe is to drastically review the past measures to support renewable energy, with a view to adjusting their program.

The EU European Commission DG Competition published guidelines for the member countries' governmental support in the areas of the environment/energy, "Guidelines on State aid for environmental protection and energy[36]" (hereafter the Guidelines) on April 9, 2014. The guidelines related to renewable energy sources aims mainly to terminate the FIT applications and shift to more market-based measures for renewable energy power generation facilities of a certain size or larger.[37]

Such market-based measures involve a series of programs to incorporate the market principle into the method of introducing renewable energy. The main pillars of the program are to abolish a purchase obligation by electric power companies specified in the previous FIT system, and to establish direct marketing which mandates renewable energy producers themselves to sell electricity through power market trading. As a support for renewable energy power generation, it will also provide a premium, the difference from the standard price used as an index for governmental aid (hereafter strike price) (FIP). These measures are to be taken by 2016, and eligibility is given to newly built large-scale renewable energy power generation facilities (500 kW or higher). It also states that facilities over 1 MW will implement competitive bidding to determine companies that will be eligible under the strike pricing, and their standards starting 2017. Other points addressed in the Guidelines include that renewable energy producers will take imbalance risks,[38] and there will be no premium paid at negative pricing[39].

The EU's policy has shifted from the previous stance recommending FIT to one focusing on measures to bring the system closer to the market principle. It adopted the above measures

33 IEA, Medium-Term Renewable Energy Market Report 2014.

34 It adopted FIP that adds fixed premiums onto market prices in 2005, followed by a transfer to FIT in 2012. After reaching the preset budget, the program stopped accepting new applications in July 2013.

35 RECHARGE, 8 September 2014.

36 Guidelines on State aid for environmental protection and energy 2014–2020, Official Journal of the European Union, 2014/C 200/01, 28.6.2014

37 It also aims to clarify standards of cost burden reduction and exemption measures in state aid, enforce the energy market in the region, and provide aid to infrastructure/power generation capacity.

38 The cost required to adjust the difference when a power generation company fails to secure its planned generation amount.

39 A negative price in which real-time surplus electricity incurs a payment to take the power back under a free electric power market.

progressively, and it is demanding the abolishment of FIT except its eligibility for small-scale facilities[40] (refer to Supplement 4 at the end of this document).

4-2. Mechanism and characteristics of new measures

These changes in governmental policy reflect the facts that the cost related to renewable energy power generation is declining,[41] there is an unhealthy impact on the electric power market from the seemingly overprotected FIT renewable energy electricity, and there are concerns about a higher electricity bill associated with increasing burden from the introduction cost.

The implementation of market-based measures is expected to bring positive effects, such as reducing state aid paid to renewable energy producers, promoting market competition among them, and encouraging market-determined supply of renewable energy.

Around the time of releasing the E.U. Guidelines in 2014, there was a rush of changes in many E.U. member countries such as switching to a FIP-type policy or adopting a bidding system. The following section will present an overview of the new systems based on their application cases to examine their characteristics.

4-2-1. FIP Overview

The German government amended its law to adopt FIP in August 2014. It mandates large-scale facilities[42] to sell electricity directly on market, and works to provide aid by supplementing the difference when average monthly price in the spot market falls below an FIT price (strike price). The strike price is set to be determined by the government initially[43], with a plan to implement a bidding system in 2017 (the system will be tested in 2015).

In the previous version of FIT that Germany had used, as shown in Figure 7(1), the tariff of renewable energy electricity was maintained at the same level regardless of demand-supply trends or electric power market pricing (solid-line arrow in the figure), and the renewable energy producers received the income value that combined both the subsidy and electric power sales.[44] This system aimed to enhance the stability and security of investment.

A switch to FIP (Figure 7(2)), in which renewable energy generation companies individually sell electricity at a market price (perforated-line arrow in the picture), changes the subsidy payable for renewable energy producers as a premium to the difference value from the governmentally set strike price (solid-line arrow in the figure) only.

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[40] As a facility with a 500 kW or less capacity (3 MW or less, or 3 units or less for a wind power generation facility) has limited prospects for participating in the wholesale market, it remains open to any support measures including FIT.

