Initiatives to Expand the Introduction of Renewable Energy in Various APEC Economies

Examples of RPS in Japan, Korea, and California in the US

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Foreword

As initiatives to increase the use of renewable energy spread globally, many APEC economies have also begun implementing the feed-in tariff (FIT) system or the renewable portfolio standard (RPS).

While FIT is a scheme that aims to promote investment in renewable energy sources through government-fixed prices for purchasing the generated electricity, RPS mandates utilities to procure a pre-determined amount or ratio of electricity from renewable sources, normally utilizing . In the face of rapid cost increase of FIT onto electricity consumers or government budget, there has been a growing need for investigations into the design details of RPS that have been implemented to control the pace and cost of renewable energy expansion.

This paper first identifies the characteristics of the RPS and FIT systems, then examine actual cases of the RPS being implemented in Japan, Korea and California. From these empirical cases, it is expected to provide insights into the introduction and implementation of renewable energy support schemes in APEC countries that aspire to expand the use of renewable energy resources while securing the economic efficiency of it.

This report is the work of the Asia Pacific Energy Research Centre. It is an independent study, and does not necessarily reflect the view of or policies of the APEC Energy Working Group or individual member economies. Hopefully, this research document will become a cornerstone of the establishment of information exchange and international collaborative activities designed to accelerate renewable energy development, leveraging APEC's economic and cooperative strengths.

Takato OJIMI
President
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Executive Summary

This paper first identifies the characteristics of the RPS and FIT systems, then examines actual cases of the RPS being implemented in Japan, Korea and California.

Chapter 1 laid out the brief history of FIT and RPS implementation in major countries and their respective characteristics. In general, FIT is characterized by priority feed-in and price control, while RPS puts more emphasis on quantity control and cost efficiency by the use of Renewable Energy Certificate (REC) trading. It was pointed out the choice of the support schemes does not necessarily reflect the technological and/or economical maturity of renewable electricity, and advantages and disadvantages of those schemes depend on policy priorities and other various conditions in each country.
Against the backdrop of growing cost concern in FIT, the RPS cases, to contrast, have been discussed in the following chapters.

Chapter 2 dealt with the RPS in Japan. Prior to the introduction of FIT in 2012, Japan had RPS scheme in place from 2003. Obliged companies had met their target throughout the implemented period. However, the problems of this system also became apparent soon after the introduction, notably, the target level, investment uncertainty and the price formation. Based on those, this chapter drew implications of Japanese RPS: First, the setting of targets is vital. In Japan's RPS, over-supply of RPS electricity had been observed from the second implementation year on, which indicated that the RPS target was not high enough to stimulate investment. Second, the system must be fine-tuned. Setting expiration dates for banking, for instance, to limit the surpluses to be carried over to the following year could have functioned as a valve to control supply and demand. It was also pointed out that switch of the scheme, namely from RPS to FIT could have merited from comprehensive review of RPS on the long-term advantages and cost-effectiveness of it.

Chapter 3 examined the RPS in Korea. The FIT system has been deployed from 2002 to 2012 when RPS replaced it. The major reason for the switch was the financial burden of the FIT system on the government. Targeted utilities under the RPS, however, have failed to achieve their quotas over two consecutive years (2013 and 2014). This

has resulted in the need to reconsider the system, including the appropriateness of the target to achieve 10% deployment by 2022 after starting at 2% in 2012. Besides, the design details may need further retouch such as the level of fines in case of non-compliance. From a longer perspective, it is expected that the use of REC trading will increase cost efficiency of the support scheme and help stimulate wider investment covering renewable and new energies.

Chapter 4 has looked into implementation details of RPS in California, highlighting the distinctive features compared with Japan's RPS. As for California's RPS, it can be said that the political intervention and administrative management are performing important roles. Namely, long-term target setting, administrative control over RPS procurement prices, and the incorporation of infrastructure development plan and costs associated with renewable electricity into RPS procurement. By capturing RPS as a regulated system, as was the case in California, the simultaneous pursuit of the promotion of the introduction of renewable energy electricity and cost containment has been made possible so far.

Initiatives to Expand the Introduction of Renewable Energy in Various APEC Economies Examples of RPS in Japan, Korea, and California in the US

Introduction

As initiatives to increase the use of renewable energy spread throughout the world, many APEC economies have also begun implementing the feed-in tariff (FIT) system or the renewable portfolio standard (RPS). For example, a FIT system was introduced in Japan in July 2012, and a mere two years after its implementation, the generating capacity of certified facilities (predominantly photovoltaic power generation facilities) has reached 70 GW. The FIT system is said to have stimulated the embracing of renewable energy, but it has also triggered fears of a rapid increase in the purchase price of electricity and a lag in the construction of infrastructure, already resulting in the government being pressured to revise the system[1]. Germany and Spain, which introduced the system earlier, have also been hit by the same problems, highlighting the need for controlling the rate at which renewable energy is introduced through a FIT system.

The FIT system is a scheme that aims to promote investment in renewable energy sources through government-fixed prices for purchasing the generated electricity, while the RPS offers a system for promoting investment by mandating utilities to procure a government-designated amount of electricity from renewable sources. Regarding the RPS, which aims to achieve quantitative control, there has been a growing need for investigations into the measures being implemented to address the issues faced by the FIT system, such as the cost of running the scheme and the integration into the grid infrastructure. This document first aims to identify the characteristics of the RPS and FIT systems, and then examines actual examples of the RPS being implemented in (1) Japan (RPS implemented in 2003 and replaced by the FIT system in 2012), (2) Korea (FIT system implemented in 2002 and replaced by the RPS in 2012), and (3) California in the U.S. (RPS implemented since 2002). These examples are examined in order to ascertain the details of the various RPS systems, how they have been designed, how they are being operated, etc. Moreover, a separate document has been prepared (attached) on the RPS being implemented in California of the U.S., which includes a comparison with the system in Japan.

[1] The 8th New and Renewable Energy Subcommittee report (December 18, 2014), among others

Chapter 1: Overview of Measures to Promote the Use of Renewable Energy

Measures to promote the use of renewable energy include research and development, demonstration projects, subsidies to assist the development of facilities, and the subsidized selling of electricity[2]. The subsidized selling of electricity has been implemented in many countries in recent years, and can generally be divided into systems based on FIT and RPS[3].

FIT is a scheme in which electric utilities are obliged to purchase electricity generated through renewable means for a fixed term at a fixed price. There are generally no restrictions on the quantity of electricity generated, and it aims to encourage deployment by creating a stable investing environment through policies to fix the purchase price and term. The difference in price between the purchase price and the traditional cost of electricity is levied on household electricity bills. The goal is to promote research and development through large-scale deployment, encouraged by privileges offered to renewable energy producers, while also gradually lowering the purchase price to encourage reductions in the cost of generation.

On the other hand, the RPS offers a system that aims to promote the spread of renewable energy through the boosting of demand for it by mandating utilities to procure a designated amount of electricity from renewable sources. The overall amount to be deployed and the amount to be designated to each utility is decided through the formulation of policies. However, who and where the electricity is procured from by individual utilities, the price, and other conditions are determined through competition on the market. Moreover, Renewable Energy Certificates (RECs), which are physically independent of the supplying of electricity, are usually issued to simultaneously create an REC trading system, enabling utilities to fulfill their quota obligations through the trading of RECs on the market[4]. It is because of these characteristics that the RPS is considered to be a measure based on market mechanisms[5]. The deployment of renewable energy progresses according to cost, but the system encourages competition

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[2] Also known as operational subsidies, as opposed to subsidies to assist the development of facilities. The system offers benefits in the form of subsidies to operate facilities and sell electricity.

[3] Electric utilities in the U.S. are given production tax credits at the federal level in accordance with the amount of electricity they generate through renewable means. This has had a major impact on the deployment of wind power generation in particular, although this document will not examine this program as it is not funded by the state governments.

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

[5] Kimura、2007

by implementing a policy to raise the designated amount of electricity generated through renewable means.

The advantages and disadvantages of measures to promote the use of renewable energy depend on the priority given to renewable energy policies and the various conditions (geographical conditions, potential, infrastructure, market structure, etc.), which differ depending on the country or region, making them difficult to compare directly. Furthermore, the economical effectiveness of FIT, which designates the price, and RPS, which designates the amount to be deployed, is theoretically the same under the same conditions[6]. However, in reality, an analysis carried out around 2008-2009 gave a high assessment to the effectiveness and cost effectiveness of the FIT system, while pointing out that under an RPS system, uncertainties in the price and conditions for selling electricity, and the cost of transactions, will lead to utilities being asked to pay a premium, causing a deterioration in the cost-effectiveness of procurement[7].

Currently, more countries have adopted the FIT system, centered on countries in Europe such as Germany and Spain. Major progress has been made in the deployment of renewable energy in these countries. This stands in contrast to countries like the U.K., where not much progress has been made after the adoption of a system based on the RPS around the early 2000s, resulting in termination after about 10 years of deployment and policy changes to switch to a FIT scheme.

However, renewable energy generation skyrocketed unexpectedly in countries that deployed FIT schemes, creating problems such as sudden increases in the cost of funding and limitations on infrastructure, which became apparent around 2009. This has led to the introduction of measures in recent years to implement major cuts in the purchasing price according to the amount of renewable energy produced (e.g., as in Germany[8]), and cases of setting aside a predetermined budget (e.g., as in the U.K.[9]), resulting in the diversification and greater complexity of subsidy programs based on FIT systems. The effectiveness of these new measures is currently unknown.

The RPS was implemented in Japan in 2003[10], and along with the deployment of RECs, it was considered to be a cost effective initiative that was based on market mechanisms. However, it failed to stimulate investment in renewable energy, mainly because the targets were set too low. The RPS was terminated in 2012, and was replaced with the

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[6] EU, 2008

[7] EU 2008、NREL 2009

[8] Renewable Energy Act (EEG) amended in 2014

[9] Energy Act 2014 (CfD)

[10] Act on Special Measures for the Promotion of New Energy Use, etc.

FIT system[11]. This resulted in the government certification of renewable energy facilities reaching a capacity of about 70 GW, centered on photovoltaic power generation, a mere two years after deployment of the system. There is a possibility of these facilities operating 10-20 years into the future under FIT subsidization, which under full operation is expected to cost 2.7 trillion yen (at 3.12 yen per kWh) in taxes (annually)[12]. In addition to such fears of skyrocketing costs, the certification of facilities rushed ahead in areas with inadequate infrastructure for handling the potential increase in electricity, and at least some of these areas are not expected to be able to expand their deployment of renewable energy in the future[13].

Korea implemented a FIT system in 2002, but they switched to an RPS system in 2012 after the purchase price began to rise, among other reasons. Some utilities must pay fines after being unable to fulfill their quota obligations under the RPS system, and discussions are currently being held to implement measures such as the revision of targets.

The FIT policy in the U.S., established at the federal level, has become toothless[14], resulting in 29 states currently implementing an RPS system[15]. California adopted the RPS in 2002, and they have maintained the system through revision of their targets. They have set for themselves the ambitious target of boosting the rate of electricity sold through the RPS to 33% by 2030, and have also announced a plan to continue striving to promote the use of renewable energy through a policy centered on RPS.

Chapter 2: Japan

1. Overview

An RPS system was deployed in Japan in April 2003 based on the Renewable

[11] Measures were implemented to give utilities with existing contracts the choice to, e.g., switch to a FIT system.

[12] The 4th New and Renewable Energy Subcommittee report and materials provided by the Agency for Natural Resources and Energy (September 30, 2014).

[13] 3rd Working Group on Grid Connection, December 16, 2014.

[14] The Public Utility Regulatory Policy Act (PURPA), enacted in 1978, granted state governments the right to mandate the purchasing of renewable energy, such as electricity, by electric utilities within their states. However, the purchase price fixed by the state was not to exceed the avoided cost of the electric utility obliged to purchase the electricity. Nevertheless, progress made in switching from petroleum-fired power generation to alternative sources of electricity in the 1980s, combined with a plunge in crude oil prices, resulted in avoided costs of electric utilities falling far below the cost of generating electricity using renewable energy sources. This led to a stagnation of investments made in renewable energy. Holt and Galligan (2013), Sato (2011).

[15] DSIRE, NREL, September 2014.

Portfolio Standard (RPS) Law announced in June 2002. It laid down targets for eight years until 2010, at the time of its deployment, and the target for 2010 was 12.2 billion kWh (about 1.35% of all the electricity sold). The system was deployed until 2012, undergoing revisions such as the establishment of a separate framework for solar power generation. However, the FIT system was adopted in July 2012, and measures were implemented to allow utilities to switch to the new system. Following this, the RPS system was terminated.

Table 1 Basic Information and Renewable Energy Policies of Japan

	Japan	
Basic Information[16]		
Area	378,000 km^2	
Population	128.37 million	
Size of the economy	5.869 trillion USD	
Amount of electricity sold	848.5 GWh[17]	
Average retail price	19.81 yen / kWh[18]	
Renewable energy policies[19]	**RPS**	**FIT**
Years of deployment	2003-2012	2012 to the present
Target	Electric utilities	Electric utilities
Goal	1.35% of electricity sold by 2010	-
Method of procurement	Through bidding and mutual agreements	Mandatory purchase
Price of procurement	Dependent on the contract	Fixed price
Term	Dependent on the contract	10-20 years
Upper limit on cost of procurement	Upper limit on cost of REC: 11 yen / kWh	None (care needed to ensure consumers are not burdened with excessive costs)

[16] Taken from the website of the Consulate-General of Japan in San Francisco

[17] Total of 10 companies in 2013 (verified data taken from the FY2013 results of electricity demand of The Federation of Electric Power Companies of Japan, April 30, 2014)

[18] Average for lighting and power (lighting: 24.33 yen / kWh; power: 17.53 yen / kWh), according to the Energy White Paper 2014

[19] California: CPUC website, among others. Japan: METI website, among others

Regulations on penalties	1 million yen fine for violating recommendations and orders	-
Goals for reductions in greenhouse gas emissions	**Voluntary action plan From 1997**	
	No legally binding goals have been set	

Table 2 Showing the framework for Japan's RPS system

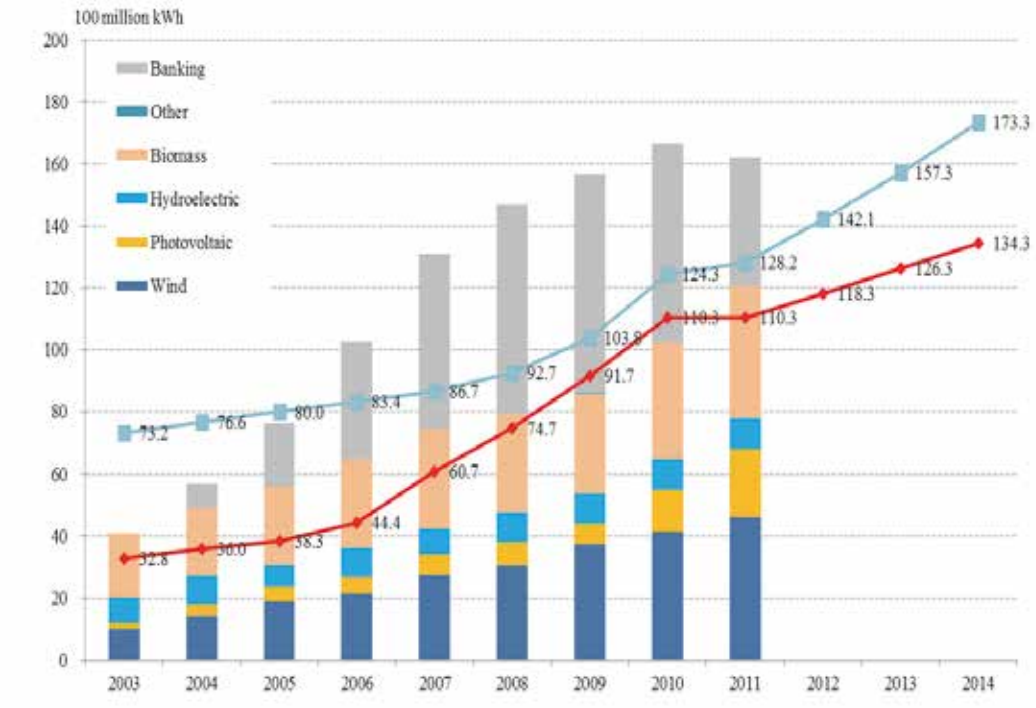
Law/Year	Renewable Portfolio Standard (RPS) Law, 2003
Target and mandatory quota	Electric utilities (power companies, specified electric utilities, power producers and suppliers) are obliged to procure a designated amount of electricity from renewable sources in accordance with the amount of electricity sold
Types of targeted energy	1. Wind 2. Photovoltaic 3. Geothermal (a binary method to be specific, from a need to conserve hot water) 4. Hydroelectric (conduit and dam type; capacity of 1,000 kW or less) 5. Biomass (waste power generation and generation by fuel cells that rely partially on biomass)
Organization for execution and operation of the system	Agency for Natural Resources and Energy

2. System Deployment Status

The total capacity of facilities that had acquired certification under the RPS Law by the end of 2011 was about 9 million kW. However, facilities that had been targeted by the Excess Electricity Purchasing Scheme for Photovoltaic Electricity accounted for about 3.8 million kW of this (not applicable for fulfillment of quota obligations), and the total capacity excluding this amount was about 5.2 million kW. Wind power generation accounted for about 49% of this amount and biomass power generation for about 44%.

