



PROVISIONAL TRANSLATION

Recommendations for Reform of the Electricity System

For Establishing an Electricity System with a significant share of Renewable Energy

May 2016

Renewable Energy Institute

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General issues: Why should the electricity system be reformed?

Effective deployment of renewable energy requires, as an essential prerequisite for its acceptance, structural reform of the electricity system. Europe has carried out reform of its electricity system to integrate markets across countries, starting with liberalization of the power market to abolish monopolies and promote competition, then moving into unbundling and the establishment of an independent regulator, and developing an environment for fair competition.

So far, the region has adopted inter-regional transmission operations and priority dispatch, among others, with the deployment of renewables taken as a given, developing a distributed energy system which provides an environment favorable to the greater deployment of renewable energy. Japan should also appropriately implement, and accelerate, the reform of its electricity system. This report is intended to present specific recommendations for doing so.

1. Power liberalization and adoption of renewables in Europe

The adoption of renewables requires something more than incentives such as the Feed-in Tariff system. Renewable energy is merely a type of source of electricity or heat. Before being appropriately integrated into an energy system to be delivered to end-consumers in the form of electricity or heat, it is nonviable as a business. That can only be realized when significant changes are made to the existing regulatory systems, market trade mechanisms, design of transmission networks, and technical aspects of their operation, so that they will adapt to renewables. This is what electricity system reform intends to achieve.

Since the 1990s, when they began reforming the electricity system, Europe has carried out a series of reforms, including the liberalization of power markets, establishing wholesale electricity markets, and unbundling. These reforms, intended to form an integrated market in Europe and promote competition, took place coincidentally with problems of climate change, which came to the surface in those days, and prompted the policy to promote renewables. That turned market liberalization from a mere method of promoting competition into structural reform of the electricity system, taking into consideration its possible contribution to the promotion of renewable energy.

For instance, electricity liberalization must come with unbundling (Specific Issue 1), which facilitates the grid connection of renewables. Grid connection and inter-regional transmission operation by independent transmission companies accelerates the adoption of renewables. Inter-regional transmission operation (Specific Issue 2) provides an effective solution for output fluctuation. Adjusting supply and demand through the market mechanism is inherently favorable for inter-regional transmission operation. An independent regulator (Specific Issue 5), established together with liberalization, not only serves to oversee market competition but also to supervise transmission companies from the standpoint of promoting renewables.

On the other hand, the Feed-in Tariff system sets official prices that allow specific power sources favorable treatment, an apparent inconsistency with liberalization. In practice, however, once purchased under the system, electricity is traded on the market. There, the market rules must make some adjustment in deciding who purchases electricity and how it is supplied (Specific Issue 3). Germany, for instance, had priority dispatch rules in place based on an EU directive, which obliged transmission companies to buy renewable power and sell it on the spot market. With the increases in installed capacity, it consequently has been replaced by another system that encourages power producers to engage in direct sales, a mode of trade that is becoming a mainstream in recent years.

Liberalization of retail also provides end-consumers with opportunities to choose their own power sources themselves. In Europe and the United States, for instance, retailers are obliged, from the viewpoint of consumer protection, to declare their energy source composition and their emissions of greenhouse gases or radioactive waste (Specific Issue 4). They constitute important selection criteria for consumers, who may prefer locally-produced renewables despite higher rates, to some degree. A monopoly would deny them such choice, and major power companies and the government developed centralized power sources under the plans which they formed.

As seen above, the adoption of renewables depends largely on institutional and policy factors, as well as technical and economic ones. Precisely because Europe has overcome the barriers that had their origins in the conventional electricity system through "energy turnaround" (Germany) or "Electricity Market Reform (EMR)" (United Kingdom), the region has succeeded in achieving ten-fold the share of renewable energy introduced as Japan (excluding hydropower). Reasonable reform of the system to be carried out from the standpoint of effective adoption of renewable energy is what constitutes the challenge to which Japan has critically lagged behind in responding.