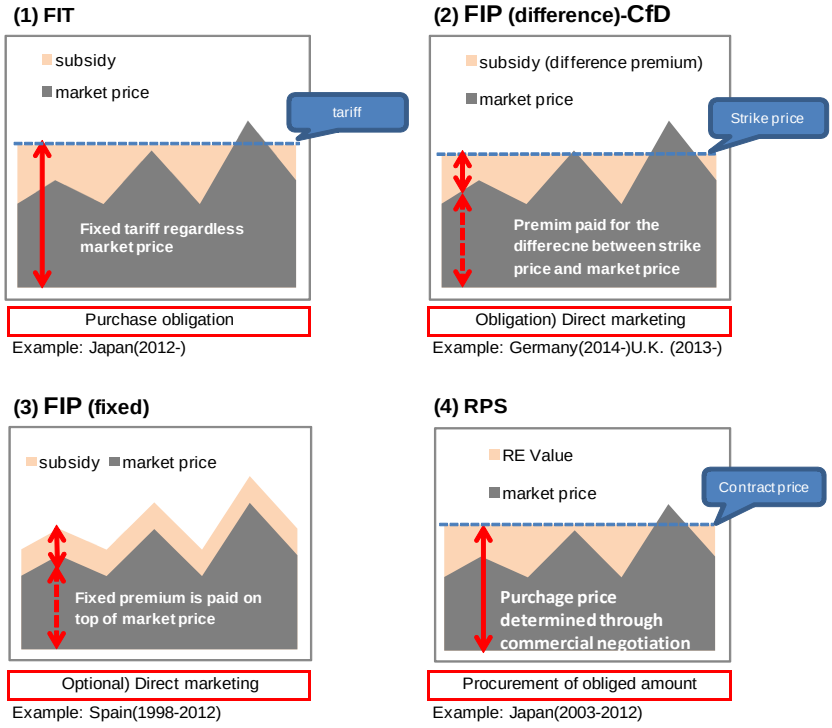
[41] IRENA Renewable Cost Database, etc.

[42] New facility with 500 kW or higher capacity installed by January 1, 2016, facility with 100 kW or higher capacity after 2016. Non-applicable smaller facilities will continue with FIT application (electric utilities are under purchase obligations, and then the distributor sells to the wholesale electric power market). The 2012 system revision in Germany excludes larger photovoltaic power generation facilities with 10 MW or higher capacity from the system.

[43] FIT tariff for small-scale facilities is also used as an index to determine the premium. The new German support scheme for renewable electricity, Oxcera, August 2014.

[44] The system cost (subsidy cost) shouldered by consumers is a value of the tariff paid to the renewable energy producers minus a market price equivalent amount (FIT in Japan is an avoidable cost).

Figure 7　Comparison and application examples of measures to support renewable energy



Note:
For (3): Spain implemented the upper/lower limits of aid amount by revising its system.
For (4) “Value of new energies”: The RPS Law enables trading of RPS electricity in two groups by dividing it into “value of electricity” and “value of new energies” which represents the value added due to the fact this portion of electricity came from renewable energy sources (new energy electricity). It is believed that an actual contract price is determined as a combined value of the value of electricity and the value of new energies.

Source: Author

The U.K. has adopted the Contract for Difference (CfD)[45] system as part of electric power market reform. CfD has fundamentally the same mechanism as the FIP in Germany, supplementing the portion where the market price falls below the strike price. One of the unique characteristics of CfD is that the power generation companies reimburse the excess in cases where the market price exceeds the strike price[46]. With regard to the electric power from established renewable energy sources, it also specifies the competitive bidding process to be used to determine strike pricing, as well as the upper limit of total aid.

[45] “Energy Act 2013” December 8, 2013. It aims to secure a stable supply of electricity, reduce the burden on the consumers, and expand low-carbon power generation.

[46] While the aid provided under CfD in the U.K. is considered to be more fixed than that of FIT, it will require more thorough examinations on the details and agreement of both systems.

Spain had a system offering both FIT and FIP as options (market sales were voluntarily) (Figure 7(3)). However the excessive profit generated for the power generation companies became a problem. Its mechanism to add fixed premiums to market prices resulted in providing additional aid even when the sales price was already high in response to an increasing electric power market price. This issue was addressed through setting upper and lower limits to the total amount of sales price and premium[47].