As will be mentioned later, the RPS deployment target (targeted amount of use) and the actual mandatory quota (standard amount of use) are predetermined under the Japanese RPS system. During the term of deployment, the amount of electricity procured through the RPS system exceeded the quota (see graph below) and every year the excess amount was carried over to the following year.

Fig 1 Fluctuations in the electricity supply generated by alternative sources of energy
(Unit: 100 million kWh)



Source: The RPS Management System of the Agency for Natural Resources and Energy, METI

3. Points Regarding the Design of the RPS System

3-1. Deployment Target and Mandatory Quota

(1) Deployment Target at the Economy-wide Level

It has been stipulated (under Article 3) that the target for renewable energy use (the national target) under Japan's RPS system is to be decided by the Minister of Economy, Trade and Industry upon consultation with the Advisory Committee for Natural Resources and Energy; the Minister of the Environment; the Minister of Agriculture, Forestry and Fisheries; and the Minister of Land, Infrastructure, Transport and Tourism. The targeted amount of use was set based on the rate of alternative energy use by the electric utility that had the highest rate of alternative energy use before enactment of the law. The mandatory quota was calculated on the premise that the same amount would be imposed on all utilities[20].

[20] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory

The system was such that the deployment target was set every four years for the following eight years. Thus, the target would be set for a maximum of eight years, and a minimum of four years in advance, with the chance to revise it every four years.

At the time when the RPS system was introduced in 2003, the target set was 12.2 billion kWh by 2010 (equivalent to 1.35% of the total electricity sold)[21]. Although this was more than twice the amount of alternative sources of energy being used at the time, it was a conservative target that would not cause a rapid increase in the burden[22].

The Advisory Committee for Natural Resources and Energy stated in reference to the deployment target at the time, "There is a need for continued consideration of measures necessary to ensure coordination between grids, the scale of costs, and how these costs are to be divided and recovered. Until these issues are resolved through discussions (within a target of three years), deployment of the system is to be limited to within the bounds of the current system in that no special measures will be required to revamp the grid."

At the time (after 1992) in Japan, electric utilities were buying excess electricity voluntarily, and a bidding system for renewable energy was set up by Hokkaido Electric Power and Tohoku Electric Power. This prompted the consideration of the implementation of this scheme in the RPS system on a national scale, and it is believed that this became the standard on which the production targets were based[23]. The government had no specific renewable energy targets, and it can be inferred that the system was deployed after its designation of being within the bounds of realistic targets that were achievable from the perspective of electric utilities.

In 2007, the year of revising the target (which occurs every four years), the target that was set in 2003 was used again for another four years from 2007-2010, and a new target was set for a further four years from 2011 to 2014. The target for 2014 was set at 17.3 billion kWh.

Moreover, in FY2007, a measure was implemented to "double count"[24] photovoltaic power based on the premise that "there was a lot of potential for technological advancement in facilities using photovoltaic power compared to other sources of electricity, and major cost cuts and growth could be expected through the creation of greater demand, resulting in the need to promote it upon consideration of the current

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Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

[21] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

[22] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

[23] Based on interviews with experts

[24] A measure to double count photovoltaic power generated to fulfill quota obligations from FY2011 until FY2014

difference in the cost of production compared to other sources of energy."[25]
Furthermore, a "new purchase system for photovoltaic electricity" was launched in FY2009 (the Excess Electricity Purchasing Scheme for Photovoltaic Power generated by households). This prompted a revision of the RPS deployment target, and the target for FY2014 was revised to 17.33 billion kWh[26]. In doing so, the meaning of the RPS target for utilities changed. With the implementation of new purchasing schemes, subsidies, etc., it became a goal for everyone in Japan to strive for.

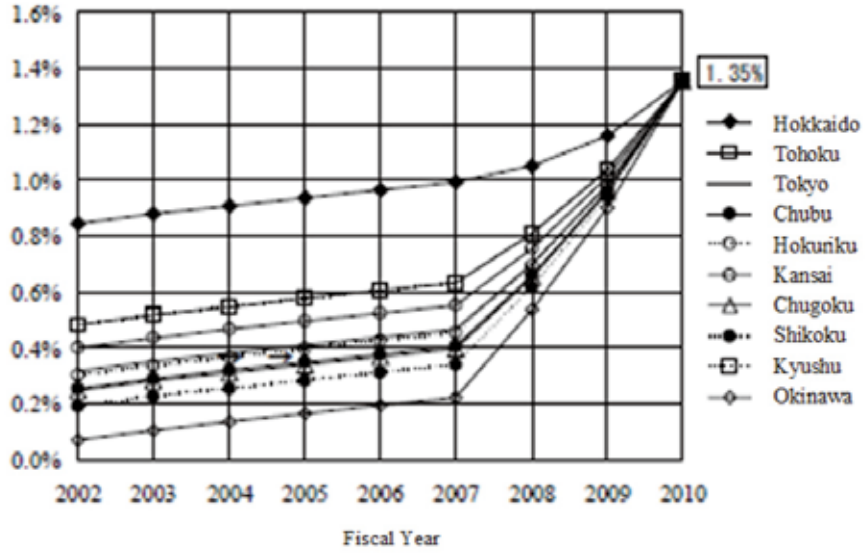
(2) Individual Targets and Procurement Methods for Targeted Utilities

Based on the economy-wide deployment target stated above, the targets for individual utilities were set as the "standard amount of use (known as 'mandatory quotas')" by the Minister of Economy, Trade and Industry (as stipulated in Articles 4 and 5).
The target mentioned above was set to boost the amount of RPS electricity to 1.35% of the total amount of electricity sold by 2010 was a measure with a provisional term of seven years after implementation. The RPS quota imposed on each utility was adjusted according to their achievements, and gradually raised over time to bring it up to the 2010 target (the deployment amount calculated from the adjusted quota was called the "standard amount of use," and this was the actual mandatory quota)[27]. This was prescribed to give utilities the time to establish generating facilities, because imposing a deployment target was expected to require a rapid increase in deployment making it extremely difficult for many utilities to fulfill their quotas[28].
Moreover, the original plan was to raise the standard amount of use to the targeted amount of use over three years from 2008, so that the same mandatory quota (about 1.35% of the total amount of electricity sold) would be imposed on all electric utilities by FY2010. However, the plan was revised in June 2006 to begin early deployment of the scheme by the latter half of 2006 in consideration of the quota fulfillment status of

[25] METI Notification No. 106, March 30, 2007: The same sentence was used in the target set in 2009 (METI Notification No. 279, August 31, 2009), 2011 (METI Notification No. 51, March 31, 2011), and 2012 (no number or date).
[26] The overall target for FY2014 was the goal amount set in FY2007 that excluded photovoltaic power (13.4 billion kWh) plus the increase in photovoltaic power generation due to the purchasing scheme (3.915 billion kWh), making a total of 17.32 billion kWh. However, the increase in photovoltaic power generation (3.915 billion kWh) was not a quota imposed on electric utilities, but it was a deployment target set by the government. It was agreed that the target for RPS-targeted utilities would be the targeted amount excluding the photovoltaic power set for FY2014 in FY 2007 (13.4 billion kWh) plus the photovoltaic power to which the purchasing scheme did not apply. (This was 0.015 billion kWh, but because of the double counting measure implemented for photovoltaic power in March 2007, it was doubled to 0.03 billion kWh.) Thus, the total was 13.43 billion kWh.
[27] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006
[28] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

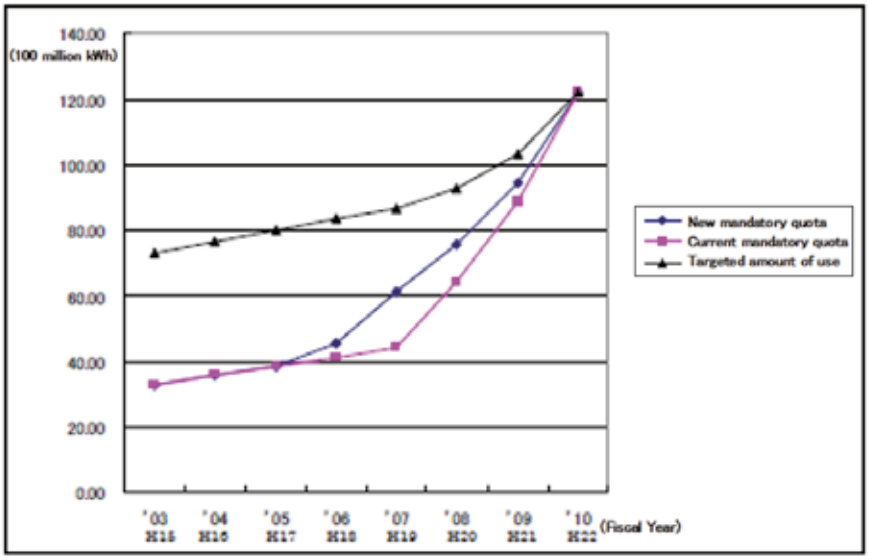
all electric utilities.

Fig 2 RPS electricity procurement rate of each company (initial forecast)



Source: RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

Fig 3 Targeted amount of RPS electricity use (revised in 2006)



* Actual results shown until 2005. The new mandatory quota and new mandatory quota ratio after FY2006 have been estimated based on energy supply and demand forecasts for 2030 (Advisory Committee for Natural Resources and Energy, March 2005).

Source: RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

The three ways in which electric utilities can fulfill their mandatory quotas are by 1) generating their own electricity using new energy sources, 2) purchasing energy from elsewhere that is generated using new energy sources, or 3) acquiring RECs equivalent to their mandatory quotas.

RECs equivalent to electricity generated from new energy sources represent the amount that can be traded between electric utilities, in accordance with the amount of such electricity used by other utilities in order to fulfill the mandatory quotas. Electric utilities that generate electricity using new sources can either sell the electricity and RECs (specifically, this is electromagnetic information with IDs allocated to every 1,000 kWh of electricity) together, or separately to different utilities. There are differences in the amount of electricity that can be generated from new energy sources depending on the region, but allowing the trading of RECs enables electric utilities to fulfill their quotas through their electronic accounts without directly engaging in the supplying of electricity generated from new energy sources. The government sees this as a way of making use of market mechanisms to override regional limitations. To electric utilities, it gives them more choices in ways to fulfill their quotas. Utilities that generate electricity using new energy have more choices in the way they can sell their electricity[29].

In addition to the trading system, the following flexible measures have also been implemented in regard to the fulfillment of quotas:

- Banking: RECs may be used to fulfill quotas in the same or following fiscal years that the RECs are registered in the electronic account. In other words, if an electric utility does not use an REC to fulfill a quota in the same fiscal year that it is acquired, the REC may be carried over to the following fiscal year. There is no limit to the amount that can be banked. This banking system was established "in consideration of the fact that the amount of electricity generated using new energy may be affected by the weather, which makes the supply unreliable and affects the balance between supply and demand"[30].
- Borrowing: There are cases when the standard amount of use has not been achieved, even after subtracting the amount that has been banked, the amount that could not be purchased because the price exceeded the maximum, and the

[29] System for Managing Electricity Generated Using New Energy, Agency for Natural Resources and Energy http://www.rps.go.jp/RPS/new-contents/gaiyou/gaiyo-soutouryou.html

[30] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

amount that was generated by household photovoltaic systems (mentioned earlier). In cases where the standard amount of use is not achieved, the deficiency can be carried over to the following year. The upper limit for borrowing is 20% of the quota in the fiscal year the deficiency is reported. There are no special procedures. The system automatically adds the deficiency onto the quota for the following fiscal year, with an upper limit of 20%.

On the other hand, if an electric utility fails to fulfill the quota with no justifiable reason, the Minister of Economy, Trade and Industry has the right to set a deadline and issue a warning or order to fulfill the quota (stipulations pertaining to Article 8 of the Act). Utilities that violate this law become subject to a fine of no more than one million yen.

3-2. Measures to Limit Costs

The penalty mentioned above is imposed when there is no justifiable reason for failing to fulfill the quota, while "justifiable reasons" are measures that are implemented to limit costs. In other words, when a REC cannot be bought for less than the maximum price due to, e.g., an imbalance in the supply and demand, the amount of the quota that could not be covered by the REC is considered justifiable. The maximum price is set as 11 yen per 1 kWh[31]. The amount that could not be fulfilled due to this reason is not carried over to the following fiscal year.

4. The Status and Issues Regarding the Operation of the System

In 2001, the New and Renewable Energy Subcommittee of the Advisory Committee for Natural Resources and Energy of Japan examined the operational status of the RPS and fixed price purchasing systems of various countries overseas in preparation for expanding new energy use. As a result, the RPS system was deployed upon winning appraisal for its overall excellence due to (1) the guaranteed effectiveness of the system, (2) the flexibility in choosing the source of electricity in fulfilling the quota, (3) the presence or absence of cost cut incentives, and (4) the fairness of cost-bearing, etc.[32]. However, the problems associated with this system also became apparent after operations began.

The RPS Law Evaluation Subcommittee was launched in November 2005, three

[31] http://www.rps.go.jp/RPS/new-contents/top/toplink-1.html

[32] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

years after operations began, based on the RPS system (supplementary provision of Article 5). Meetings were held to discuss the operation of the system (six meetings were held until May 2006)[33]. Committee members included academics, people from electric utilities, people involved in electricity generation using new energy, and other experts. The problems with the RPS system identified in the committee report are outlined below.

One of the problems concerned the target standard. It became apparent in FY2005, in the second year of operation, that more than 50% of the quota (3.83 billion kWh) had already been attained through banking (2.1 billion kWh) in the previous fiscal year, when the system went into operation. The report even pointed out the possibility of the banked amount exceeding the quota in the following fiscal year, which was before FY2008, when supply and demand were to be further stimulated[34]. On the other hand, the report stated that after FY2008, "the maximum amount of effort would be required in both the public and private sectors to achieve the FY2010 target due to the possibility of difficulties in securing the space to set up wind farms, procuring resources for biomass power generation, and various other conditions[35].

The second problem that was identified was the difficulty of establishing a renewable energy business plan. The report indicated that the timing of setting targets in particular "made businesses in generating electricity using new energy risky, because such facilities usually require around 10 years or more to recover investment costs, while the 8-year goal of achieving the targeted amount of use did not offer sufficient time[36].

The third problem was the price. In reality, most cases involve the purchasing of both the electricity generated using new energy and the REC, but such transactions were executed mainly upon negotiation, making the prices unclear. The report stated, "Ever since deployment of the RPS Law, the government has been carrying out surveys of the price every year, but the surveys are not carried out frequently and the announcements of results are also irregular. This led to the lack of an index for trading RECs, and people pointed out the difficulty of making judgments. The lack of a reference for a suitable price made it difficult to plan businesses in new energy"[37].

These were problems pointed out back in 2006, but they also applied in the years after

[33] http://www.meti.go.jp/committee/gizi_8/8.html

[34] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

[35] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

[36] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

[37] RPS Law Evaluation Subcommittee Report (Proposal), the New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy, RPS Law Evaluation Subcommittee, May 26, 2006

while the RPS system was in operation. These problems highlight the importance of setting targets. As we have so far seen, the RPS system in Japan began with conservative targets so as to avoid placing a heavy burden on utilities. The overall deployment target was far from being harsh, and the individual quotas imposed on utilities were also open to adjustment. Although the targets were revised halfway through deployment of the system, they were not enough to stimulate supply and demand.

In consideration of this situation, the implications of the RPS system in Japan were as is outlined below.

First, the setting of targets is vital. The RPS targets of Japan were to lower greenhouse gas emissions, deploy renewable energy, and other targets, and they failed to clarify the priority goals of the government's policies, the intentions behind them, and the connections between the policies. The objectives behind the setting of targets were unclear. The objectives of policies must be more than just natural outcomes or the policies become meaningless, but perhaps the deployment targets of Japan's RPS system were nothing more than just BAU (business as usual).

Second, the system must be fine-tuned by, e.g., setting expiration dates for banking and other systems that allow surpluses to be carried over to the following year. Although this is an absolute necessity for the system, it is difficult to change the rules for banking once they have been set, even when it is clear that there will be an overachievement of the quota, and neither is it a desirable measure for ensuring the stability of the policy. Therefore, there is a need for a system design that incorporates a function to act as a regulator valve to control supply and demand. Utilities did not make effective use of REC trading, but there is a need for thorough reconsideration of the system rules, such as the effectiveness of setting maximum prices.

Last, the switch in Japan from the RPS system to the FIT system was made without an adequate examination of the long-term advantages and cost-effectiveness of the RPS system. There was also inadequate studying of the meaning of changing systems in line with the objectives of the policy, and there is a need for more consideration, including the status of domestic and overseas FIT and RPS operations.

Chapter 3: Korea

1. Overview

A FIT system was introduced in Korea in 2002 based on "The Act on the Promotion of the Development, Use, and Diffusion of New and Renewable Energy," and it was

implemented for around 10 years, after which the RPS system[38] was deployed in January 2012 to replace FIT as a measure to further promote the cause.

Deployed as a new measure to promote the cause, the RPS mandates the use of new and renewable energy (fuel cells and IGCC thermal power generation) for major electric utilities, and aims to boost the ratio of electricity generated using renewable energy to 10% by 2022. When targeted utilities are unable to fulfill their quotas, they are made to pay a surcharge. The RPS electricity is purchased entirely by KEPCO[39] through the wholesale electricity market[40].