2. Current state of electricity system reform in Japan

Japan also started working to reform its electricity system around 1995, only to produce insufficient results, as seen in the lack of unbundling (Specific Issue 1). That left the wholesale power trade quite small in market size and in an underdeveloped environment for fair competition (Specific Issue 3), which allowed power producers and suppliers (PPSs) a market share of no more than 5.2% (2014 Electric Power Investigation Statistics). In addition, the lower policy priority given to renewable energy resulted in relative indifference not only to economic incentives for promoting renewables but also system design, as seen in the case of inter-regional transmission operations (Specific Issue 2). Precedence was given to the stability of supply under a monopoly over competition in the market, and to existing power sources, including nuclear energy, over renewables. That led Japan, in contrast to Europe, to recognize little need to reform the electricity system in preparation for the growth of renewable energy.

However, it was only after 2011, when the Fukushima Daiichi Nuclear Power Plant of Tokyo Electric Power Company (TEPCO) failed, followed by rolling blackouts and power shortages, did Japan make a start on the full-scale reform of its electricity system. Behind this action lies the serious recognition that centralized power sources, concentrated along the Pacific coast and other limited areas, were vulnerable to tsunamis, that there was insufficient capacity to transmit electricity from the western part of Japan to the eastern region, and that the government, faced with an absolute shortage of supply capacity, could do nothing but impose uniform measures, such as top-down rolling blackouts and ordinances for restricting power consumption. Japan came to realize that especially with a view to adding to its amount of distributed power sources, such as renewable energy, rather than centralized power sources, an environment for fair competition must be developed through unbundling and/or other measures, and that for the reasonable adjustment of supply and demand to be performed with the users involved, inter-regional electricity trade through the market must be introduced as a prerequisite.

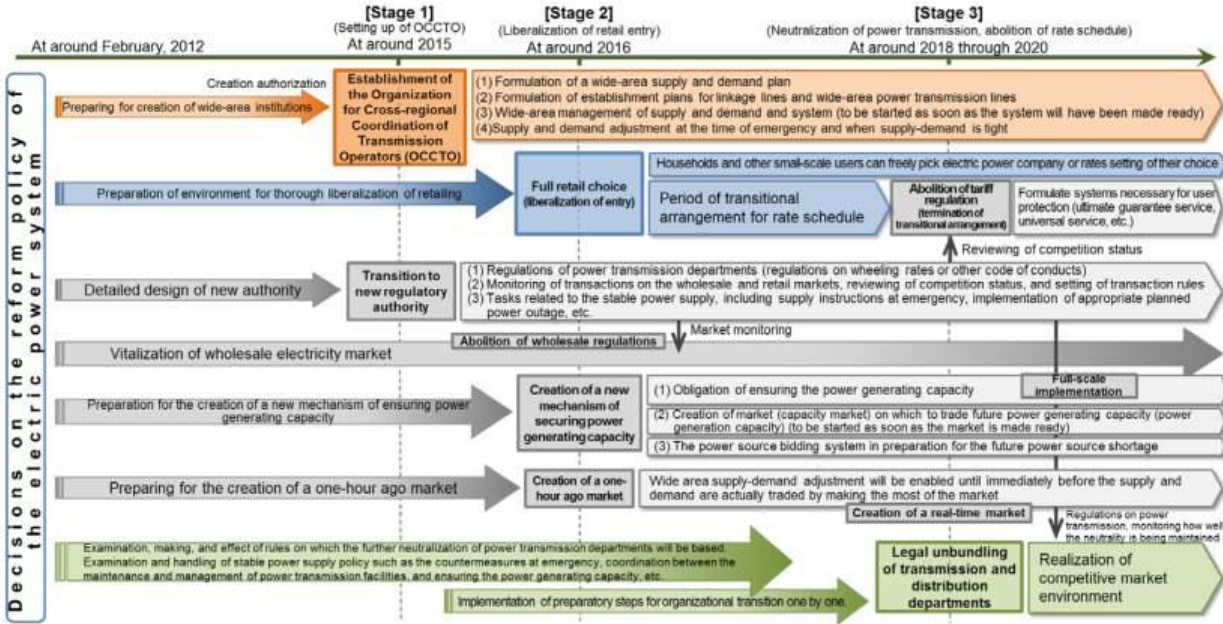
In response, the government of Japan, based on deliberations at the Electricity System Reform Expert Subcommittee, which started in February 2012, adopted the Cabinet Decision on the Policy on Electricity System Reform in April 2013¹, before three series of amendments were