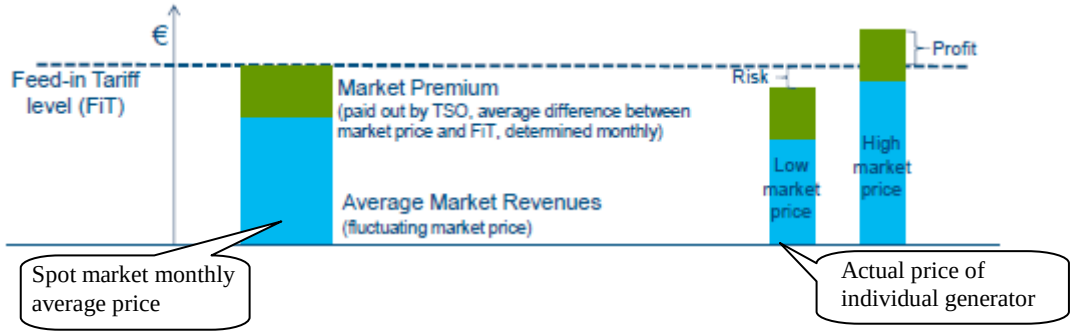
4-2-2. Direct market sales to promote market competition among renewable energy producers

It is true that FIP with market sales obligations favors renewable energy electricity through its price assistance, and it is also designed to promote market competition among renewables producers. The profitability under FIT fluctuates for renewable energy producers in response to (1) power generation cost size and (2) the generated power amount. FIT also adds another strategy: (3) to sell at a higher sale price in the market (refer to Figure 8).

As discussed earlier (4-1), this is a system in which power generation companies sell electricity in the market while taking imbalance risks, and renewable energy producers are expected to be competitive in the market to enhance the implementability of their power generation plan. This is achieved through by improving the accuracy of power generation projections, applying storage technology to enable a power supply that reflects demand-supply movements (market trends), and making combined use of other power sources. FIT with purchase obligations similarly had instances where fixed-tariff was used for renewable energy electricity even when the market had a negative pricing from surplus electricity. A future response to such cases is expected to reflect signals from the market where such renewable energy producers withhold power output.

This could also indicate that lower competitiveness could result in a profit that is below the government's prediction, imposing a larger profitability risk on renewable energy producers in comparison with that of FIT.

Figure 8　Concept of direct marketing in Germany



Source: Added to BMWi materials (September 2014)

[47] Royal Decree 661/2007

4-2-3. System cost reduction through competitive bidding

In addition to adopting FIP, a system cost reduction is expected to be seen when incorporating a system to determine premium standard (strike price) by competitive bidding.

Prior to countries such as Germany, Italy introduced FIP for large-scale facilities (excluding photovoltaic light and thermal power generation) that were scheduled to start operation in 2013 or after, in which competitive bidding is used to determine the strike price[48] (refer to Supplement 5 at the end of this document). In the past, three cases of bidding for wind power generation have occurred (2012, 2013, and 2014), and the winning bids were for a total of 907 MW for 2012 and 2013, and 356 MW for 2014. The 2014 bidding resulted in the lowest winning price of 8.89 euro cent/kWh, at a price reduction rate of 26.38% to 30% in comparison with the government-determined strike price (12.7 euro cent/kWh).[49]

In the U.K., bidding was held to determine a CfD strike price in January this year (2015), resulting in a photovoltaic power clearing price (winning bid) nearly 60% lower than the strike price that had been set by the government as the upper limit price in some cases.

Table 1 CfD bidding results in the United Kingdom

Maturity of technology	Renewables	Number of cases	Facility capacity (MW)	Reference price (yen/kWh)	Minimum clearing price (yen/kWh)	Max reduction %
Established	Photovoltaic	5	71.55	**21.6**	**9**	**58%**
	Land wind power	15	1,162	**17.1**	**14.3**	**17%**
Not established	Offshore wind power	2	748.55	**25.2**	**20.6**	**18%**

Note: Calculated at GBP 1＝JPY 180.