Table 3 Basic Information and Renewable Energy Policies of Korea

	Korea	
Basic Information[41]		
Area	102,000 km^2	
Population	Around 50 million	
Size of the economy	1.3046 trillion USD (2013)	
Amount of electricity sold[42]	455.1 million kWh	
Average retail price	89.3 won/kWh[43]	
Renewable energy policies[44]	**FIT**	**RPS**
Years of deployment	2002-2011	From 2012
Target	Electric utilities	Electric utilities generating over

[38] Purchasing of electricity through the FIT system continues to this day (the purchasing term is 15 to 20 years), but no new applications are being accepted for FITs.

[39] A stock company with 51% of stocks owned by the government. Korea established a policy of dividing and privatizing utilities in 1998 after being struck by the Asian currency crisis, and KEPCO was divided into Generation, Transmission, and Distribution Divisions in 2000. KEPCO's Generation Division was divided up into six companies (five companies with pumping-up and thermal power plants, and KHNP, which owns hydroelectric and nuclear power plants), but the stocks of the subsidiaries are owned entirely by KEPCO. KEPCO is in charge of the transmission, distribution, and retailing of the electricity (Japan Electric Power Information Center, Inc. (a))

[40] With the division and privatization of KEPCO's Generating and Distribution Divisions, Korea Power Exchange (KPX) was founded in 2001. As a general rule, it is a market that all utilities are obliged to take part in. The wholesale price of electricity is not decided upon bidding by the utilities, but it is decided through cost-based calculation by KPX (Japan Electric Power Information Center, Inc. (a))

[41] Taken from the Ministry of Foreign Affairs' website

[42] Japan Electric Power Information Center, Inc. (a)

[43] Overall unit price for 2011. For household use: 105.1 won. For general use: 101.7 won, for industrial use: 81.2 won, etc. Japan Electric Power Information Center, Inc. (a)

[44] California State: CPUC website, among others. Japan: METI website, among others

		500 MW
Goal		E.g., 10% of electricity sold by 2022
Method of procurement	Mandatory purchase	Through mutual agreements
Price of procurement	Fixed price purchase	Based on the contract
Term	15-20 years	Based on the contract
Upper limit on cost of procurement	-	None
Regulations on penalties	-	Fine equivalent to 150% of the average market price will be imposed for RECs that do not fulfill annual quotas
Greenhouse gas emissions reduction target	**"Low Carbon, Green Growth" (2009)**	
	30% reduction in 2020 compared to BAU	

Table 4 The framework for Korea's RPS system

Law/Year	Renewable Portfolio Standard (RPS) Law, 2011
Target and mandatory quota	Major electric utilities that generate 500 MW or more are required to submit RECs equivalent to their annual quotas.
Types of targeted energy	In addition to renewable energy, IGCC and fuel cells are targeted as forms of new energy, each with predetermined REC issuing coefficients.
Organization for execution and operation of the system	New and Ministry of Trade, Industry & Energy (MOTIE), Korea Energy Management Corporation (KEMCO), Energy Center (KNERC)

(Reference) Based on IEA, Policies & Measures Database

2. System Deployment Status

The amount of electricity generated by renewable energy facilities set up over roughly three years (January 2012 to September 2014) since deployment of the RPS system was 3,166 MW. Of this amount, 1,203 MW were from photovoltaic power generation.

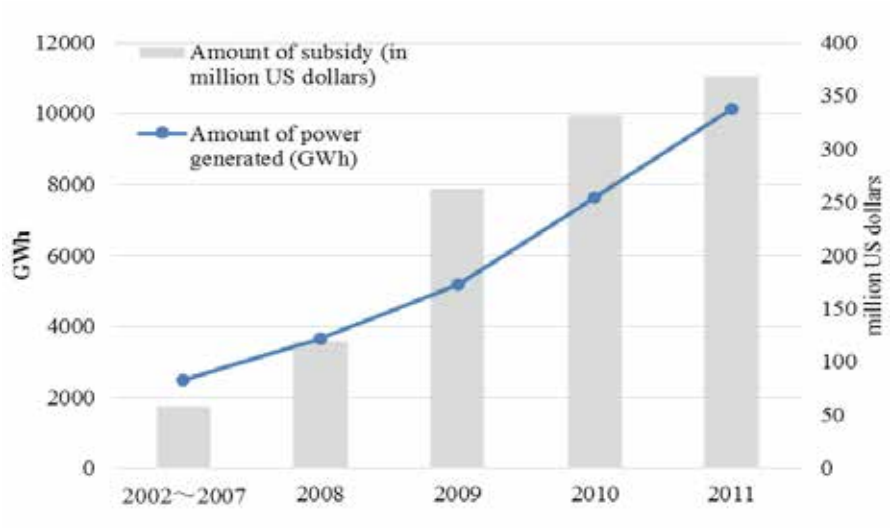
The amount generated after 10 years of deploying the FIT system was only 1,030 MW at 2,089 facilities, and 497 MW of this were accounted for by photovoltaic power generation. As this demonstrates, renewable energy deployment skyrocketed in Korea due to the RPS system:

> Amount generated under FIT system (2002-2011): 1,030 MW, of which 497 MW were generated through photovoltaic generation
> Amount generated under RPS system (2012-2014): 3,166 MW, of which 1,203 MW were generated through photovoltaic generation

Moreover, one of the main reasons for switching from the FIT to the RPS system was the increase in the purchase price of electricity generated under the FIT system. In Korea, the extra cost of generating electricity under the FIT system (dependent on the amount generated) is not charged to consumers, but is paid for by the government. This in turn is funded by the "Power Industry Fund," set up primarily for the purpose of financing R&D in renewable energy[45]. Although the maximum amount that the power authority is legally able to collect for the fund is set at 0.6% of the revenues from electricity charges, the actual amount collected is half of this, or 0.3%, due to opposition from consumers. In 2011, the amount collected annually for the fund was 500 billion won, while the amount paid to finance the FIT system climbed to over 300 won. This led to criticism for placing an excessive burden on the government[46]. This was one of the reasons that prompted the switch to the RPS system in 2011.

[45] 3.7% is collected from electricity bills paid by consumers. Japan Electric Power Information Center, Inc. (a)
[46] Based on interviews (February 4, 2015), Seoul National University

Fig 4 Increases in the amount of electricity generated and the cost to purchase it under the FIT system in Korea



(Reference) Based on material provided by KEMCO

3. Points Regarding the Design of the RPS System

3-1. Deployment Target and Mandatory Quota

(1) Deployment Target at the Economy-wide Level

The government set a target of raising the amount of new or renewable energy used to 11% of the primary energy by 2035. The target for electricity generation was 13.4% by 2035 (3.7% had been achieved as of 2012).

Table 5 New and renewable energy deployment target in Korea

Renewable energy supply plan relative to primary energy

	2012	2014	2020	2025	2030	**2035**
Percentage of new and renewable energy	3.2%	3.6%	5.0%	7.7%	9.7%	**11%**

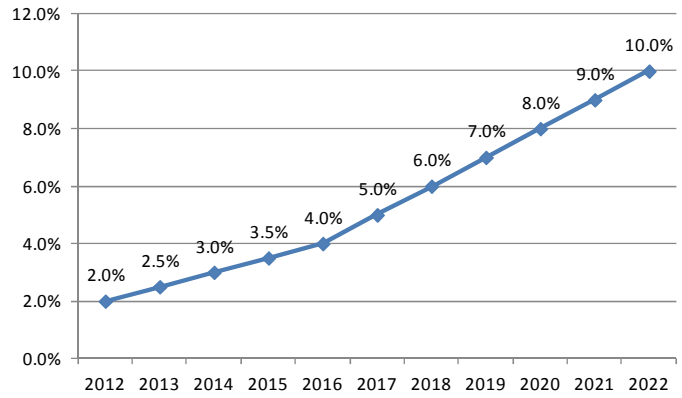
Renewable energy supply plan relative to electricity generated

	2012	2014	2020	2025	2030	**2035**
Percentage	3.7%	6.0%	9.0%	11.5%	13.1%	**13.4%**

(Reference) The Institute of Energy Economics, Japan and EDMC

As indicated in the graph below, the procurement target under the RPS system is set to rise almost 1% each year, with the target for 2022 set at 10%. However the target may be revised every three years[47].

Fig 5 The RPS deployment target in Korea



(Reference) Based on information from KEMCO's website

(2) Individual Targets and Procurement Methods for Targeted Utilities

Targeted utilities are those that own facilities with generating capacities of over 500 MW. There are currently 14 such utilities. Of these, five are subsidiaries of KEPCO[48]. Other targeted utilities include K-Water and IPP of the POSCO Group (steel industry).

1. Korea Hydro & Nuclear Power Co., Ltd.
2. Korea South-East Power Co.
3. Korea Midland Power Co.
4. Korea Western Power Co.
5. Korea Southern Power Co.
6. Korea East-West Power Co.
7. Korea District Heat Corporation
8. Korea Water Resources Corporation
9. Posco Energy
10. SK E&S
11. GS EPS

[47] IEA/IRENA, Joint Policies & Measures Database, last modified March 2014

[48] 84.5% of the domestic generating capacity is covered by KEPCO and its five subsidiaries. Japan Electric Power Information Center, Inc. (a)

12. GS Power
13. MPC Yulchon
14. Pyeongtaek Energy Service

Targeted utilities must submit RECs equivalent to their quotas every year. The coefficient for REC issuance is determined by the energy source and technology used. The RECs remain valid for three years.

RECs allow for direct engagement in generating electricity using renewable energy sources (direct acquisition) and the purchasing of RECs only on the market (indirect acquisition). There are no maximum or minimum limits to acquiring RECs either way, but for photovoltaic power RECs, 50% or more of the electricity must be generated by facilities owned privately by individuals[49].

Table 6 RPS targeted energy in Korea and coefficients for REC issuance

Energy and technology	Categories	Coefficients of REC issuance
Photovoltaic	Farmland	0.7
	>30 kW	1
	<more than 30 kW	1.2
	Integrated into building materials	1.5
Wind	Land-based	1
	Offshore <5 km	1.5
	Offshore >5 km	2
Bioenergy	Biogas	1
	Biomass	1
	Landfill gas	0.5
	Energy from waste	0.5
Hydroelectric		1
Tidal		2
Fuel cell		2
IGCC		0.25

(Reference) Based on information from KEMCO's website

3-2. Measures to Limit Costs

In order to fulfill quotas, targeted utilities can build their own generating facilities, or acquire RECs through trading on the market from utilities that generate electricity using new or renewable energy. This is expected to promote the deployment of low cost sources and technologies across the entire country[50].

[49] Gavin, KEMCO material
[50] Based on interviews (February 3, 2015), KEMCO

The maximum price for quota fulfillment is not predetermined under the RPS system of Korea. However, as mentioned in the next section, targeted utilities were unable to fulfill their quotas, resulting in the imposing of fines. Under such circumstances, the fine becomes the virtual maximum price. The fine is 150% of the market price of RECs.

4. The Status and Issues Regarding the Operation of the System

The FIT system was deployed in Korea in 2002, and it continued for approximately 10 years. A switch was made to the RPS system in January 2012 (a scheme that includes the trading of RECs). However, this transfer was not made through the hypothetically anticipated process whereby the renewable energy market matures to a level that allows competition to kick in, but was prompted by the financial burden of the FIT system on the government.

The purpose of deploying the RPS system was to bolster the adoption of renewable energy other than photovoltaic power through the mandatory quota and penalty system[51]. This was effective in boosting the capacity of facilities in a short time. However, targeted utilities failed to achieve their quotas in 2013 and 2014, resulting in the imposing of fines (around 50 billion won in 2013) over two consecutive years. This has resulted in the need to reconsider the system, including the appropriateness of the target to achieve 10% deployment by 2022 after starting at 2% in 2012. It has turned out be a less than smooth strategy for replacing the FIT system.

[51] Based on interviews (February 3, 2015), KEMCO

Fig 6 Changes in the supply of electricity generated using new energy (100 million kWh)

<This fiscal year – Five electric utilities – Non-transfer to RPS system – Estimate – Surcharge>

Unit: 100 million won

		2013 (for 2012)		2014 (for 2013)	
KOSEP		106.3		6	
KOMIPO		48.3		113	
KOWEPO		41.1		181	
KOSPO		5.9		62	
EWP		35.4		79	
Total (KEPCO and five KEPCO subsidiaries)		**237.0**		**441**	
Other	GS EPS				54
	POSCO				3
	SK E & S		17		
Total			**254**		**498**
Rate of fulfilment (%)			64.2		67.2

(Reference) The Institute of Energy Economics, Japan and EDMC

The organization operating the system believes this situation, including the need to impose fines, can be improved in the future by making use of the flexibility of the system (the carrying over and borrowing of certificates), and by targeted utilities laying down long-term procurement plans. They also have high expectations for the role of RECs in the discovery of suitable domestic land for development through trading on the market[52].

Suggestions for the RPS system in Korea given its deployment status are outlined below.

First is the need to perpetuate the measures. The short-term increase in deployment is not the true goal of RPS. There is a need to consider a more gradual increase based on the original plan, taking into account the deployment status under the FIT system.

Second is the level of expectations for cost effectiveness. Coefficients are used under the RPS system of Korea to determine the issuance of RECs, and although there is criticism that this system will break down market principles, it is a reflection of the priority of policies. Other than that, everything else about the system is left up to the market to decide, so it has the potential to reflect market trends more flexibly than the FIT system in which the government imposes tariffs.

[52] Based on interviews (February 3, 2015), KEMCO

For this reason, it has attracted a lot of attention for how the system will operate after overcoming short-term disorders (the imposing of fines).
However, there are certain aspects of the system that need fine tuning. Under the current system, the fine is the virtual maximum price (150% of the market price of RECs), but there is a need to reconsider the system because this was not the intention of the government.
Last, the differences with the system in Japan are (1) the lack of an assumption that electricity prices will increase in accordance with system costs, and (2) the goal of the renewable energy policy in Korea is believed to stem more from an interest in industrial policies than energy. These reasons have resulted in the offering of opinions that consideration ought to be given to measures to include overseas investments in renewable energy in the fulfillment of RPS quotas, leading to the possibility of the system developing into something very unique.

Chapter 4: The State of California in the United States

A separate document has been prepared (attached) on the RPS being implemented in the state of California of the United States, which includes a comparison with the system in Japan.

Initiatives for the Simultaneous Pursuit of the Promotion of the Introduction of Renewable Energy and Cost Containment
Seen in the Example of the RPS System in the State of California

Introduction

In Japan, the feed-in tariff (FIT) system was introduced in July 2012 to help expand the introduction of renewable energy, replacing the renewable portfolio standard (RPS) that was implemented in 2003. The response to the FIT scheme in renewable energy investment was so huge that the generating capacity of certified facilities (largely photovoltaic power generation facilities) has reached 70 GW only two years after the commencement of the scheme. While the FIT scheme was credited with giving a boost to the increased introduction of renewable energy, the government is already under pressure for the review of the scheme amid a sense of unfairness stemming from the application of high purchase prices to certain facilities, concerns over rapidly increasing cost burdens on electricity users, and a lag in the construction of system

infrastructure to take in electricity generated from renewable energy sources[53]. Germany and Spain, which introduced the FIT system earlier, have also experienced similar problems, highlighting the difficulty for the government in setting appropriate purchase prices and, as a problem linked to this, the need for controlling the rate at which renewable energy is being introduced through the FIT system.

The FIT system is a command and control scheme that requires electric power companies to purchase electricity at government-set preferential prices, while the RPS system seeks to increase investment by allocating government-designated amounts of electricity from renewable sources and thereby creating demand. The RPS system is commonly known as the market mechanism-based scheme where the government controls the amounts of power to be introduced but decisions on procurement prices of electricity from renewable energy sources are left to market forces. These characteristics were given importance when the RPS system was previously implemented in Japan.[54].

At a time when the review of measures to promote renewable energy is being called for, the need is growing to look into how countries and areas currently implementing RPS systems are actually running them, including methods related to decisions on procurement prices. Therefore, this paper examines the State of California in the U.S., which is proactively introducing renewable energy by continuing the RPS system as the principal policy measure and as the target of case research. This paper also examines the key characteristics and challenges of the RPS system's institutional design and operation. It then considers the implications for Japan's renewable energy promotion measures, while looking at the main differences between Japan's RPS and FIT schemes and California's RPS system.

This chapter is structured in the following way. Sectionfig1 discusses the key characteristics of measures to promote renewable energy (FIT/RPS) and provides an overview of how they are positioned in renewable energy policies in recent years. Section 2 then looks at the institutional overview and implementation status of the RPS system in California. Section 3 examines the following as the key points in California's RPS system: (1) the establishment of introduction targets/assigned amounts, (2) provisions concerning methods of procurement of RPS-based electricity, (3) the mechanism to contain costs, and (4) responses concerning system development. Based

[53] The 8th meeting of the New and Renewable Energy Subcommittee (December 18, 2014), etc.

[54] RPS Act Evaluation Study Working Group Report (Draft; provisional translation), May 26, 2006, RPS Act Evaluation Study Working Group (provisional translation), New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy

on these discussions, Section 4 presents cost pictures and the operational status of the RPS system. Lastly, Section 5 sums up points of reference based on implementation examples of the RPS system in California.