¹ The Cabinet Decision explicitly states, as part of its purpose, that the Government will establish a structure to secure stable supply even when introducing renewable energy that often involves output power fluctuation.

made to the Electricity Business Act (Figure 1). Based on these policies, the Organization for Cross-regional Coordination of Transmission Operators (OCCTO) was set up in April 2015, and the Electricity Market Surveillance Commission, was formed in September that year (renamed as the Electricity and Gas Market Surveillance Commission (EGC) on April 1, 2016). The retail market has just been fully liberalized in April 2016. The decision has already been made that power transmission and distribution operations will be legally unbundled from power generation by April 2020. With these measures implemented appropriately, Japan's electricity system will potentially be significantly transformed into a system that is favorable for renewable energy.

Renewable Energy Institute (REI), while basically appreciating these reforms, believes there is more that can be done to accelerate the move. In the Specific Issues discussed below, from the viewpoint of promoting the effective adoption of renewables on a much larger scale in a manner compatible with their stable supply, as well as market competition and economic viability, we offer these 13 recommendations in five areas: Mode of unbundling and significance of transmission companies; Expanded inter-regional transmission operations and inter-regional transmission lines; Integration of renewable energy into the wholesale electricity market; Full liberalization of the retail market and expanded adoption of renewable energy; and Roles an independent regulator should have to perform.

Figure 1 Roadmap for Electricity System Reform



Source: "Report of the Electricity System Reform Expert Subcommittee," the Ministry of Economy, Trade and Industry, February 2013

Specific Issues: Thirteen recommendations for reform

1. Mode of unbundling and significance of transmission companies

1.1 Three types of unbundling

In the age of the natural monopoly, which goes with the economy of scope, as well as that of scale, the electricity business was usually operated by a single power company under a system of transmission and distribution integrated with generation. In the days of the liberalized electricity market, however, it is inevitable to lease out transmission networks, which are still left as a natural monopoly, to promote new entries into the power generation business. A structural solution for this is to be found in unbundling.

Around the globe, unbundling is divided into three major types. The first is ownership unbundling. As far as power plants and transmission networks are owned together by a group of companies which virtually constitutes a single entity in capital terms, they have conflicting interests between their competitive and monopolistic sectors, making it hard to prevent anticompetitive behavior. In Europe, some countries that liberalized the electricity market around 1990, such as Spain, the United Kingdom, Norway, Sweden, Belgium, and the Netherlands, implemented ownership unbundling of power companies at the same time to separate their transmission sectors, setting up completely independent entities in capital terms. The fact that in these countries, the state-run power companies were dominant in the market was probably a factor that made it rather easy for the governments, as owner, to carry out ownership unbundling according to their policy decision.

The second type, legal unbundling, requires that the transmission sectors, once spun off, to be registered as a separate entity, regardless of whether capital ties are maintained or not. That is, power companies need nothing more than to separate their transmission sectors to be a subsidiary, a scheme which is weaker in force than ownership unbundling. This type of bundling has been adopted by France, Germany, and Scotland, the United Kingdom, among others. In Germany, with the history of major power companies having been set up and run as private-sector businesses, the government had difficulty in forcing ownership unbundling on them from the standpoint of private ownership. At the start of power liberalization, in 1998, they chose legal unbundling. However, through the process of competition in the market, two of the four major companies then got their transmission subsidiaries fully unbundled, while one transferred 75% of the stake in its transmission company. The one remaining maintains legal unbundling.² Even legal unbundling may leave the possibility of neutrality being secured for transmission companies if, as in Germany, behavior regulation works properly under an independent regulator (Specific Issue 5).