Source: DECC Press Release, February 26, 2015

4-2-4. Long-term stability of policy support

The earlier sections discussed, among the characteristics of FIP and bidding system, an aspect focusing on economic efficiency of the support program with the use of the market principle. At the same time, it also placed value on long-term stability with a view to securing investment in renewables. Both RPS and FIP share the need to make direct sales in the market. For RPS (mentioned in Figure 7(4)), there were challenges stemming from individually negotiated contract price/conditions, which have a higher uncertainty and thus hinder potential investment (refer to 2 earlier). For this reason, FIP is designed with consideration to providing a level of certainty and long-term stability of profitability in the renewable energy business. The approaches made for this goal include either a governmentally determined premium or one determined through bidding that is to be provided with a long-term contract [50]by the government or an organization established by the government (for CfD in the U.K., refer to Supplement 6 at the end of this document).

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[48] DM/6/7/2012.

[49] Wind Power Monthly, August 27, 2014.

[50] In the cases of land wind power generation, 15-year contract for CfD in the U.K., and 20-year for FIP in Germany and Italy.

5. Conclusion

This paper reviewed the past renewable energy support (RPS and FIT) programs, and summarized features of new support measures in Europe (FIP and bidding).

RPS, used in Japan up to 2012, had an issue of higher profitability risks for power generation companies, in addition to challenges associated with determining targets. On the other hand, the countries that chose FIT focusing on risk reduction, including Japan, have experienced difficulties in determining appropriate tariff, and its derivative effect which is controlling the amount and rate of system installation.

The FIP system, widely adopted in Europe, has abolished the total purchase obligation on generated power, which is a feature of FIT, and operates on the premise of having direct marketing sales by renewable energy producers. As for the determining the aid standard, it favors the market to exercise the price discovery function through competitive bidding. Compared to FIT, FIP expects power generation companies to participate in the market in response to demand-supply trends, and take a business profitability risk that fluctuates with its sales performance. At the same time, the government secures the bottom line of electricity pricing (premium) in the long term to provide long-term stability in the power generation business.

While it has been expected that support costs will be reduced based on the bidding results in Italy and the U.K., some express pessimistic views on the project's implementability rate due to factors such as risks from low-priced bidding.[51] Although this warrants further observation of the system's trends to determine its effectiveness, a system design that combines both market competition and long-term state aid will be a useful reference when reviewing the FIT system in Japan.

6. Supplements

Supplement 1 Japan's RPS target achievement status

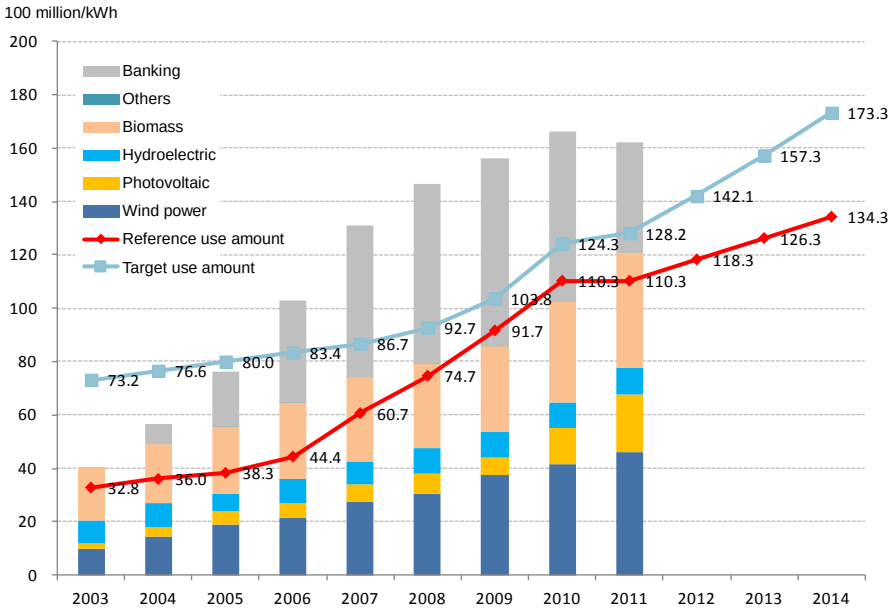
The cumulative facility capacity certified under the RPS Law (by the end of FY2011) is approximately 9 million kW, approximately 3.8 million kW of which is counted toward the applicable facility under "the excess electricity purchasing scheme for photovoltaic power" (it counts toward RPS Law target achievement, but cannot be used for the company obligations). A total cumulative facility capacity excluding the above value is approximately 5.2 million kW.