Abbreviations

ACP:	Alternative Compliance Payment
AMFs:	Above Market Funds
CAISO:	California Independent System Operator
CEC:	California Energy Commission
CPUC:	California Public Utility Commission
FIT:	Feed-in-Tariff
IE:	Independent Evaluator
IOU:	Investor-Owned utility
LCBF:	Least Cost, Best Fit
LCOE:	Levelized Cost of Electricity
MPR:	Market Price Referent
ORA/DRA:	Office of Ratepayer Advocates/Division of Ratepayer Advocates
PGC:	Public Goods Charge
PRG:	Procurement Review Group
REC:	Renewable Energy Certificate
RPS:	Renewables Portfolio Standards

1. Key Characteristics of Renewable Energy Promotion Measures and Their Positions in Renewable Energy Policies in Recent Years

Measures to promote renewable energy include research and development/demonstration, subsidies for the introduction of necessary facilities, and subsidies for the selling of generated electric power[55]. Subsidies for sales of generated electricity, implemented by many countries in recent years, are broadly divided into the FIT and RPS schemes[56].

[55] Also known as operational subsidies, as opposed to subsidies to assist the development of facilities. These promotional measures offer benefits only in the stages of operating facilities and selling electricity.

[56] In the United States, electric utilities are given production tax credits at the federal level in accordance with the amount of electricity they generate from renewable energy sources. These tax credits have had a major impact on the deployment of wind power generation in particular. However, this paper does not examine the production tax credits since they are not funded by the state government.

The FIT scheme requires electric power companies to purchase electricity generated from renewable energy sources at fixed prices for a certain period of time. Generally, it does not specify the amounts of electricity to be purchased, but pursues the growth of renewable energy by increasing the certainty of investment with policy measures to set purchase prices and purchase periods. The difference between the costs of electric utilities' purchases and the costs of conventional electric power generation is borne by consumers as surcharges to electricity bills. The FIT scheme is designed to encourage a decline in power generation costs by gradually lowering the fixed purchase prices, while drawing out the effect of learning from the massive introduction of renewable energy through the preferential treatment accorded to producers of electricity from renewable energy sources.

The RPS system, on the other hand, aims at the spread of renewable energy by creating demand for renewable energy through policy measures, requiring electric power companies to produce a set ratio of electricity they sell from renewable energy sources and imposing penalties on them when they fail to meet the assigned ratios. While the overall amounts of electricity from renewable sources and the assigned ratios are set under government policies, market competition is said to determine the electric power sources that individual utilities under obligations procure, the suppliers, the prices, and the terms. In addition, it is the common practice to issue renewable energy certificates (RECs) for electricity generated from renewable energy sources and to establish a renewable energy certificate trading system to make it possible to achieve the requirements through market trading of RECs, decoupled from the physical supply of electric power[57]. Due to these characteristics, the RPS system is positioned as the market mechanism-based measure[58]. It is structured to proceed with the introduction of renewable energy in the order of cost from the cheapest price, increase investment by lifting the assigned amounts of renewable energy, and encourage competition among renewable energy sources.

No simple comparison of the relative merits of measures to promote the introduction of renewable energy is warranted because the political positioning of renewable energy and given conditions (geographical conditions, potential, electric power infrastructure, market structure, etc.) are different among countries and areas. In theory, the economic efficiency of the FIT and RPS systems, which respectively fix the power purchase price and decide the amount of electricity generated, is said to be

[57] EPA website: http://www.epa.gov/greenpower/gpmarket/rec.htm
[58] Kimura、2007

identical if the given conditions are identical[59]. However, in truth, analyses presented around 2008-2009 highly rated the effectiveness and cost efficiency of the FIT scheme in light of the status of the introduction of renewable energy in Europe. It has also been pointed out that under the RPS system, the cost efficiency of the procurement of renewable energy deteriorated because of premiums sought to compensate for the uncertainties of contract prices and other terms for the selling of electricity generated from renewable sources and high transaction costs[60].

In practice, while the number of countries implementing FIT schemes increased mainly in Europe, including Germany and Spain, and power output from renewable energy sources expanded substantially in these countries, the introduction of renewable energy slowed down in Britain and other countries that adopted RPS systems from around the early 2000s. These countries announced plans to scrap RPS systems for the shift to FIT-based measures some 10 years after the adoption of their RPS systems.

However, the power generation from renewable energy sources in countries with the FIT schemes increased at a pace beyond the expectations of their governments, and sharp rises in the costs of running the schemes and problems related to constraints on system infrastructure became obvious from around 2009. Against this background, we have seen in recent years the emergence of measures to substantially lower purchase prices in accordance with the amounts of electricity purchases (in Germany[61], for example), as well as the establishment of budget quotas for subsidies in advance (Britain[62]), with FIT-based subsidy systems becoming more diversified and complicated. It has yet to be seen whether the revised schemes will prove successful.

In Japan, the RPS system was introduced in 2003[63], and was positioned as a market mechanism-based measure with high cost-benefit performance, including the use of REC certificates[64]. But investment in renewable energy did not advance much. The principal factor behind the failure was the setting of loose targets, indicating that the establishment of the assigned amounts with policy significance is the key to a viable RPS system.

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[59] EU, 2008

[60] EU 2008、NREL 2009

[61] Renewable Energy Act (EEG) amended in 2014

[62] Energy Act 2014 (CfD)

[63] Act on Special Measures for the Promotion of New Energy Use, etc.

[64] RPS Act Evaluation Study Working Group Report (Draft; provisional translation), May 26, 2006, RPS Act Evaluation Study Working Group (provisional translation), New and Renewable Energy Subcommittee, Advisory Committee for Natural Resources and Energy

When the FIT scheme was introduced to replace the RPS system in 2012[65], facilities for power generation from renewable energy sources, centering on photovoltaic power generation facilities with the generating capacity of some 70 GW, were certified by the government within only two years after the launch of the FIT scheme. If these facilities are actually installed and connected to the power grid, the electricity generated will be purchased at preferential prices for a period of 10-20 years going forward, with the surcharges imposed on power consumers estimated to amount to 2.7 trillion yen (3.12 yen per kWh) in a single year[66]. In addition to concerns over increasing costs, the progress in the certification of facilities without a mechanism that fully reflects the amount acceptable to the power grid for each electricity supply area is giving rise to a situation where at least some areas cannot expect to see an increase in the electricity generated from renewable energy going forward[67]. This is a situation with an excessively large introduction of renewable energy-sourced electricity in the initial stage of the FIT scheme, which has placed restrictions on the introduction of such electricity in later stages. This situation brings heavy lingering burdens of the costs of high-cost power sources introduced in the initial stage for a long period to come and also limits the benefits of cost reductions through the effect of learning.

As described above, while European countries and Japan have adopted the FIT schemes as their principal means of promoting renewable energy, we are currently experiencing problems with the control of the introduction of renewable energy-sourced electricity. By extension, we also have problems with the cost of running the FIT schemes by administratively establishing appropriate purchase prices, as well as with the coordination with the development and operation of the power grid infrastructure.

Looking at the situation in the U.S., following the de facto failure of the FIT policy at the federal level[68], a total of 29 states currently have the RPS system in place[69]. The

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[65] Transitional steps were taken to allow the option of the transfer to the FIT scheme for existing contracts.

[66] The 4th meeting of the New and Renewable Energy Subcommittee, Resources and Energy Agency document, September 30, 2014

[67] The 3rd meeting of the Working Group on Grid Connection of Renewable Energy, December 16, 2014

[68] The Public Utility Regulatory Policy Act (PURPA) of 1978 granted state governments the right to mandate the purchasing of electricity generated from renewable energy by electric utilities within their states. However, the purchase price fixed by the state government was not to exceed the avoided cost of the electric utility obliged to purchase the electricity. Nevertheless, the progress made in switching from petroleum-fired power generation to alternative sources of electricity in the 1980s, combined with a plunge in crude oil prices, resulted in avoided costs of electric utilities falling far below the cost of generating electricity from renewable energy sources. This led to the stagnation of investment in power generation from renewable energy. Holt and Galligan (2013)、Sato（2011）

[69] DSIRE, NREL, September 2014

state of California introduced the RPS system in 2002 and keeps the program in place by revising the targets for the introduction of renewable energy. California has announced a plan to continue to expand renewable energy with the RPS program as the principal means, setting the ambitious goal of increasing the percentage of renewable energy in the state's electricity mix to 33% by 2020.

The overview and operation status of the RPS system in California is summed up in the following section.

Table 1 Basic Information and Renewable Energy Policies of California and Japan

	California	**Japan**	
Basic Information[70]			
Area	4,240,000 km^2	3,780,000 km^2	
Population	37.69 million	128.37 million	
Economic scale	$1.959 trillion	$5.869 trillion	
Electricity sales	259.5 billion kWh[71]	848.5 billion kWh[72]	
Average retail price	13.53 ct/kWh[73]	¥19.81/kWh[74]	
Renewable energy policy[75]	**RPS**	**RPS**	**FIT**
Years of implementation	2002-present	2003-2012	2012-present
Parties subject to requirements	Electric utilities	Electric utilities	Electric utilities
Renewable energy introduction goal	Increase the percentage of renewable energy to 33% of electricity sales by 2020	Increase the percentage of renewable energy to 1.35% of electricity sales by 2010	-
Procurement methods	Bidding and bilateral contracts	Bidding and bilateral contracts	Regulatory requirements for purchase
Procurement prices	Under contracts	Under contracts	Fixed prices
Period	Under contracts	Under contracts	10-20 years

[70] The Consulate-General of Japan in San Francisco website and the Teikoku-Shoin website
[71] Figures for 2012 (EIA)
[72] Total for 10 firms in FY2013 (Electricity Demand in Fiscal 2013 (Confirmed Report), Federation of Electric Power Companies, April 30, 2014)
[73] The average of all sectors (Residential: 18.12 ct/kWh, Commercial: 18.13 ct/kWh, Industrial: 13.40 ct/kWh), EIA (December 2013)
[74] Lighting and power total (Lighting: ¥24.33/kWh, Power: ¥17.53/kWh), Energy White Paper 2014
[75] State of California: CPUC website, etc., Japan: METI website, etc.

Upper limit on procurement cost	Provisions to use the cost of natural gas-fired thermal power generation as a benchmark	REC ceiling price: ¥11/kWh	None (care taken to avoid excessive burdens on electricity users)
Punitive clause	Fines of 5ct/kWh for the shortfall, with the annual maximum set at $25 million (some ¥2.6 billion)	Fines of ¥1 million for violations of recommendation/orders	-
Greenhouse gas emissions reduction targets	**Global Warming Solutions Act of 2006 (AB 32)**	**Voluntary Action Plan 1997-present**	
	Reduce to the 1990 level by 2020 Reduce by 80% from 1990 by 2050	Legally binding targets are not yet established	

Source: Prepared by the author based on available data

2. An Overview of the RPS Program of the State of California

2-1. An Overview of the Program

The California state government introduced the RPS program in 2002, requiring all electricity retailers in the state to procure a certain percentage of electricity generated from renewable energy sources. The current RPS target (the percentage of electricity sales) calls for the raising of that ratio to 25% by the end of 2016 and to 33% by the end of 2020[76]. The framework of California's RPS program is shown in the table below:

Table 2 The Framework of the RPS Program of the State of California

Laws	2002 state law (SB1078): The program launched (Target: 20% by 2017) 2006 state law (SB107): Revision (Target: 10% by 2010) 2011 state law (SBX 1-2): Revision (Target: 33% by 2020)
Current targets	Divide the compliance period into the three-year specific periods and provide for the average percentage of electricity sales for each specific compliance period: • Compliance Period 1 (2011 to the end of 2013): 20%

[76] 2011 state law (SBX 1-2)

<table>
<tr><td></td><td>• Compliance Period 2 (2014 to the end of 2016): 25%
• Compliance Period 3 (2017 to the end of 2020): 33%
• Subsequent years beyond 2020: Should not fall below 33%
(The minimum percentage to be raised each year for the Compliance Periods 2 and 3. See Chart 1.)</td></tr>
<tr><td>Companies Subject to requirements[77]</td><td>All electricity retailers in the state:
• Investor-owned utilities (IOUs)
• Publicly-owned utilities (POUs)
• Energy service providers
• Community choice aggregators)
*The three largest IOUs below account for about two-thirds of electricity sales in the state.<table><tr><td>Pacific Gas & Electric (PG&E)</td><td>75,537 GWh</td></tr><tr><td>Southern California Edison (SCE)</td><td>73,823 GWh</td></tr><tr><td>San Diego Gas & Electric (SDG&E)</td><td>16,504 GWh</td></tr><tr><td>Total for the three IOUs (2013)[78]</td><td>165,864 GWh</td></tr><tr><td>Total electricity sales in the state[79]</td><td>259,538 GWh</td></tr></table></td></tr>
<tr><td>Energy sources covered[80]</td><td>Wind power, solar light, solar heat, hydraulic power (canals), small hydraulic power (no more than 30MW), an increment of power generation through improved efficiency of large-scale hydraulic power facilities (dams), geothermal heat, bio diesel, biomass, sewage disposal gas, landfill gas, urban solid waste, tidal power, wave power, ocean heat, and fuel batteries using renewable energy</td></tr>
<tr><td>Implementation/ operation organizations[81]</td><td>The California Public Utilities Commission (CPUC)[82] and the California Energy Commission (CEC) are jointly responsible for operating the RPS program. Their respective roles are as follows:
• CPUC: Determination of the mandated amounts for companies subject to the requirements, confirmation of compliance; examination and approval</td></tr>
</table>

[77] Under the RPS system prior to the 2011 state law, parties subject to the requirements were limited to IOUs. Public Utility Code §399, 11

[78] CPUC, 2013

[79] The figure for 2012 (EIA)

[80] CPUC website: http://www.cpuc.ca.gov/PUC/energy/Renewables/FAQs/01REandRPSeligibility.htm

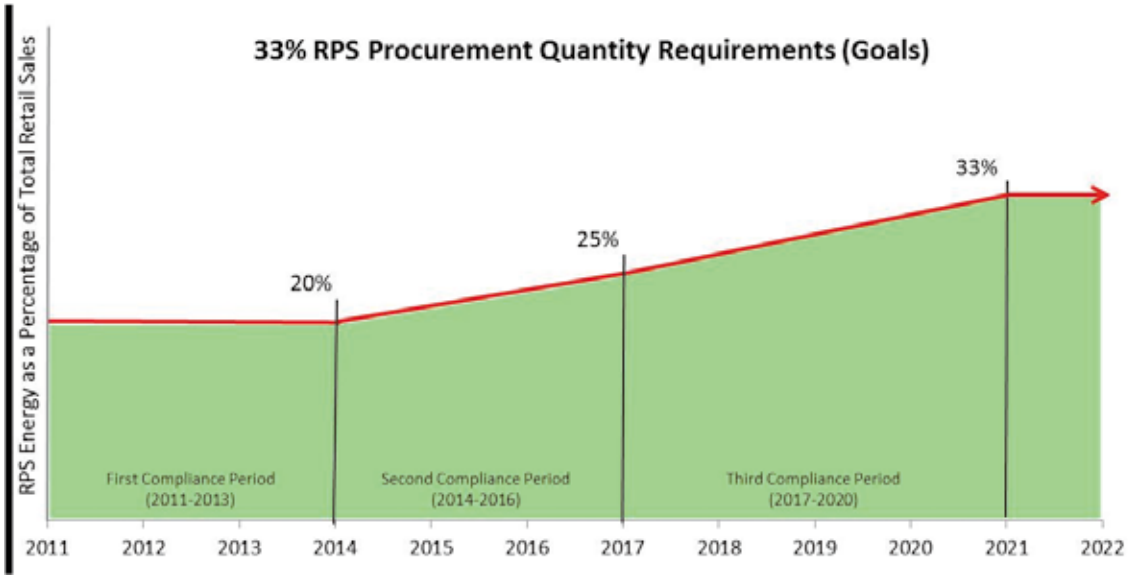
[81] CEC website

[82] Electricity retail prices in the state of California are regulated prices, and CPUC is responsible for the examination and approval of electricity rates filed by electric utilities. Project for the Promotion and Adjustments of Locations of Power Supply in FY2011 (Actual Condition Survey on Electricity Rates in Foreign Countries), March 2012, Mitsubishi Research Institute

	of RPS contract prices, etc.; reports on the costs of RPS compliance, etc. • CEC: Certification of facilities; creation and operation of the record system for renewable energy certificates, etc.[83]

Source: Prepared by the author based on materials from CPUC and the California Energy Commission, etc.

Chart 1 The Targets and Compliance Periods of the RPS Program



Source: CPUC website

2-2. The Implementation Status of the RPS Program

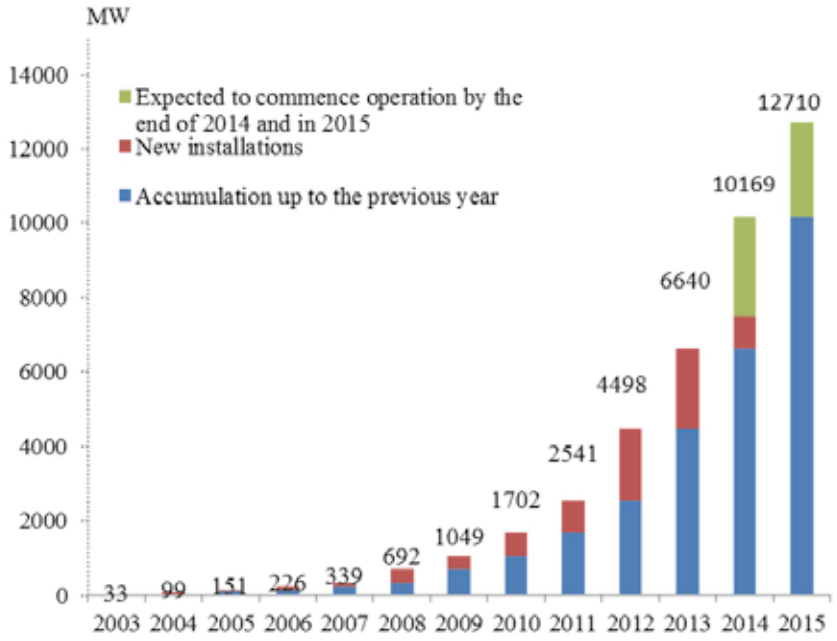
(1) Introduction of Facilities and the Status of Power Generation

The generating capacity of facilities that were introduced and commenced operations under the RPS program expanded from 33MW at the time of the launch of the program in 2003 to approximately 7,500MW in 2014. The generating capacity is expected to exceed 10GW by the end of 2014, nearly matching the generating capacity of facilities that went into operation under Japan's FIT scheme (about 12GW as of June 2014)[84].