The third, functional unbundling, transfers the grid operation to an independent system operator (ISO), regardless of its ownership, a common system in the United States. It allows a single ISO to manage more than one transmission network owned by different entities in an integrated manner, an advantage when it comes to promoting inter-regional transmission operations. On the other hand, the scheme also has a disadvantage in that the separation of grid operators and owners may hinder solid progress in capital expenditure or other business. Whether ownership, legal, or functional unbundling is adopted, the fair operation of a grid by a transmission

² Behind these moves lie the European Commission, which promotes market integration through Europe. The EU's third Electricity Directive, issued in 2009, and stating that ownership unbundling is the most preferred from the standpoint of promoting competition, offered three options including legal unbundling (Independent Transmission Operator: ITO) and functional unbundling (Independent System Operator: ISO).

company or an ISO from a neutral position contributes to the introduction of renewable energy on a large scale.

1.2 Transmission companies and renewable energy

Once becoming independent through ownership or legal unbundling, transmission companies are freed from the interests of generation and the retail business. Anticompetitive behavior is less likely because, they, along with the transmission service left as the sole source of income, find it reasonable to allow any power plants, regardless of their owners or type of power sources, to get connected to the grid. Securing fairness for grid connection is the first step to the introduction of renewables.

What is especially important beyond that for renewable energy is progress in inter-regional transmission operations (Specific Issue 2). Even independent transmission companies each have some coverage area designated for them, though they have no need to commit themselves to power plants located in their own service district, and instead have an incentive to make the most of the transmission networks they own, leading them to make a reasonable choice; accepting electricity generated outside the area during times of short supply while allowing any surplus, which should be priced lower there, to be transmitted outside. This enables supply and demand to be balanced across regions, making it easier to buffer any fluctuations in the output from wind and solar power plants.

In Europe, where priority dispatch of renewable energy has been made obligatory under an EU Directive (Specific Issue 3), transmission companies also have important roles to play. When instructed by the regulator to supply renewable electricity with priority, the transmission company, as monopolist, must obey. To make that possible, they not only operate across a inter-regional basis but also choose from several options, such as load following, mainly in thermal power plants, and the employment of pumped-storage hydropower plants, in a way that is reasonable, or in order of lower marginal cost. Any shortage in capacity of the transmission networks serves as a strong incentive for the transmission companies, as the statutory monopoly, to create some buildup.

In a world with unbundling, transmission companies play a role not only as a neutral network operator but also in making the electricity system more flexible from a comprehensive perspective (Specific Issue 3). As an entity responsible for power supply stability, they strive to accept as much renewable energy as reasonably possible.

1.3 Prospects of unbundling in Japan

The current state of Japan demonstrates a striking contrast to what has been described above about Europe. Unbundling has adopted merely on an accounting basis, with no transmission company having been set up in the first place. Under such conditions, as has long been pointed out in the field of renewable energy and beyond, the problem of grid connection is preventing sufficient competition in the market. This has set up a significant barrier against the adoption of renewables. For instance, wind-generated electricity is subject to a "capacity limit for grid connection," a restriction which is peculiar to Japan.

With amendments made to the Electricity Business Act in 2015, Japan has also decided that legal unbundling be adopted by April 2020. TEPCO had its transmission section legally unbundled in April 2016, setting up the first transmission company (subsidiary) in Japan. While appreciating such progress in the area of reform, REI has some concern that it may take time before the diverse range of problems that have already become apparent are solved because the

reform will only produce any effect from 2020, at the same time wondering whether legal unbundling will by itself produce sufficient results.

For instance, new rules introduced for the Feed-in Tariff system in January 2015 allow power companies (grid operators) without any limitations to suppress the output from renewable power sources without paying compensation, casting a dark shadow over any investment in renewable energy. This provides contrast to the priority dispatch rules which have been adopted in Europe. One factor behind this seems to be the lack of independent transmission companies. The new rules also fail to take fully into consideration the effect of inter-regional transmission operations. Here, OCCTO, inaugurated in April 2015, is expected to play a part.