While renewable energy target after launching RPS (Overall target; called "target use amount") was set at 12.2 billion kWh (approx. 1.35% of resale power), the total procurement amount including banking (carryover) from the previous year exceeded the mandate amount (amount allotted to each company as an obligation; called "reference use amount") by 50% in the second year of RPS installment 2005.[52] The RPS electricity amount continued to exceed not only the reference use amount but also the target use amount, producing a carryover every year to the following year.

[51] Wind Power Monthly, November 17, 2014.

[52] RPS in Japan was regulated to adjust actual obligation amount (reference use amount) of each applicable operator according to the performance of each company, with the aim of avoiding a sudden burden increase. For this reason, it was decided to gradually draw the two separate values, a total reference use amount and the introduction target, closer gradually.

Figure 9　Changes in RPS electricity volume in Japan
(electricity supply from new energy sources)



Note 1: The usage target for 2009 has been revised in response to the introduction of photovoltaic power generation surplus purchasing system in 2009.
Note 2: Reference use amount is a total of obligation amount of every company, and target use amount is a target value over the entire program.
Source: Based on the Agency for Natural Resources and Energy RPS management system.

Supplement 2　FIT price in Japan

The chart below contains FIT tariff in Japan. Since the beginning of the system implementation, the tariff for photovoltaic power generation has been reduced in response to lower system prices (solar panels, power conditioners, frames, and construction cost)[53]. The prices for other renewables remain unchanged as their introduction has not progressed.

Pricing category was set in FY2014 for offshore wind power generation and medium- to small-sized hydroelectric power generation using existing waterways, and separate price categories were set within waste-wood driven biomass power generation with a capacity of less than 2,000 kW and capacity over the amount in 2015.

[53] The assumed IRR has been lowered as the first three years from the system inception is regarded as a profit special consideration period and will finish at the end of June 2015.

Table 2　Tariff/duration and its conditions under a fixed-price purchase system

Energy source	Class/Requirement		Support measures: Purchase price (yen/kWh) (excl. tax) H24	H25	H26	H27(1)*	H27(2)*	Duration	Premise: IRR（before tax） H26	H27(1)	H27(2)	Facility use rate H26	H27(1)	H27(2)
Photovoltaic	Residential	Less than 10kW	42yen	38yen	37yen	33yen**		10 years	3.2%	3.2%	3.2%	12%	12%	12%
	Non-residential	10kW or higher	40yen	36yen	32yen	29yen	27yen	20 years	6.0%	6.0%	5.0%	13%	13%	14%
Wind power	Land	Less than 20kW	55yen	55yen	55yen	55yen		20 years	1.8%	1.8%	1.8%	20%	20%	20%
		20kW or higher	22yen	22yen	22yen	22yen			8.0%	8.0%	8.0%	20%	20%	20%
	Offshore ***				36yen	36yen		20 years	10%	10%	10%	30%	30%	30%
Geothermal		Less than 15,000kW	40yen	40yen	40yen	40yen		15 years	13%	13%	13%	80%	80%	80%
		15,000 kW or higher	26yen	26yen	26yen	26yen			13%	13%	13%	80%	80%	80%
Medium/small hydroelectric	New installation	Less than 200kW	34yen	34yen	34yen	34yen		20 years	7%	7%	7%	60%	60%	60%
		200kW to 1000kW	29yen	29yen	29yen	29yen			7%	7%	7%	60%	60%	60%
		1000kW to 30,000kW	24yen	24yen	24yen	24yen			7%	7%	7%	60%	60%	60%
	Existing waterway use	Less than 200kW			25yen	25yen			7%	7%	7%	60%	60%	60%
		200kW to 1000kW			21yen	21yen			7%	7%	7%	60%	60%	60%
		1000kW to 30,000kW			14yen	14yen			7%	7%	7%	60%	60%	60%
Biomass	Gas	Methane fermentation gas	39yen	39yen	39yen	39yen		20 years	1%	1%	1%	80%	80%	80%
	Solid fuel	Waste wood, etc. Less than 2,000kW	32yen	32yen	32yen	40 yen			8%	8%	8%	80%	80%	80%
		Waste wood, etc. 2,000kW or higher				32 yen				8%	8%	80%	80%	80%
		General wood/agricultural product residue, etc.	24yen	24yen	24yen	24yen			4%	4%	4%	80%	80%	80%
		General waste/sluge, etc.	17yen	17yen	17yen	17yen			4%	4%	4%	80%	80%	80%
		Recycled wood	13yen	13yen	13yen	13yen			4%	4%	4%	80%	80%	80%