[83] Western Renewable Energy Generation Information System (WREGIS): http://www.energy.ca.gov/portfolio/wregis/index.html

[84] Prior to the introduction of the FIT scheme, the generating capacity stood at some 20GW (METI website).

Chart 2 Trends of the Introduction of Facilities under the RPS Program (New Installations since 2003)



Source: Prepared by the author based on Renewable Portfolio Standard Quarterly Report, 2nd Quarter 2014, CPUC, etc.

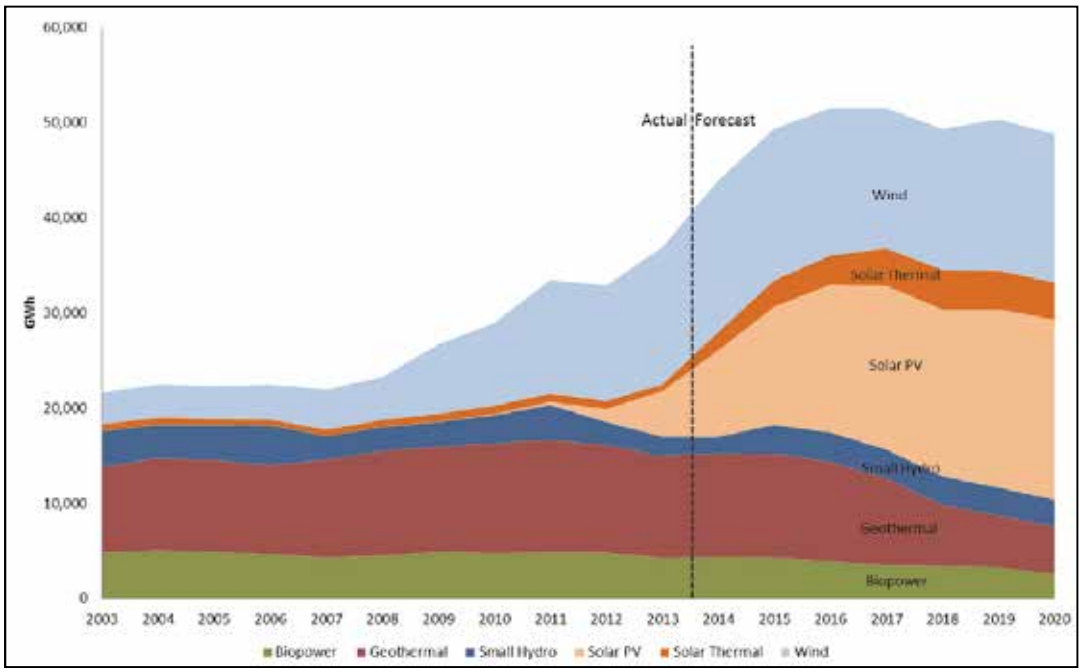
The current RPS electricity output of some 40TWh comes chiefly from wind power generation (36%) and geothermal power generation (25%). Photovoltaic power generation has been rapidly increasing since 2011. The state government is making proactive efforts to expand the utilization of solar energy, separately implementing policy measures focusing on photovoltaic power generation[85]. There are forecasts that, by 2020, solar light is anticipated to account for 32% and solar heat for 10% of the RPS electricity production.

The RPS program also covers power output from renewable energy sources at existing facilities, and the state government is gearing up toward the promotion of dispersed power systems as well. According to the California Energy Commission, the generating capacity of facilities for electricity for wholesale in operation now stands at 15,500MW, and coupled with the capacity of privately-owned power facilities of 1,900MW, the state's total generation capacity of renewable energy

[85] Go Solar California Solar Initiative, etc. http://www.gosolarcalifornia.ca.gov/

electricity comes to 17,400MW (some 45TWh in terms of power output)[86].

Chart 3 Trends of Renewable Energy Power Output and Output Forecast



Source: Renewable Portfolio Standard Quarterly Report, 2nd Quarter 2014, CPUC

(2) Target Achievements and Outlook

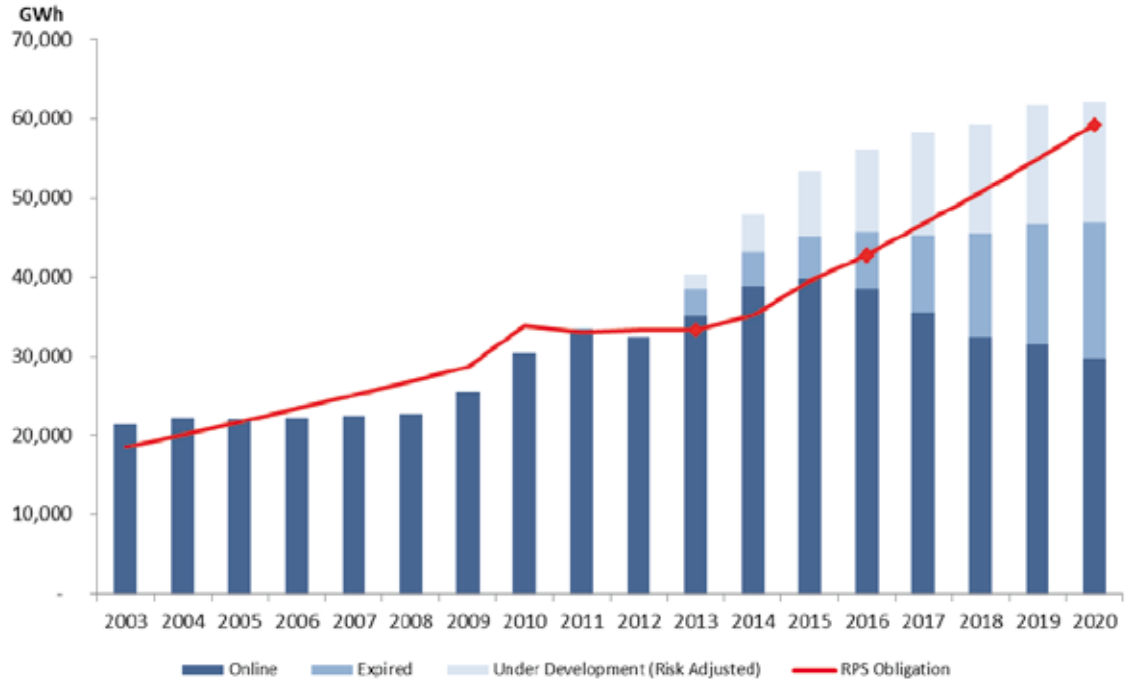
The combined percentage of RPS renewable energy electricity for the three IOUs, the key players subject to the obligations under the RPS program, currently stands at 20.9%, with each of them achieving the target of the program's Compliance Period 1 (20% from 2011 to the end of 2013) (PG&E: 20.6%, SCE: 20.7%, SDG&E: 21.6%)[87]. Following the introduction of the RPS program, there were periods, between 2006 and 2010, when the targets were not met amid the stagnant investment in renewable energy. As the state government stepped up efforts to turn the tide (See 3.), however, procurement of RPS electricity increased thereafter.

Based on the future outlook that takes the realization rate of projects into account, Compliance Period 2 (until the end of 2016) is expected to witness the percentage in excess of the target achieved. Though a shortfall is expected at the moment for Compliance Period 3 (until the end of 2020), electric utilities subject to

[86] Tracking Progress, Renewable Energy Overview, CEC, Last Updated March 27, 2014
[87] CPUC, 2014(d)

the requirements are allowed to carry over, or bank, the excess portion achieved beyond the specific compliance period[88]. Since they are required to maintain the RPS percentage no lower than 33%, however, electric utilities are planning additional investment[89]. CPUC is of the view that it is possible to achieve the 2020 target[90].

Chart 4 Trends of Supply of RPS Electricity and Supply Forecast



Noted: "Expired" indicates the expiration of contract periods. If there are more years remaining in the equipment life, however, such facilities are likely to provide additional supply by renewing contracts.
Source: Renewable Portfolio Standard Quarterly Report, 2nd Quarter 2014, CPUC

3. Key Points in the Institutional Design of California's RPS Program

3-1. Introduction Targets and Obligatory Assignment

(1) Introduction Targets at the State Level

The RPS program presents the future expansion of renewable energy as specific production targets, and induces investment by creating demand by means of

[88] The excess can be carried over, or banked, up to three years. Public Utility Code §399.14(a)2(c) Behles (2011)
[89] CPUC, 2014(d)
[90] CPUC, 2014(a)

obligatory assignment of targeted output to electric utilities. This makes it all the more important to establish appropriate production targets[91]. The target for renewable energy electricity production (the percentage of renewable energy electricity in electricity sales) upon the 2002 launch of California's RPS program was set at 20% by 2017[92] (the percentage of renewable energy electricity, excluding hydraulic power generation, was 11% in 2001). Soon after the commencement of the RPS program, the California Energy Commission proposed in 2003 to move up the target achievement year to 2010 with the same percentage target of 20%[93]. In order to achieve this new target, electricity utilities subject to the obligations were required to increase the percentage of RPS electricity by 1% each year[94].

However, the combined RPS percentage of the three major IOUs stood at only 17% in 2010, failing to achieve the 20% target by 2010[95]. As one of the reasons behind this, there were a lot of projects that failed to be realized for problems related to access to the power transmission network, financing, availability of construction sites, and approval and permissions[96].

The California state government took steps to deal with the situation (to be discussed below), and at the same time set out to establish long-term RPS targets. This is probably because the RPS program is positioned as the important policy means in the state's measures to combat climate change[97].

California in 2006 enacted the Global Warming Solutions Act of 2006 (AB 32), which incorporated the introduction of the ceilings on greenhouse gas emissions ahead of the federal government and other states, and established the goals of reducing greenhouse gas emissions to the 1990 level by 2020 and reducing them by 80% from the 1990 level by 2050[98]. Then California Governor Arnold Schwarzenegger (Republican) took the initiative in taking countermeasures against global warming at the quasi-state level, hosting the three summit meetings at the governor level on

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[91] Kimura, 2007

[92] Senate Bill 1078

[93] 2003 Energy Action Plan I

[94] 2006 state law 107

[95] CPUC, Renewables Portfolio Standard Quarterly Report, (3rd Quarter, 2011) According to the hearings (Lawrence Berkeley National Laboratory, September 5, 2014), no fines were imposed on them, and it is assumed that the revision of the target to postpone the 20% target achievement year from 2010 to the end of 2013 provided electric utilities with some reprieve.

[96] Behles, 2011

[97] Electricity Journal, December 2013, Vol. 26, Issue 10; Behles (2011)

[98] Assembly Bill 32 and Executive Order S-3-05 (CPI, 2012)

climate change between 2008 and 2010, while incumbent Governor Jerry Brown (Democrat[99]), who took office in 2011, has also been proactively pushing ahead with his environment and energy policies[100].

The California Energy Commission fell in step with the proactive Governors, and in 2005 proposed setting the long-term RPS target at 33% by 2020[101], and following the signature by the Governor in 2008[102], under the 2011 state law (SBX 1-2), the new targets were introduced to set the RPS percentage at 20% by the end of 2013, at 25% by the end of 2016, at 33% by the end of 2020, and at no lower than 33% beyond 2020[103]. The law also provides for RPS procurement through REC trading (to be discussed below) as a measure to increase the flexibility of RPS electricity procurement.

According to the California Energy Commission, the establishment of these targets in global warming countermeasures and the RPS targets is based on the high degree of environmental awareness, partly cultivated during fierce popular movements against the construction of nuclear power plants since the 1970s. In setting the RPS targets, the state government and electric utilities held numerous meetings to consider the need to expand power transmission infrastructure and costs involved (to be discussed below) and took necessary responses, and the California Energy Commission points out that these efforts provided the important basis for establishing the higher targets at the state level[104].

(2) Individual Targets of Electric Utilities Subject to Obligations

Under the 2006 state law, there was a mechanism in place for the RPS percentage to be imposed on electric utilities subject to the RPS obligations to add an equivalent of 1% of the previous year's electricity sales to the assigned amount for the previous year. However, the 2011 state law introduced some flexibility by dividing the

[99] The state of California is a solid electoral power base for the Democratic Party, with Democrats occupying all major public offices, including the incumbent governor. The Democrats also captured over two-thirds of sets in both the state Senate and House (super majorities) in the 2012 election (the Consulate-General of Japan in San Francisco website)

[100] The Consulate-General of Japan in San Francisco website

[101] 2004 Energy Report Update, 2005 Energy Action Plan II

[102] November 2008 Executive Order S-14-08

[103] No production target has been set for the entire renewable energy, including sectors subject to the RPS obligations. The California Energy Commission estimates the renewable energy percentage, including renewable energy other than that covered by the RPS program, at around 35% by 35% (hearings, California Energy Commission, September 4, 2014).

[104] Hearings, California Energy Commission, September 4, 2014

compliance period into shorter three-year specific compliance periods while setting the lower limits for the annual procurement percentage beyond 2014 (See 2-1).

Table 3 California's RPS Compliance Periods and the Minimum Procurement Percentage

California RPS Compliance Periods	Procurement Quantity Requirement =
Compliance Period 1 (2011 - 2013)	2011 retail sales * 20.0% + 2012 retail sales * 20.0% + 2013 retail sales * 20.0%
Compliance Period 2 (2014 - 2016)	2014 retail sales * 21.7% + 2015 retail sales * 23.3% + 2016 retail sales * 25.0%
Compliance Period 3 (2017 - 2020)	2017 retail sales * 27.0% + 2018 retail sales * 29.0% + 2019 retail sales * 31.0% + 2020 retail sales * 33.0%
Year 2021, and each year thereafter	Annual retail sales * 33.0%

Source: The CPUC website

As seen above, the state of California maintained the RPS program since its launch in 2002 by raising the RPS targets, and the establishment of the targets to increase the renewable energy percentage to 33% by 2020 and maintain at least that level beyond 2020 provides signals for continued investment in renewable energy[105]. At the same time, the establishment of these RPS targets serves as the benchmark for management of the speed at which renewable energy is introduced. The above points should serve as a useful reference in considering the relevant institutional design in Japan[106].

3-2. Ways to Achieve the Assigned Obligations

CPUC confirms the compliance by collating RECs submitted by electric utilities subject to the obligations and the assigned amounts at the end of the compliance period. There are the three permitted ways for electric utilities subject to the obligations to

[105] Hearings, California Energy Commission, September 4, 2014

[106] In Japan, the target established at the time of the introduction of the RPS system in 2003 was 12.2TWh (equivalent to about 1.35% of electricity sales) for 2010. While the target was more than double the level of the actual use of new energy, etc. at the time, it still represents the establishment of a moderate target in a bid to avoid a rapid increase in burdens. Further, the FIT scheme was introduced in 2012 in the course of the review of the Basic Energy Plan, and the specific target for the introduction of renewable energy has yet to be established even now.

acquire RECs: 1) generation of RPS electricity on their own; 2) purchase of RPS electricity from other utilities; and 3) acquisition of RECs through REC trading. The procurement of RECs in excess of the assigned amounts can be carried over (for banking as discussed earlier) for use in the following year and beyond (including cases beyond the compliance period)[107].

In California, suppliers of RPS electricity are not restricted to those in the state. As long as they are located within the area under the jurisdiction of the Western Electricity Coordinating Council (WECC)[108] and their facilities to generate renewable energy electricity meet the qualifications prescribed by the California Energy Commission, electricity and RECs supplied by them can be used for compliance with the assigned amounts[109].

Under the RPS system generally, the economic efficiency of the procurement of RPS electricity is pursued by making use of REC trading. In California, the upper limit is put in place on the percentage accepted for the achievement of the assigned amount through the procurement by REC trading alone. Of the annual assigned amounts of electric utilities subject to the RPS obligations, the percentage of electricity procured only through REC trading (called Category 3. For example, cases where only RECs are acquired from renewable energy electricity generated out of the state without the physical supply of electricity) is set at 25% for Compliance Period 1, at 15% for Compliance Period 2 and at 10% for Compliance Period 3, for the gradual reduction in the accepted percentage[110].

On the other hand, the lower limit is in place on the percentage for the integrated procurement through the actual supply of electricity and RECs (called Category 1. For example, cases where renewable energy electricity generated within the state is directly procured), set at 50% for Compliance Period 1, at 65% for Compliance Period 2 and at 75% for Compliance Period 3, for the gradual raising of the accepted percentage[111]

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[107] CPUC, 2014(d)

[108] Covers the interconnected area in the western part of the continental U.S. from Canada (Alberta and British Columbia) to Mexico (Baja California). In the United States, the area includes 14 states (Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, Colorado, Wyoming, portions of Montana, South Dakota, New Mexico and Texas) located in between.