Based on the understanding described above, and from the viewpoint of turning the transmission networks neutral and promoting inter-regional transmission operations, REI offers the two recommendations below:

Recommendation 1: Thorough behavior regulation under legal unbundling

Legal unbundling, though it is the easiest option for countries, like Japan, where power companies are operated as private-sector entities, is insufficient as structural regulation in terms of liberalization of the grid. This is because parent companies that own the power plants maintain ownership of the transmission subsidiaries, an incentive for anticompetitive behavior. To prevent that, it is important to thoroughly implement behavior regulation to secure independence of the transmission subsidiaries. Specifically, some measures must be taken in terms of directors serving both for the parent and its subsidiary, employees seconded to a subsidiary while employed by the parent, financing and transactions between them, trademarks, company names, marketing and advertisements, and buildings and IT systems, in order to keep the transmission business fully neutral.

These behavior regulations may not fully work, depending on the way they are implemented. That makes it critical for the Electricity Market Surveillance Commission, set up in September 2015 and renamed as the Electricity and Gas Market Surveillance Commission (EGC) on April 1 2016, to examine, after the fact, whether transmission operations are kept neutral, and whenever necessary, give operators instructions to take remedial measures. Neutrality should be one of the key screening points when deciding whether a license for general transmission should be granted to an applicant.

Recommendation 2: Ownership unbundling and other possibilities for further structural arrangements

Where legal unbundling is insufficient in the effects it produces, further structural arrangements are needed. From the viewpoint of economy of scale, which is inherent in the transmission service, ten transmission companies (general transmission operators) operating together across the country of Japan seems inefficient. Especially, to obtain greater effects from inter-regional transmission operations, transmission companies should merge together, or take other measures to become larger in scale.

Accordingly, the government (Agency for Natural Resources and Energy (ANRE) and EGC) should, taking into consideration ownership unbundling as a future possibility, design and implement policy programs that lead power companies (general transmission operators), or private-sector entities, to opt for it, and the transmission companies to grow in scale.

What is required first for that to happen is for the EGC to perform thorough surveillance of the transmission operators even before legal unbundling comes into force. In Germany, the Federal

Network Agency works for the thorough implementation of behavior regulation, which is one of the factors which made ownership of transmission subsidiaries less attractive. This leads power companies to decide to sell their transmission subsidiaries (ownership unbundling).

Second, the government should work more positively to provide power companies with incentives for ownership unbundling. In the United States, for instance, power companies were allowed, as an exceptional measure after the power market liberalization, to collect any stranded cost they had made mainly for generation capacity investment from electricity rates, in compensation for the consent they had given to unbundle transmission operations and sell their power plants to promote competition. From the same standpoint, the Japanese government may also take some measures to encourage the power companies to either sell their transmission subsidiaries or get them merged.

As the third option, enabling OCCTO to work as something more than a coordinator for inter-regional transmission operations, the Organization may be promoted to a nation-wide grid operator, or an ISO. A nationwide ISO setup to be commissioned to operate the entire grid means that not only legal but also functional unbundling comes into force, an effective way to allow the grid to be operated in a more neutral manner and across regions.³ To transform OCCTO into an ISO, it must be authorized to issue electricity supply instructions and formulate grid plans, as well as guaranteeing greater neutrality by far in the management of its personnel affairs.⁴

³ In the first place, functional unbundling was adopted in the United States because there was more than one power company (grid operator) in a single state. For the purpose of enabling grids across regions, beyond state borders, Regional Transmission Operators (RTOs) were set up, such as the Pennsylvania-New Jersey-Maryland Interconnection (PJM) and the Midcontinent Independent System Operator (MISO).

⁴ In California, for instance, directors of the state ISO are appointed by the Governor. The current five directors have experience as a university professor, corporate manager and state official, with no-one from the power companies on the board. Two of them, on the other hand, have expertise in renewable energy.

2. Expanded inter-regional transmission operations and inter-regional transmission lines

2.1 Significance of inter-regional transmission operations

The term, inter-regional transmission operations, refers to transactions of electricity beyond the area coverages of conventional power (transmission) companies to adjust the balance between supply and demand across regions. Given the great diversity between consumers (demand) as well as between power plants (supply), aggregating needs and supplies across regions to adjust the balance is actually more reasonable in economic terms, and at the same time more helpful to the stability of supply. For that reason, the Electricity Business Act obliges the Electricity Utilities to take into consideration inter-regional transmission operations (Section 2 of the Act) even from the days of the absolute regional monopoly.