* For 2015 (1) is April 1 to June 30, For 2015 (2) is after July 1 (profit special consideration period ended)

** With an obligation to install output control compliant equipment: 35 yen/kWh

*** If access required by ship, etc., for both construction and operation maintenance.

Source: Compiled by the Institute of Energy Economics, Japan (IEEJ) based on information from the Agency for Natural Resources and Energy website, etc.

Supplement 3　Automatic adjustment of upper-limit measures and tariff of photovoltaic generation implementation amount for FIT in Germany

Germany raised FIT's tariff once for photovoltaic power generation in the 2004 revision,[54] followed by a consecutive price drop every year. As introduction amounts remained at a high level[55] in the April 2012 revision, it also implemented a mechanism called a "breathing cap" that automatically adjusted the tariff according to the introduction amount over a certain period, in addition to further tariff reductions.

The current law (revised in August 2014) applies a similar mechanism to photovoltaic, land wind power, and biomass. Photovoltaic power generation has an annual renewable energy target amount of 2.4 to 2.6 million kW, with quarterly tariff adjustments to apply a preset reduction rate (-2.80% to +1.5%) based on excess and deficiency of the quarterly introduction amount. It also stipulates that the aid[56]will terminate when the introduction amount reaches 52 GW.[57]

[54] The tariff revised in 2004 was 43.4 to 57.4 euro cent/kWh according to facility capacity, and 18.3 to 24.2 euro cent/kWh as of January 2012.

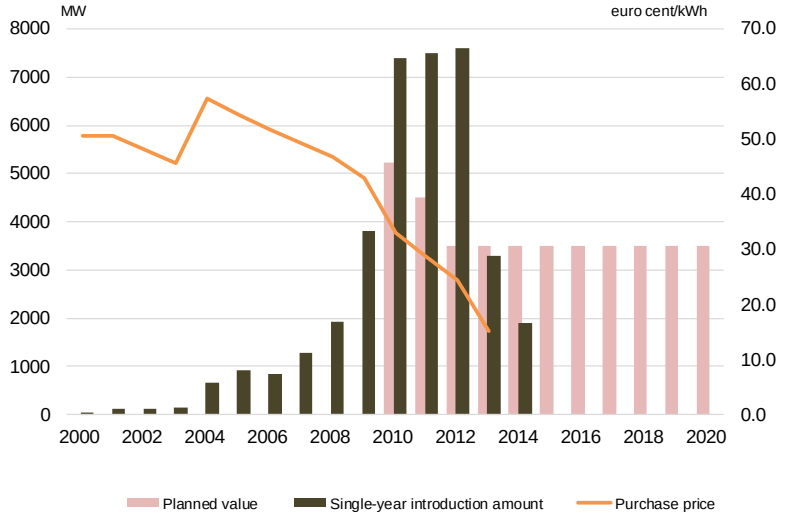
[55] Three consecutive years since 2010 recorded over 7 GW of annual introduction amount of photovoltaic power generation.

[56] Besides photovoltaic power, prescribed measures include setting the upper limit to 2.5 million kW annually for land wind power and 0.1 million kW annually for biomass, along with automatically adjusting the tariff.

[57] The value scheduled for introduction domestically, with the aim of achieving the EU Directive target by 2020.