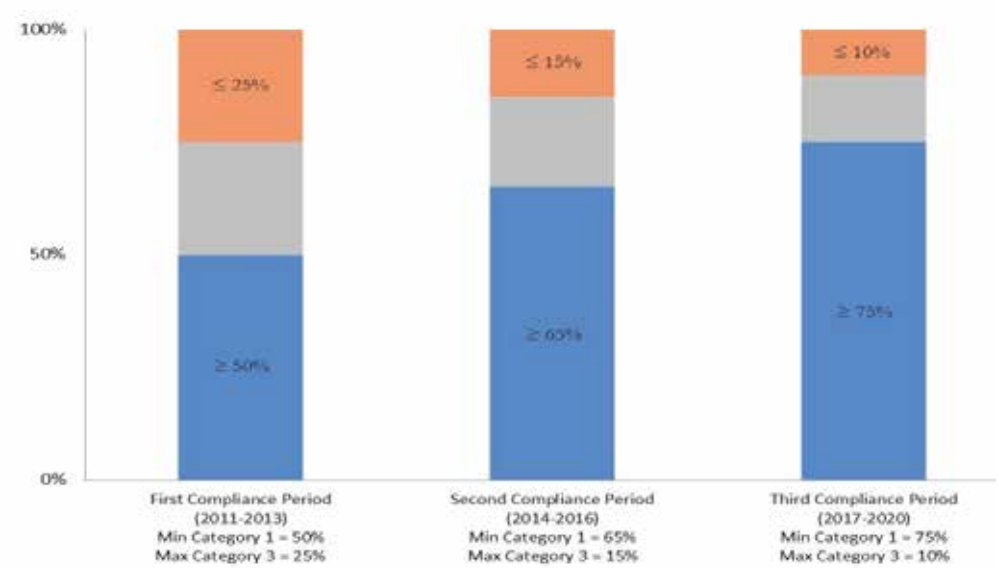
[109] When electric utilities outside the area of the California Independent System Operator (CAISO) supply renewable energy electricity to CAISO, they must provide faired electricity. Electric utilities subject to the RPS obligations can load the additional costs (power transmission, congestion handling and rebidding, etc.) associated with the out-of-state procurement in the screening of bids for RPS electricity. The CPUC website (confirmation as of October 31, 2014, Last Modified: 2/1/2012): http://www.cpuc.ca.gov/PUC/energy/Renewables/procurement.htm

[110] CPUC website, 33% RPS Procurement Rules

[111] The status of out-of-state procurement and the achievement of the assigned amounts only through REC trading

(See Chart 5).

Chart 5 Provisions for the RPS Procurement Percentage by Category



Note: Category 1 represents the case where the physical procurement of renewable energy electricity and the transfer of RECs take place in an integrated manner, while Category 3 represents the case where only the transfer of RECs takes place.
Source: CPUC website

As seen above, California's RPS program places some restrictions on the fulfillment of the assigned amounts through REC trading. Based on RPS procurement prices for 2013 (to be discussed below), the prices are 9.23 ct/kWh for Category 1 and 8.92 ct/kWh for Category 3, offering cheaper prices for the acquisition of REC certificates alone[112]. The restrictions placed on RPS trading despite the difference in economic efficiency are apparently adopted as a compromise between the view that that the procurement from within the state should be encouraged over the out-of-state procurement in the hope of creating employment within the state with construction, operation and maintenance of renewable energy electricity facilities and the view that the availability of low-cost generation of renewable energy electricity should be utilized from the standpoint of keeping electricity bills[113].

While no such restrictions were placed under Japan's RPS scheme, REC certificate

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is not shown in CPUC's compliance reports and cost reports or on the WECC database. There is an estimate that existing projects that fall under the Category 3 account for 20-25% of the 2013 target. BC Hydro, US Renewable Energy Credit Markets Report, November 2013

[112] CPUC, 2014(b). For 2012, the prices are 7.68 ct/kWh for Category 1 and 7.77 ct/kWh for Category 3. (CPUC, 2013)

[113] Hilton and Marriott (2010)

trading was little utilized in the absence of the targets for introducing renewable energy that could have helped make REC trading more active.

3-3. Ways to Contain Costs

Under the RPS system, some measures to contain costs may be introduced to avoid sharp rises in the costs of running the system in anticipation of overly high prices to procure RPS electricity from the market. The cost-containing measures may include the establishment of the ceilings on RPS electricity procurement prices and REC prices, coupled with exemptions from the obligations to satisfy the assigned amounts for the excess portions and, as seen in some U.S. states with RPS systems other than California, alternative compliance payments (ACPs) are used as the de facto ceiling prices[114]. Fines on the shortfall amounts may also function as the ceiling prices.

The state of California imposes fines of 5ct/kWh for a shortfall in the assigned RPs amount, or up to $25 million (some ¥2.6 billion) per utility a year[115]. However, fines, which now stand at levels below the procurement cost (to be discussed below), have never been levied before[116], making it unlikely that fines function as the ceiling prices[117]. On the other hand, measures to keep RPS procurement costs within the acceptable range are incorporated into the RPS program, as discussed below, in the forms of (1) the application of the common bidding process and evaluation criteria, (2) the examination of the economic efficiency of procurement prices, and (3) the placement of ceilings on additional costs. However, the 2011 state law (SB2) calls for the improvement in the measures to contain RPS costs, and CPUC is currently considering the issue[118] (See 4-2).

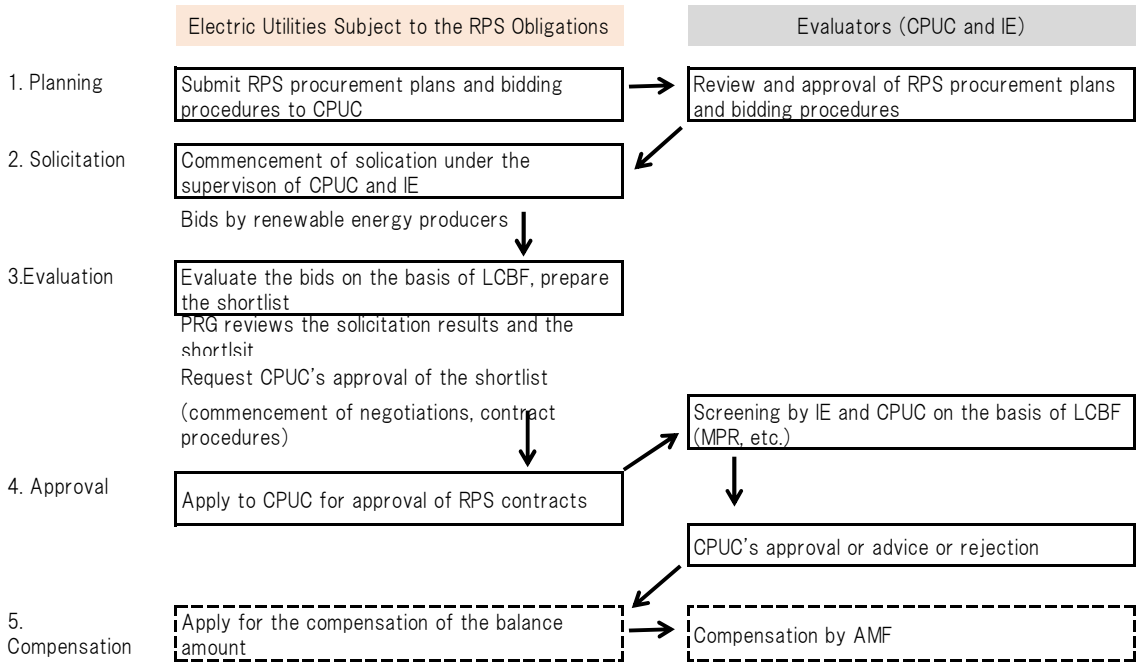
(1) The Bidding Process and Evaluation Criteria

Electric utilities subject to the RPS obligations in California are required to go through the process from the solicitation of offers for RPS electricity and bidding[119] to the project screening and conclusion of procurement contracts in accordance with the criteria of "Least Cost, Best Fit (LCBF)"[120], [121] (See Chart 8). LCBF is a document of

[114] NREL (2014), Cory and Swezey (2007)
[115] CPUC website
[116] Until 2010 (Behles, 2011)
[117] As fines are also intended as social sanctions, they are not necessarily chosen solely on the basis of the economic advantages and disadvantages of the RPS procurement. It is not known how electric utilities subject to the RPS program in California position potential fines.
[118] CPUC, 2014(a)
[119] Technology-neutral competitive bidding (CPUC, 2014(a))
[120] D.04-07-029 (Least Cost, Best Fit)

resolutions concerning the framework of bidding procedures for RPS electricity and evaluation criteria for projects for bidding, put together by CPUC in 2004[122]. The document of resolutions presents, among other things, the evaluation criteria for direct and indirect costs of the RPS electricity procurement (to be discussed below) as well as how to take into account the qualitative characteristics (environmental impact, diversification of energy sources, benefits to the local communities, etc.) in ranking projects that are on par in the evaluation of prices.

Chart 6 An Overview of the RPS Contract Screening Process



Note: IE: Independent Evaluator, LCBF: least-cost, best-fit, PRG: Procurement Review Group
Source: Prepared by the author based on the CPUC website (Confirmation as of August 26, 2014, Last Modified: 2/1/2012) http://www.cpuc.ca.gov/PUC/energy/Renewables/procurement.htm

Following the process, electric utilities subject to the RPS obligations proceed with preparations for the procurement of RPS electricity under the supervision of the Independent Evaluator (IE) designated by CPUC, are evaluated by the Procurement Review Group (PRG) comprising state government organizations and consumer groups,

[121] While bilateral contracts between parties involved are allowed, CPUC states that competitive bidding is desirable. (CPUC, 2014(a)) For the cost compensation to be discussed later, the procurement through competitive bidding is one of the necessary qualifications.

[122] Aside from electric utilities subject to the RPS obligations, the industry association for wind power generation, consumer groups and research institutions, etc. also participated in the deliberation on the formulation of the document of resolutions. D.04-07-029 (Least Cost, Best Fit)

etc.[123], and then apply to CPUC for approval of RPS procurement contracts. The PRG is responsible for consultations with electric utilities subject to the RPS obligations under confidentiality, evaluation of details of RPS procurement contracts and advice in advance of the application for CPUC approval. Then, RPS procurement contracts are concluded for projects approved by CPUC.

The next topic is the evaluation of the economic efficiency of direct costs (RPS prices) of the RPS electricity procurement.

(2) Evaluation of the Economic Efficiency of RPS Prices

As part of the evaluation based on LCBF (mentioned above), RPS prices in California are evaluated for their economic efficiency with the market price reference (MPR) as a benchmark. Specifically, the MPR is the supply cost of natural gas-fired thermal power generation and the levelized cost of electricity (LCOE) obtained by discounting the construction, holding and operation costs for the assumed establishment of the 500MW combined cycle gas turbine (CCFT) plant by various project durations (10 years and 20 years, etc.). Cost items include capital costs, operating costs, natural gas prices, financing costs, approval and licensing costs, and the cost of compliance with environmental regulations, and the MPR is calculated by CPUC in view of fluctuations of these costs[124]. The MPR, as the representative value of long-term market prices for power generation, is also used as the benchmark for tariff calculations under the FIT[125] scheme[126].

For instance, the latest MPR (2011)[127] stands at around 8.35 ct/kWh for procurement contracts with the contract start in 2012 and a supply period of 15 years, and at around 10.13 ct/kWh for procurement contracts with the contract start in 2015 and a supply period of 20 years (see Table 4 and Chart 7). The MPR rises and falls primarily in response to fluctuations in natural gas prices. Up until now, the MPR announced in 2008 was at a high level overall[128], which presumably led to increased

[123] The PRG includes the California Department of Water Resources (DWR), the California Energy Commission's Energy Division, Union of Concerned Scientists (UCS), the Division of Ratepayer Advocates (DRA), the Coalition of California Utility Employees (CUE) and the consumer group Utility Reform Network (TURN). (CPUC website)

[124] CPUC website, MPR (Confirmation date: October 9, 2014)

[125] As a means of supplementing the RPS program, the FIT scheme was introduced under the 2006 state law (AB1969) to cover small electricity generation facilities of up to 3MW, but was discontinued on July 24, 2013.

[126] Resolution E-4442, December 1, 2011

[127] The MPR for 2011 is the latest value as CPUC is in the process of studying new cost-containing measures under the 2011 state law.

[128] From around this time, the tendency became obvious of natural gas prices falling sharply due to increased shale gas production. But further research is necessary to find out how such market trends have been reflected in the

investment in photovoltaic power generation and other high-cost projects (photovoltaic power generation increased from around 2011, as described above).

Table 4 MPR Examples by Release Year (Nominal Prices)

Unit: ct/kWh

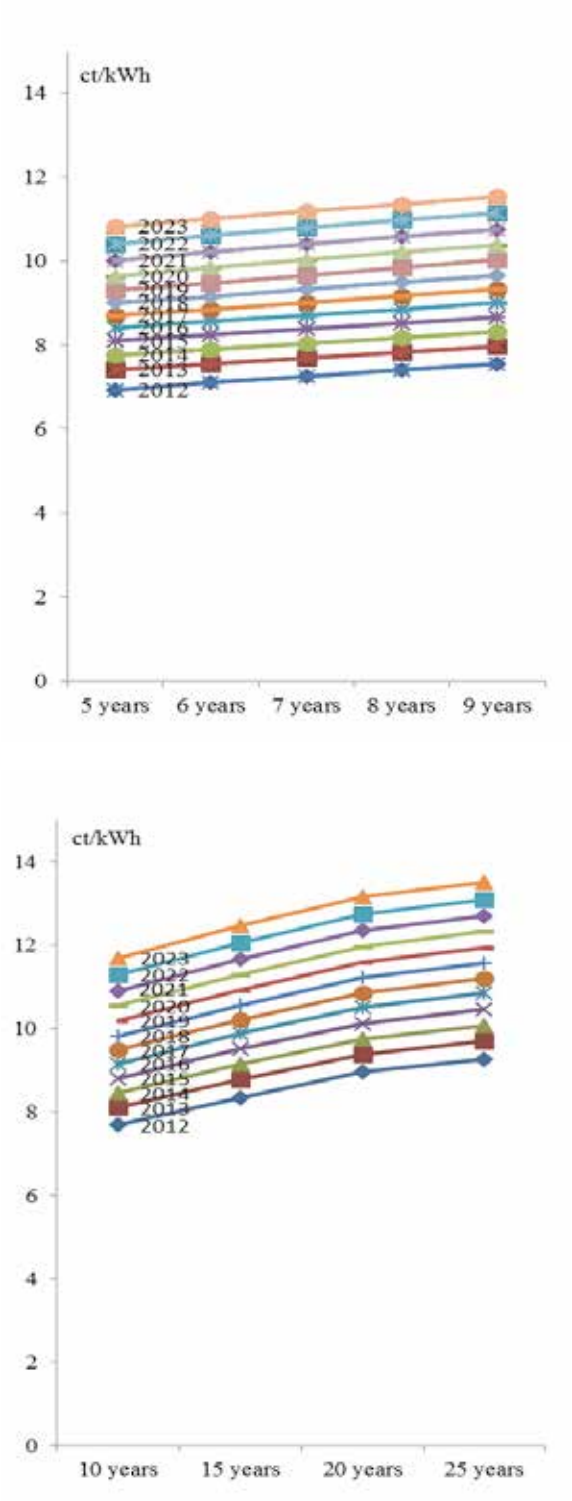
	2005	**2006**	**2007**	**2008**	**2009**	**2011**
Start in 2010 10-year contract	7.60	7.97	9.36	10.18	8.45	-
Start in 2012 15-year contract	8.10	8.42	9.84	11.41	9.85	8.35
Start in 2015 20-year contract	-	9.39	10.61	13.29	11.65	10.13

Source: Prepared by the author based on the document of resolutions for the MPR calculation, CPUC (2005-2011)

MPR.

Chart 7 MPR for 2011

Left chart: Short-term contracts (less than 10 years)・Right chart: Long-term contracts (10 to 25 years)



Note: The years in the graphs are the contract start years, and the years in the horizontal axis

indicate the contract periods.
Source: Prepared by the author based on CPUC, Resolution E-4442 concerning 2011 MPR

The 2011 MPR is higher for later contract start years (see Chart 7), primarily because of rising gaseous fuel prices (futures prices) for the coming 12 years quoted on the New York Mercantile Exchange (NYMEX), which account for 70% of the cost in terms of the CCGT lifecycle[129] and rising CO_2 emission regulations[130] compliance costs[131].

The MPR is announced after bidding, and RPS bid prices are evaluated against the latest MPR. If bid prices (contract prices) based on actual costs of renewable energy electricity generation fall below the MRP, RPS costs decline below this.

(3) Establishment of the Ceilings on Additional Costs

Electric utilities subject to the RPS obligations are allowed to reckon RPS prices under contracts with power generators in electricity rates as reasonable costs if they are below the MPR[132]. For biddings where RPS prices are above the MPR, on the other hand, electric utilities subject to the RPS obligations reckon the amount equivalent to the MPR in electricity rates and at the same time can apply to CPUC for the compensation for the difference above the MPR if contracts are approved by CPUC[133].