Following the enforcement of these measures, the introduction amount of photovoltaic power generation was 3.3 million kW in 2013, and 1.9 million kW in 2014, which are both below the governmental introduction plan (submitted to the E.U. based on Directive 2009). The installation amount in 2014 did not meet the annual target defined at the system revision in 2014.[58]

Figure 10 Changes in single-year capacity increase, introduction plan, and tariff for photovoltaic power generation facility in Germany



Note: The 2013 value is projected by BSW; extracted high-value tariff only; the 2010 planned value is calculated by subtracting the BMU 2009 achieved amount from the cumulated planned value by the National Renewable Energy Action Plan (NREAP).
Source: Tariff: FY2011 METI-commissioned survey, single-year introduction amount: BSW, planned value: compiled based on NREAP and BMU references

Supplement 4 EU Guidelines on state aid for environmental protection and energy

The E.U. established the "Guidelines on State aid for environmental protection and energy" in 2008. To better reflect the recent conditions in which member countries' aid programs are expanding to the energy field, a new edition of the Guidelines which covers the energy field was compiled (published on July 1, 2014).[59] The Guidelines are released as a communique at the European Commission, although without legal binding power, and they are viewed as important guidelines in the E.U. and have been adopted at the ministerial level[60].

The chart below illustrates the transition schedule of renewable energy measures indicated in the Guidelines. FIP has been adopted earlier than the initial schedule in some countries such as Germany.

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[58] Automatic purchasing price adjustment currently set (applied since January 2015) at 9.09 to 12.89 euro cent/kWh for photovoltaic power generation. RECHARGE, 6 January 2015.

[59] It addresses nine applicable fields including renewable energy: (1) renewable energy, (2) energy efficiency measures (including cogeneration, district heating/cooling), (3) resource efficiency/waste management, (4) carbon capture and storage (CCS), (5) reductions in or exemptions from environmental taxes/reductions in or exemptions from funding support for electricity from renewable sources, (6) energy infrastructure, (7) generation adequacy, (8) tradable permit schemes, and (9) relocation of undertakings. Every member country is required to have its domestic policy comply with the Guidelines within a year after the issuance.

[60] DG Competition conducted studies on competition in the energy field in the past, and proposed a revision draft. One example is the June 2005 study in which an analysis was made on factors influencing the existing monopolistic electric power market even after liberalization and high prices, and the revision draft proposal was made based on it. The Delegation of the European Commission to Japan, March 7, 2006.

Figure 11　Schedule of future measures to support renewable energy

	2014	2015	2016	2017
	Guidelines issued	**Pilot phase**	**Obligatory premium system**	**Obligatory competitive bidding system**
Guideline requirements	After issuance, comply its aid system within 1 year	Aid provided for 5% of planned renewable energy capacity	(500kW or larger facility, etc.) Premium system by principle	(1MW or larger facility, etc.) Competitive bidding as a principle
Discretion by each country	Support measures (FIT, FIP, etc.)	Support measures (FIT, FIP, etc.)	[FIT optional] Wind power: 3MW or less than 3 units Others: less than 500kW	[Premium system optional] Wind power: 6MW or less than 6 units Others: less than1MW [FIT optional] Wind power: 3MW or less than 3 units Others: less than 500kW

Source: Based on the Guidelines on state aid for environmental protection and energy 2014–2020

Figure 12　Future system implementation schedule in Germany

Facility capacity	August 2014	2015	2016	2017
500kW or higher	**FIP**	**FIP** Competitive bidding (test introduction)	**FIP**	**FIP** Competitive bidding
Up to 500kW	**FIT**	**FIT**		
Up to 100kW			**FIT**	**FIT**

Note:For FIT, FIPis also optional. It can be switched between FIT andFIP monthly.

Source: Based on Legal Sources on Renewable Energy (Germany), E.U., December 11, 2014

Supplement 5　FIT and bidding system in Italy

It is specified that Italy provides state aid to large-scale renewable energy power generation facilities (chart below) in the form of FIP from 2012, and bidding is for the premium's strike price. Power generation companies are required to bid at a price below the governmental base tariff, and the difference from the market price will be provided as a premium[61]. The base tariff is to be dropped by 2% every year after 2014. It also establishes an annual upper limit on capacity that is under the scope of FIP aid. The shortest term for the aid is 20 years.

[61] Basic report on the promotion of introducing new energy 2013.

Table 3　Competitive bidding system application in Italy

Energy source	Facility size	Base tariff cent/kWh	Duration Year	Max capacity (MW)		
				2013	2014	2015
Land wind power	Over 5MW	12.7	20	500	500	500
Offshore wind power	Over 5MW	16.8	25	650	0	0
Geothermal	Over 20MW	8.5	25	40	0	0
Hydroelectric	Over 10MW	9.6	30	50	0	0
Biomass	Over 5MW	12.2 to 14.5	20	470	0	0

Source: Based on Legal Sources on Renewable Energy (Italy), E.U., November 24, 2014

Supplement 6　CfD overview in the United Kingdom

CfD in the U.K. mandates renewable energy producers to sell electric power in the market, and concludes a contract, Contract for Difference (CfD), with the CfD Counterparty[62] as a commercial transaction. CfD is a contract that balances the difference between the government-determined standard price (strike price) and the wholesale market price (reference price) between them.

In cases where the market price falls below the strike price, the power generation company receives the difference of the strike price from the CfD Counterparty, and if it exceeds it, the power generation company pays the CfD Counterparty.

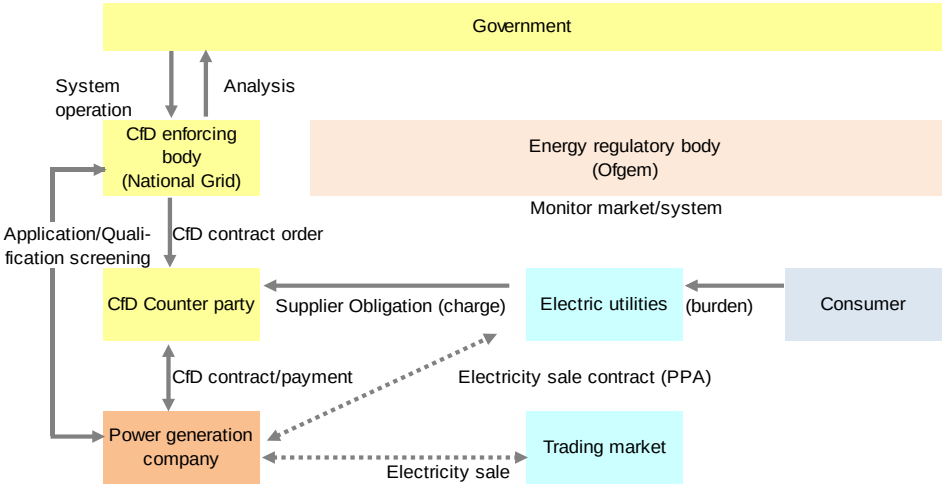
It does not specify a purchase obligation for either the electric power distributor or the reseller. As for the final sale method for power generation companies, it has incorporated a measure (Offtaker of Last Resort: OLR) which mandates specific power suppliers to conclude a Backstop Power Purchase Agreement (BPPA).[63] BPPA is concluded at a price below the market price based on bidding from power suppliers.[64]

The contract term for CfD is 15 years. It aims to avoid excess aid to control the system cost, as well as to stabilize the return for renewable energy investment over the long term. Although CfD is not a direct governmental contract, having a state-owned organization as its counter party of the contract enhances the credibility for the investors.

It is assumed that operational expense for the system (funds for the gap payments) is covered by the supplier obligation from the electric power companies, and the companies pass on the charges to their consumers.[65] As this surcharge is managed under the Levy Control Framework (LCF: a mechanism to monitor and control public charges for the power generation companies through electricity bills) with a preset upper limit, any aid measures including CfD will operate within the upper limit of the relevant aid budget.

62　A state-owned limited-liability company, Low Carbon Contracts Company (LCCC), is established.
63　DECC, September 2014 https://www.gov.uk/government/consultations/implementing-the-offtaker-of-last-resort
64　Introduction to the OLR Scheme, Ofgem, April 2015.
65　Electricity Market Reform: Consultation on Proposals for Implementation, October 2013, DECC, p. 116.

Figure 13　CfD scheme



Source: Based on Implementing Electricity Market Reform, DECC, June 2014, DECC