The requirements in this case include that RPS prices are determined in competitive bidding, that various indirect costs (imbalance, sales of surplus electricity, attenuation of existing renewable energy sources and the expansion of transmission lines, etc.) are not included in RPS prices, that they are under long-term contracts of 10 years or longer, and that RPS prices are not for only RECs, etc.[134]

Funding for the compensation comes from Above Market Funds (AMFs). Funding for AMFs comes in turn from the public goods charge (PGC)[135], [136]. At the time of the

[129] Rising from $4.84/MMBtu to $7.96/ MMBtu 12 years later (Resolution E-4442, December 1, 2011, CPUC)

[130] The California Air Resources Board (CARB) introduced the emissions trading system (Cap and Trade) in October 2011.

[131] In the MPR calculation, costs of compliance with the emissions trading system are assumed to be $16.27/$CO_2$t in 2013, $26.08/$CO_2$t in 2015, and $36.6/$CO_2$t in 2020. Resolution E-4442, December 1, 2011, CPUC

[132] Resolution E-4442, December 1, 2011

[133] Resolution E-4442, December 1, 2011

[134] Covers new projects set to commence operations on January 1, 2005, or later. CPUC website (Confirmation date: October 15, 2014, Last Modified: 29/10/2010): http://www.cpuc.ca.gov/PUC/energy/Renewables/SB1036implementation.htm

[135] The PGC, introduced in 1998, was levied on IOU consumers in accordance with their consumption of electricity for the purpose of subsidizing energy-saving, renewable energy development and R&D programs to encourage investment contributory to the public good after the 1996 deregulation of electric utilities. The California Energy

AMF inception[137], a total of some $770 million (some ¥88.8 billion) was allocated and made available to electric utilities subject to the RPS obligations[138]. If electric utilities subject to the RPS obligations cannot receive the compensation as their RPS procurement reaches the allocated amounts, they are allowed to keep the procurement of RPS electricity to the extent possible below the MPR[139]. Under this mechanism, the total cost of achieving the RPS introduction targets by going above the benchmark price is defined to match the total compensation by AMFs[140].

The key points in the cost-containing measures under California's RPS program described above are the enhancement of the transparency of competitive conditions through the procurement of RPS electricity by following the predetermined common procedures and evaluation criteria and going through the evaluation that include third parties and the management of procurement costs by the state government. This characteristic stands out in comparison with Japan's RPS system where RPS procurement costs were not managed, with RPS procurement contracts being bilateral contracts negotiated individually between parties involved. In Japan, partly because the introduction targets were moderate and the positioning of the RPS system in global warming countermeasures was not clear, contract prices were kept low, which are believed to have failed to induce an expansion of investment[141]. Under Japan's RPS system, REC certificate prices above ¥11/kWh were recognized as valid reasons for electric power companies covered by the system not to perform the assigned obligations[142]. But there is no record of this measure being invoked, and it is believed that they had no major impact, such as becoming the benchmark for procurement

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Commission is responsible for the PGC budget allocation. The extension of the PGC was considered at the time of the expiration on January 1, 2012, but as the stage congress rejected the extension, the PGC has been abolished.

136 Public Utilities Code § 399.15(d)

137 The ceilings on costs had been provided for from the initial RPS introduction (2002, SB1078). The initial provisions stated that renewable energy electricity generators allowed to go beyond market prices can request the California Energy Commission to compensate for the difference within the limits of the budget for supplementary energy payments (SEPs). The revision in 2007 (SB1036) created AMFs to replace SEPs, and provided that electric utilities subject to the RPS obligations apply to CPUC for approval of procurement contracts and compensation for the difference, instead of renewable energy electricity generators requesting the compensation. CPUC website: http://www.cpuc.ca.gov/PUC/energy/Renewables/SB1036implementation.htm

138 CPUC website: http://www.cpuc.ca.gov/PUC/energy/Renewables/SB1036implementation.htm

139 Public Utilities Code § 399.15(d)(3)

140 Public Utilities Code § 399.15(d)

141 Hearings of prominent figures, October 7, 2014

142 Management System for New Energy and Other Electricity, Agency for Natural Resources and Energy: http://www.rps.go.jp/RPS/new-contents/top/toplink-1.html

prices[143].

While the RPS program of California can be described as the market mechanism-based policy measure in comparison with Japan's FIT scheme given price competition among renewable energy electricity generators in biddings, California's program has more rigorous cost management incorporated in the institutional design than under Japan's FIT scheme, through the screening of procurement prices and the ceilings placed on prices. Purchase prices under the FIT scheme in Japan are determined each year based on generation costs for each power source, but there exists no mechanism to reflect actual costs in the cost of running the scheme in that year after the determination of purchase prices. Under current circumstances, therefore, the costs rise in proportion to purchase prices and amounts purchased in the absence of the ceilings set on the costs. However, in California as well, some question the effectiveness of the RPS program in view of actual conditions of the program's operations. Section 4 provides an overview of these issues.

3-4. Responses on the Grid Connection Front

The state government is playing the leading role not only in the management of the cost of achieving the RPS targets but also in responses on the grid connection front in association with the raising of the RPS targets. As discussed above, the 2010 target of 20% failed to be met, with one of the factors behind the failure being the problem of access to the power grid. Because of this, the state government has been dealing with the issue of the integration of renewable energy[144]. Under the Renewable Energy Transmission Initiative (RETI), the California Energy Commission is dealing with such issues as the review of locations in the state that require the construction and reinforcement of power transmission infrastructure, greater efficiency in site location and licensing procedures for the construction of power generation facilities and transmission lines, and the identification of development zones with high cost efficiency and little environmental impact[145]. In tandem with this, California Independent System Operator (CAISO) is developing and implementing construction plans for the power transmission and distribution network, development of the imbalance market[146] that contributes to the integration of renewable energy, and also

[143] Hearings of prominent figures, October 7, 2014

[144] Responses in terms of power system operations in order to enable the simultaneous pursuit of an expansion of the introduction of renewable energy and the stable operation of the electric power system, and the development of rules for utilization of intra-area connection lines and market trading rules, etc.

[145] California Energy Commission: http://www.energy.ca.gov/reti/

[146] The voluntary market for automatic adjustments of the differences between the supply and demand plan and

undertaking demonstration projects for the Smart Grid and electricity storage technology[147].

As a result of a number of meetings to consider the necessity and costs of such measures, CPUC has recognized indirect costs of the construction of power transmission lines in association with the procurement of RPS electricity as part of the RPS procurement costs and allowed these indirect costs to be passed on to electricity rates. In the initial stage of the RPS program operation, under the aforementioned LCBF, increases in indirect costs of renewable energy electricity (costs of construction of the power transmission network and other costs related to the integration of renewable energy) was recognized as at negligible levels[148], and electric utilities subject to the RPS obligations were not allowed to include these costs in the evaluation of bid prices[149]. In the current operation of the RPS program, electric utilities subject to the RPS obligations, instead of being subjected to the screening based only on direct costs of the procurement of RPS electricity, are allowed to pass on those indirect costs to electricity rates as part of the RPS procurement costs after preferentially considering projects best fit for the power system requirements[150].

real-time supply and demand every five minutes by employing lowest-cost power sources and means. CAISO website: http://www.caiso.com/informed/Pages/CleanGrid/default.aspx

147 CAISO: http://www.caiso.com/informed/Pages/CleanGrid/default.aspx

148 In California, the Integration Study: California Renewables Portfolio Standard Renewable Generation Integration Cost Analysis has been conducted in three stages since 2003.

149 Order Instituting Rulemaking to Implement the California Renewables Portfolio Standard Program., Opinion Adopting Criteria for the Selection Least-Cost and Best-Fit Renewable Resources, Decision 04-07-029, July 8, 2004

150 CPUC website (Confirmation date: August 26, 2014, Last Modified: 2/1/2012): http://www.cpuc.ca.gov/PUC/energy/Renewables/procurement.htm

Chart 8 Power Transmission Line Construction Projects in California

Source: Tracking Progress (Transmission Expansion), June 2014, California Energy Commission

4. Actual Conditions and Problems of the RPS Program Operation

4-1. The Status of RPS Procurement Costs

(1) The Current Status of Procurement Costs

Under the 2011 state law[151], CPUC is required to submit annual reports on the RPS electricity procurement costs to the legislative body[152].

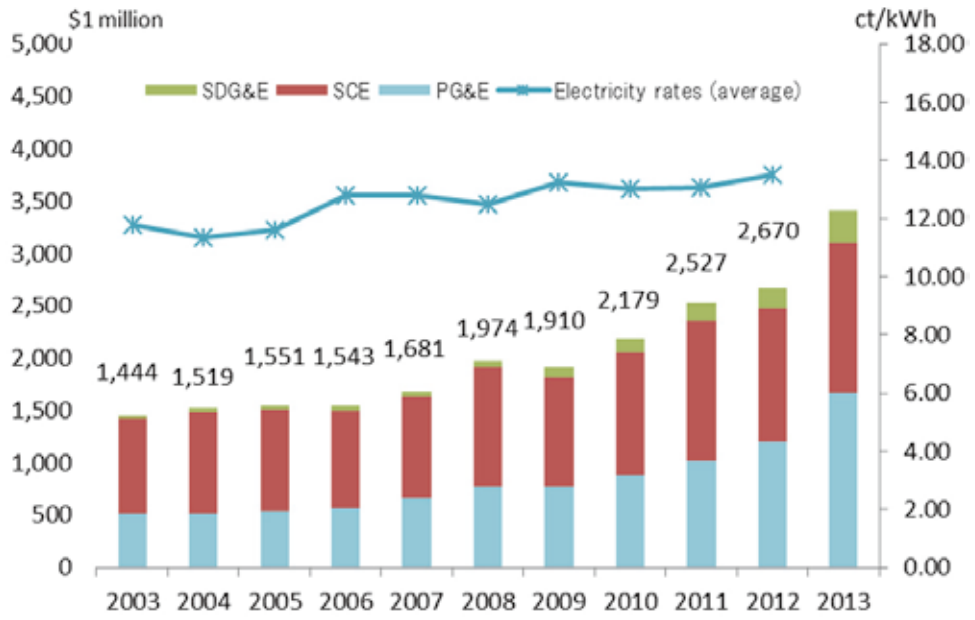
The direct costs of RPS electricity procurement for the three major IOUs have been increasing every year, currently standing at $3.4 billion (some ¥366.6 billion) (the preliminary figure for 2013) (the combined total of direct costs for other small electric utilities stands at $13.7 million (the revised final figure for 2012)). Electricity rates since the introduction of the RPS program have all but moved sideways[153] (See Chart 9).

[151] SB2(1X) and SB836, Public Utility Code 910, 911 (CPUC, 2014(a))

[152] The costs of RPS electricity procurement are passed on to electricity bills of consumers. CPUC reports do not provide figures for cost burdens of consumers per electricity sales, as surcharges under Japan's FIT scheme. The assessment of cost burdens and sizes is shown as "reference" at the end of the paper.

[153] Average Price by State by Provider (1992-2012), EIA

Chart 9 Trends of RPS Procurement Costs (Direct Costs) and Electricity Rates (Average for All Sectors) of the Three Major IOUs



Note: The combined total figures for the three major IOUs.
Source: Prepared by the author based on CPUC, Report to the Legislature in Compliance with Public Utilities Code 910, February 2014, and March 2013, and Average Price by State by Provider (1992-2012), EIA

Looking at the cost breakdown and the percentage of electricity output by energy source for the latest year of 2013, wind power generation has the highest share of around 40% for both (See Chart 12).

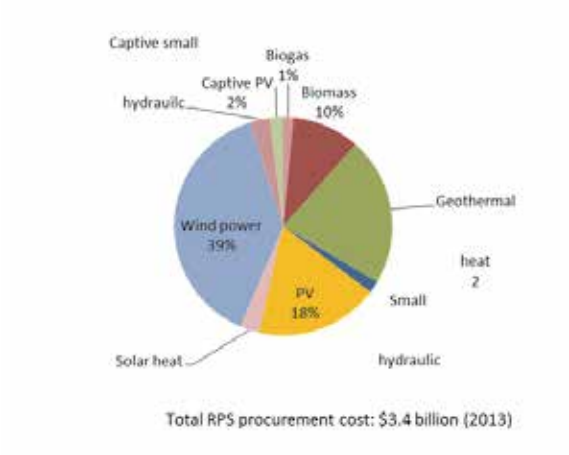
Indirect costs are not presented systematically, as no common calculation method applicable to all of the three major IOUs has been established. Though CPUC views the indirect costs up until now as small relative to the direct costs[154], the three major IOUs estimate that the cost of constructing power transmission lines related to the procurement of RPS electricity will amount to $10.1 billion (¥1.1 trillion) by 2020[155]. CPUC has not clarified the outlook for burdens of grid buildup costs, stating that the

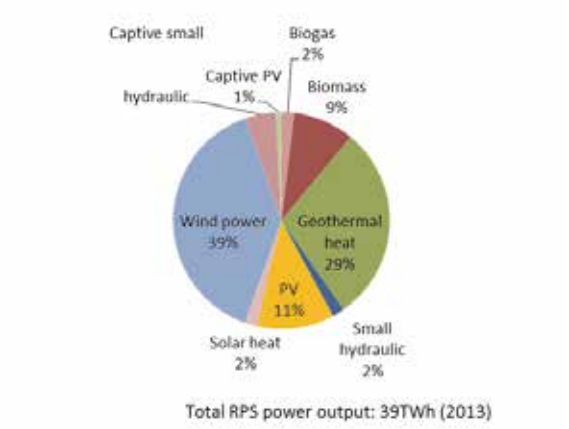
[154] The total integration costs for 2013, estimated by the three major IOUs using their respective calculation methods, came to about $17.44 million (about ¥1.8 billion). CPUC, 2014(c)

[155] If grid buildup costs arise at the electricity distribution level in the integration of renewable energy projects, renewable energy electricity generators are to bear those costs. Because of this, these costs are believed to be reflected in the direct costs via the inclusion in bid prices, though they are not accounted for in the indirect costs of RPS procurement. CPUC, 2014(c)

costs for construction of power transmission lines and enhanced flexibility in the power grid are designed to secure the stability of the overall system and the costs stemming from the expansion of RPS electricity cannot be clearly identified. On the other hand, the three major IOUs point out that since power transmission line construction projects are to be completed one after another over the coming decade, the bulk of the costs has not been included in electricity rates through 2013 and that they are likely to be passed on to consumers going forward[156].

Chart 10 Percentage of RPS Electricity Procurement Costs (Left) and Electricity Output (Right) of the Three Major IOUs





Source: Prepared by the author based on CPUC, Report to the Legislature in Compliance with Public Utilities Code 910, February 2014

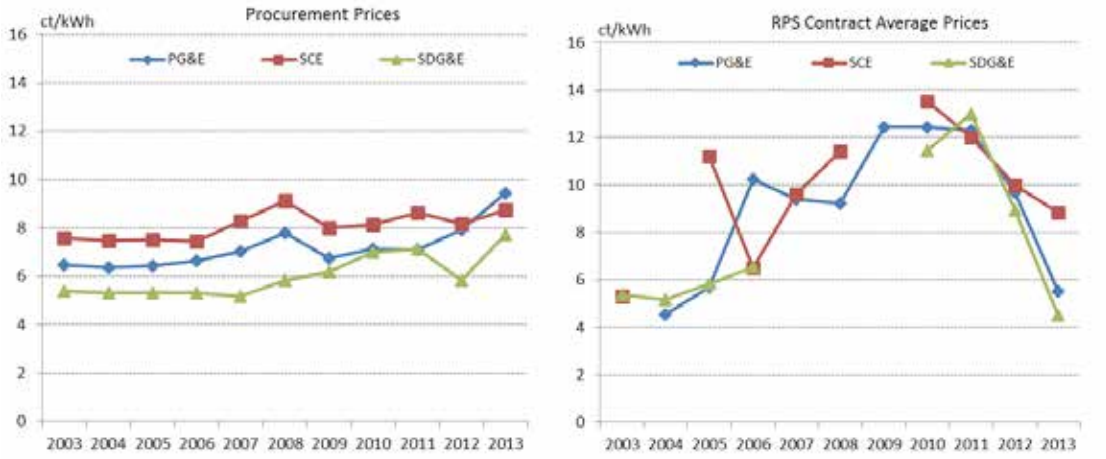
(2) Trends of Procurement Prices

The trends of the RPS procurement prices (electricity purchase and REC

[156] CPUC, 2014(c)

acquisition prices based on existing contracts) of the three major IOUs for each year and the newly approved RPS contract average prices are shown in the chart below[157]. According to CPUC, the RPS procurement costs (left, Chart 13) rose in recent years as the RPS contract prices stood at high levels from 2008 through 2009. The RPS contract average prices for each year (right, Chart 13) stayed low right after the introduction of the RPS program as contracts mostly covered existing facilities, but then turned higher as contracts with new facilities increased in tandem with the expansion of the RPS targets. The RPS contract average prices declined since 2011 apparently by reflecting the market trends. Explaining this development, CPUC points out that the RPS market has matured and become increasingly competitive[158].

Chart 11 Trends of RPS Procurement Prices (Left) and Approved RPS Contract Average Prices (Right) of the Three Major IOUs



Note: RPS contract average prices are not announced when the number of projects is fewer than three.
Source: Prepared by the author based on CPUC Padilla Report 2013 and 2014

4-2. Reactions to the Cost of Running the RPS Program

As seen above, the state of California has achieved the high percentage of the introduction of renewable energy (20% in 2013) through the state's own RPS program. In the absence of noticeable rises in electricity rates, it may be said that the RPS

[157] The weighted average of price differences depending on supply time slots, including transactions of RECs only.
[158] CPUC, 2014 (b)

program is being operated smoothly and steadily until now. As discussed below, however, there are remaining problems with the effectiveness and transparency of cost control and calls are also emerging for improvements in the way the program is being operated.

While the institutional design incorporates cost-containing measures, there is the possibility that they are not being applied properly in the actual operations. Explaining reasons for that possibility, some people point out that since CPUC is the principal player in the screening of RPS contracts and at the same time the principal player in the management of the ceilings on the costs, CPUC does have some leeway to provide ranges in the interpretation of LCBF and/or to allow for some exceptions[159]. The Office of Ratepayer Advocates (ORA)[160], an organization to represent consumer interests, released a report, "Green Rush"[161], in 2011 that summarized the trends of the RPS electricity procurement by the three major IOUs and CPUC's RPS contract approval. According to the report, of the total of 184 RPS projects submitted to CPUC for approval since 2002[162], only two projects failed to obtain approval. However, 59% of RPS contracts approved and concluded were priced above the MPR, with the average contract price exceeding the MPR by 15%. Funds necessary to compensate for the difference between the MPR and the RPS contract prices are estimated at $6.0 billion (about ¥647.7 billion), far larger than the above-mentioned amount of funds allocated for the compensation ($770 million (about ¥83.2 billion)).

As the Public Goods Charge (PGC), the source of funding for the compensation of the price differences, was abolished at the end of 2011 (See 3-2), there is currently no mechanism in place to continuously secure funding resources for the compensation. The method to recover the RPS costs in excess of the compensation ceilings remains unknown, and the ORA states that these costs may have an impact on electricity rates going forward as the approved projects commence operations one after another (normally, it takes three to five years from bidding to the commencement of operations). CPUC levies charges for the spread of renewable energy by creating the Electricity Program Investment Charge (EPIC) in September 2011 in lieu of the

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[159] CPI, 2012

[160] The independent division within CPUC representing the interests of consumers. It was renamed to the present name in September 2013 from the Division of Ratepayers Advocates (DRA).

[161] Division of Ratepayer Advocates (DRA), Green Rush: Investor-Owned Utilities' Compliance with the Renewables Portfolio Standard, February 2011

[162] Up to the end of 2010 (Renewable Portfolio Standard Quarterly Report, 4th Quarter 2010, CPUC). The most recent data put the number of RPS contracts approved by CPUC at over 360. (Renewable Portfolio Standard Quarterly Report, 2nd Quarter 2014, CPUC).

PGC[163]. But the use of EPIC is limited to R&D and demonstration projects[164] and does not cover RPS procurement costs or the compensation[165].

In connection with this, there are legal provisions that allow electric utilities subject to the RPS obligations, with the approval of CPUC, to pass the excess portion above the MPR on to electricity rates after procuring RPS electricity on their own at the cost in excess of the MPR at the stage where the compensation is no longer possible[166]. However, as criteria for this are unknown and there is the prospect that the cost of the power grid buildup will be required going forward, there exist concerns that RPS-related costs may be added to power generation costs in a nontransparent manner and passed on to electricity rates. Under these circumstances, CalWatchdog, a consumer group, leveled harsh criticisms against CPUC, etc. for their failure to systematically provide likely burdens of consumers and future outlook[167].

The ORA, based on the Project Viability Calculator developed by CPUC, made an assessment of the realization rate of already approved RPS contracts, and recommended that priority should be given to cost containment and approval should be withheld for high-cost projects going forward, noting that the present pace of the introduction of renewable energy makes the achievement of the 33% target by 2020 highly likely[168].

Against this backdrop, the 2011 state law (SB2) requires CPUC to consider new cost-containing measures and calculate the ceilings on the costs of achieving the RPS targets of electric utilities subject to the RPS obligations[169]. CPUC states that pursuant to the previous provisions[170], it plans to set the cost ceilings at levels that would not bring excessive impacts on electricity rates[171]. The draft plan unveiled by CPUC in July 2013 sets the ceilings on the ratio to the overall cost[172] of the RPS

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[163] Because of the legislature's rejection of the PSG extension (as discussed earlier), CPUC introduced EPIC as an administrative measure. Unlike the PSG, EPIC does not cover energy-saving projects. Briefing Report, Senate Republican Caucus, May 2013

[164] The 2012-2014 budget totals $467 million, of which the budget for the California Energy Commission stands at $368 million, with the ceiling on annual expenditures set at $162 million. ORA: http://www.dra.ca.gov/general.aspx?id=2104

[165] A reply to an inquiry made by e-mail (November 22, 2014), CPUC

[166] Public Utilities Code § 399.15(d)(4), Resolution E-4442, December 1, 2011

[167] Cal Watch Dog, The Dirty Secrecy of Clean Energy Cost, March 19, 2012

[168] Division of Ratepayer Advocates (DRA), Green Rush: Investor-Owned Utilities' Compliance with the Renewables Portfolio Standard, February 2011

[169] CPUC, 2014(a)

[170] Public Utility Code §399.15(d)(1)

[171] CPUC, 2014 (a)

[172] The sum of forecasts on the assumption of the growth rate of 2.75% for 10 years since the initial year (CPUC, 2013 (b))

procurement costs of IOUs[173] and presents the new method of reviews every two years on the basis of future prospects[174].

Aside from the above, CPUC plans to proceed with efforts to contain the costs of the entire RPS program, through, among others, the review of the requirements of the aforementioned LCBF, the precise capturing of the status of RPS progress, the examination of the necessity of the development of power transmission infrastructure, and greater efficiency in RPS contract screening procedures[175].

5. Summary and Suggestions

The RPS system is commonly regarded as a scheme designed for the cost-efficient introduction of renewable energy by leaving the price-discovery function for renewable energy electricity to the market. When examining the case of the renewable energy introduction in California however, it can be said that the political intervention and administrative management are performing important roles in the simultaneous pursuit of the promotion of the introduction of renewable energy electricity and cost containment. While there are some remaining problems with respect to the operations of the RPS program, it successfully achieved the high percentage of renewable energy (20% in 2013) without triggering sharp rises in electricity rates so far. The key characteristics of California's RPS program is summarized below, with some comparison with problems with Japan's systems (RPS/FIT):

The first point has to do with the policy leadership with the establishment of long-term introduction targets. The state of California maintained the RPS program since its launch in 2002 by raising the RPS targets, and the establishment of the targets to increase the renewable energy percentage to 33% by 2020 and maintain at least that level beyond 2020 provides signals for continued investment in renewable energy as one of the means to combat climate change.

Under Japan's RPS system, the targets sufficient to maintain investment were not established, and the FIT scheme was then introduced without any specific numerical target. It is hoped that clear targets will be established going forward, together with the consideration of the energy mix.

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[173] The direct costs of the RPS electricity procurement and the costs of running electricity generating facilities over the 10-year period (CPUC, 2013 (b))

[174] CPUC, 2013 (b)

[175] CPUC, 2014 (a)

The second point is the administrative control over specific procurement prices of RPS electricity from the dual standpoints of investment promotion and cost containment. In the subsidization of sales of renewable energy electricity, investment is not forthcoming if procurement prices (contract prices under the RPS system and purchase prices under the FIT scheme) are too low, while cost burdens get excessive if procurement prices are too high. To deal with this problem, California examines the economic efficiency of contract prices for RPS electricity procurement using natural gas-fired thermal power generation as the benchmark, while giving a measure of competitive edge to the power generation from renewable energy sources by having the benchmark reflect the cost of global warming countermeasures. While based on market principles, such as competitive bidding and the procurement through the REC certificate trading system for enhanced economic efficiency in achieving targets, the political intervention and administrative management are playing important roles in both aspects of the promotion of investment in renewable energy and cost containment.

In its renewable energy promotion measures so far, Japan has no experience in specifically operating the mechanism for limiting the cost of running the system. Reflecting on an avalanche of applications for the FIT scheme, which touched off concerns over sharp rises in costs, it is essential for Japan to establish appropriate incentives and take cost-containing measures.

The third characteristic of California's RPS program is that following the establishment of the higher targets, the state is taking specific steps to deal with the grid connection issue. The parties concerned, including the state government and CAISO, are proceeding with the identification of places where the construction of the power transmission network is necessary as well as the development of construction plans. They are also in the process of developing the structure to comprehensively capture the costs of promoting renewable energy by developing rules for society to bear the necessary indirect costs associated with the expansion of the introduction of renewable energy, such as costs of measures to deal with the variability of renewable energy electricity (changes in wind power and photovoltaic power output) as part of RPS procurement costs.

At present, Japan's FIT scheme is increasingly confronted with the pressing issue of constraints in the grid connection. With restrained output as the principal response for the time being, what the grid integration costs, coupled with purchase costs under the FIT scheme, should be borne and the policy to expand the volume that can be connected to the power grid are likely to be considered going forward.

In order to expand the introduction of higher-cost renewable energy, it is deemed necessary to take comprehensive policy responses that enable the simultaneous pursuit of the establishment of ambitious targets and cost-containing measures, including measures with respect to the power grid. The state of California, taken up in this paper, is just a single example, and the state's RPS program cannot be discussed by generalizing it as how RPS systems should be operated. Instead, by capturing an RPS system as a regulated system[176], California's RPS program, including its future responses, should be regarded as a notable case of a system that attempts at the simultaneous pursuit of the promotion of the introduction of renewable energy and cost containment through administrative controls. The California program has some effectiveness problems, and Japan also needs to consider whether the system operation with a larger government role, as in California, is desirable or whether the system that gives full play to the market mechanism is desirable. It is necessary for Japan to review the desirable scheme as a system that serves the broader policy objectives, including the consistency with the electricity system reform and the power source portfolio based on climate control as well as the promotion of renewable energy. In order to deal with problems such as the rapid introduction of renewable energy beyond amounts that can be connected to the power grid and sharp rises in electricity rates, however, responses, such as the establishment of appropriate measures and ceilings, should be examined regardless of institutional differences between the FIT scheme and the RPS system. Fundamentally, lower administrative costs of running the system are more desirable. But it is not so easy to ascertain the appropriate levels of subsidies. Particularly at the stage of an immature market, the government's meticulous responses and the flexibility in improving the system as necessary will be required.

<Reference> Assessment of Cost Burdens and Sizes

The costs of procuring RPS electricity are passed on to electricity rates paid by consumers, but the CPUC report does not show specific cost burdens on consumers per unit of electricity sales, such as surcharges under Japan's FIT scheme[177]. The breakdown of electricity rates presented by CPUC covers levies for the Public Purpose Program (subsidies for energy-saving and renewable energy R&D costs) but does not

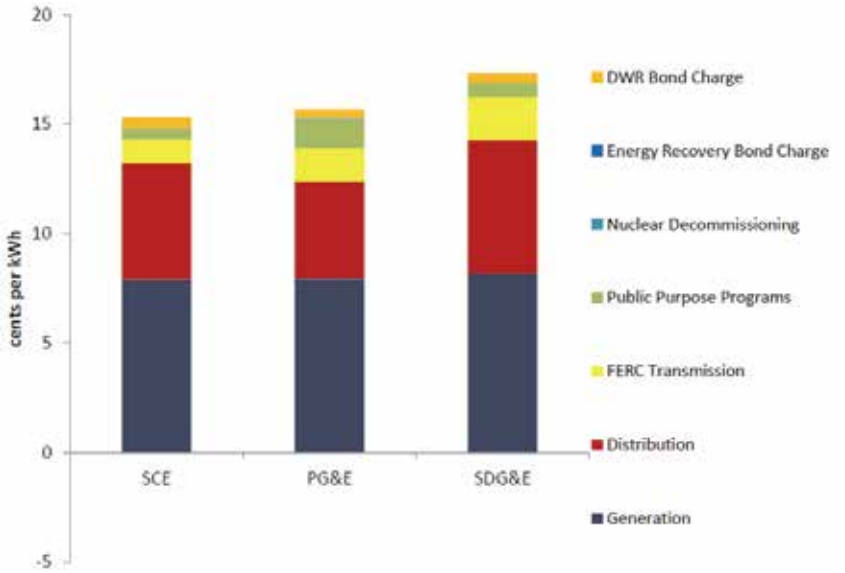
[176] Hearings, California Energy Commission, September 4, 2014

[177] According to the hearings (Lawrence Berkeley National Laboratory, September 5, 2014), RPS costs are not shown in detailed statements of electricity rates provided to consumers.

include RPS costs[178], which are presumed to be accounted for as part of power generation costs.

CPUC indicates the degree of RPS procurement costs as the percentage of RPS procurement costs in the revenue requirements of the three major IOUs[179]. The percentage in 2013was 13.4% for PG&E (9.7% in 2012), 11.9% for SCE (11.2% in 2012) and 10% for SDG&E (6.3% in 2012)[180], all of which exceeded the previous year's levels and topped 10%[181].

Chart 12 (Reference) Breakdown of Electricity Rates (2013)



Source: Electric and Gas Cost Report, CPUC, April 2014

CPUC also estimates the cost benefit of the RPS electricity procurement by assuming that the MPR is an avoidable cost. Taking the combined RPS procurement costs for the three major IOUs for the 2011-2013 period, the additional cost of electricity procurement proved to be negative (cost savings)[182].

But these estimates are significantly influenced by natural gas price forecasts, and

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[178] Utility Consumers' Action Network: http://www.ucan.org/index.php/energy/tips-resources-energy/understand-your-electric-bill/sdg-e-programs-public-purpose

[179] Padilla Report and Public Utilities Code 910, 2013 and 2014

[180] CPUC, 2014(c)

[181] As discussed below (4-2), the idea of setting the ceilings on costs is under consideration using the ratio of RPS procurement costs to overall cost.

[182] CPUC, 2014(c)

CPUC says it is considering the RPS-based method of estimating the cost benefit[183].

Table 5 (Reference) CPUC Estimates of Additional Cost/Cost Savings of RPS

	Calculation base: MPR assumed to be the avoidable cost			Cost savings ($million)			
	Reference MPR	Terms	MPR(ct/kWh)	PG&E	SCE	SDG&E	Total for 3 IOUs
2013	2011 MPR	Contract start year 2013 Contract period 20 years	9.3	-25	92	74	141
2012	2011 MPR	Contract start year 2012 Contract period 20 years	8.9	147	114	101	362
2011	2009 MPR	Contract start year 2011 Contract period 20 years	10.1	1,410	1,560	330	3,300

Source: Prepared by the author based on Report to the Legislature in Compliance with Public Utilities Code 910, CPUC, February 2014 and March 2013

Meanwhile, the three major IOUs show additional costs by assuming that spot market prices are the avoidable cost (based on CAISO's day-head market prices and the capacity cost[184]). Based on their presentation, the RPS procurement in 2013, for example, brought a combined additional cost of about $1.62 billion for the three major IOUs, which is estimated to translate into the cost increase of 4.2-4.5 ct/kWh per unit of power output.

CPUC is of the view that there are some problems with the method of calculating these estimates, saying that it is hard to imagine to procure 20% of electricity sales (equivalent to the RPS obligations) on the spot market.

Table 6 (Reference) RPS Additional Costs Estimated by the 3 Major IOUs (2013)

		PG&E	SCE	SDG&E
Cost	Additional cost (ct/kWh)	**4.2**	**4.2**	**4.5**
	Additional cost ($million)	713	732	172
Calculation base	Spot market price (ct/kWh)	4.21	4.28	4.12
	Capacity market price ($ /kW/year)	67.5	65.42	-

Source: Prepared by the author based on the Report to the Legislature in Compliance with Public Utilities Code 910, CPUC, February 2014

The comparison between the direct costs of the RPS electricity procurement in California and purchase costs under Japan's FIT scheme in 2013 is show in the table below. The ratio of the renewable energy electricity procurement/purchase costs to the revenue of electricity rates/operating revenue of electric power

[183] CPUC, 2014(c)

[184] The cost to secure other power sources as the operational reserve power in preparation for a possible decline in output of renewable energy electricity

companies (data for cross-reference from both sides) is about 9% for California and about 3% for Japan. As discussed above, it should be noted that the percentage of RPS electricity for the three major IOUs is above 20% in California (the share of renewable energy (excluding large-scale hydraulic power generation) in Japan is 2.2%[185]) and those purchase costs under Japan's FIT scheme are expected to increase substantially in FY2014.

Table 7 (Reference) Comparison of Renewable Energy Electricity Procurement/Purchase Costs (2013)

Unit: \100 million

	Renewable energy cost (A)	Power business revenue (B)	(A)/(B)
California 2013	**4,047**	44,173	**9.16%**
	RPS procureement cost	Power business revenue	
Japan FY2013	**5,791**	181,558	**3.19%**
	FIT purchase cost	Power business operating revenue	
Japan (Up to July 2014)	3,443		
	FIT purchase cost		

$=\118 (the exchange rate on December 1, 2014)

Note: The RPS procurement costs for California are the combined total for the three major IOUs and small electric utilities subject to the RPS obligations
Source: Prepared by the author based on the state of California: EIA and Report to the Legislature in Compliance with Public Utilities Code 910, CPUC, February 2014, Japan: Statistical information of the Federation of Electric Power Companies and the Agency for Natural Resources and Energy website

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