However, regional monopolies in fact operated under a scheme that integrated both generation and transmission, making inter-regional transmission operations far from easy in principle to carry out. This is because the power companies held responsible under the scheme in each region for the entire process starting from generation through transmission to retail, avoided relying on any power sources located out of their coverage areas, and instead adjusted their own plants to balance supply with demand. As a result, they added to power plants in their own area, while leaving existing inter-regional transmission lines redundant.⁵

In contrast, in the days of variable renewable energy being introduced on a large scale, inter-regional transmission operations are in much greater demand. Some point out that Europe has made great progress in the adoption of renewables because the region has a grid network spreading beyond national boundaries like a mesh, and in a sense that is the case. However, it should also be noted that another important factor behind the success is the reasonable system developed to employ transmission networks efficiently. In turn, you may point out, Japan has so far failed to promote inter-regional transmission operations in part because the country lacks independent transmission companies, which should all play a central role in such operations, leaving the scheme for employing transmission networks across regions underdeveloped.

2.2 Rules for inter-regional transmission lines

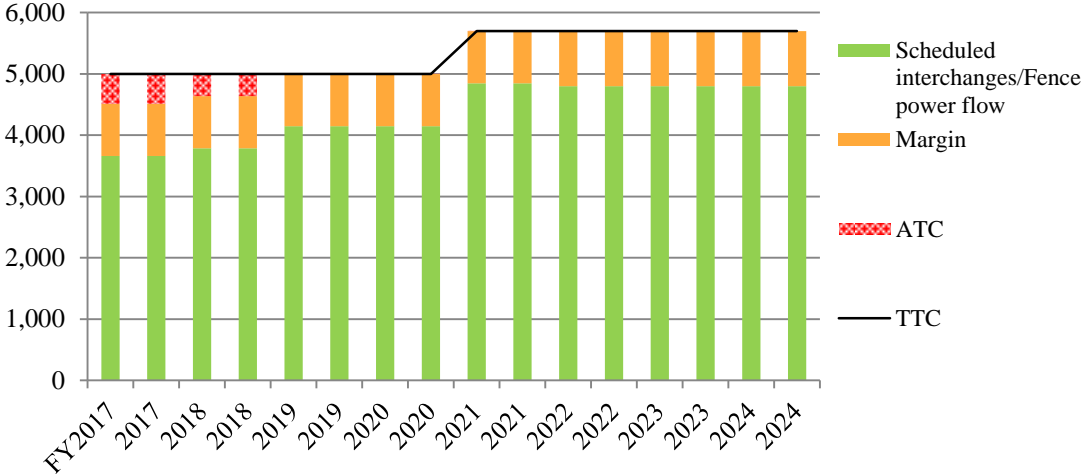
One factor that can be pointed out as hindering inter-regional transmission lines is the conventional rules. Under Japan's existing rules, set by the Electric Power System Council of Japan (ESCJ), users of a grid network are allocated some of its capacity using the first-served method, based on a long-term plan. That part of the capacity is called "scheduled interchange," which has been used for long-term fixed power sources, such as nuclear, coal-thermal, and hydroelectric plants.

In the case of transmission lines between TEPCO and Tohoku Electric Power Company, for instance, more than two-thirds of their total transfer capacity (TTC) has been allocated as scheduled (Figure 2). The TTC of a transmission line less scheduled interchange and margin constitutes "available transfer capacity (ATC)," which can be used for power sources other than those that are long-term fixed. Among the renewables, solar and wind power generation is especially sensitive to weather, and how much electricity these two sources will produce can only be forecast at the last minute, when nothing but ATC is left for them. However, ATC

⁵ For instance, the Hokkaido-Honshu Transmission Line, often mentioned as a barrier against the adoption of renewables in Hokkaido, has a utilization rate of a mere 2.7% (toward the Tohoku region). OCCTO, FY2015 "Annual Report"

accounts for around 10% of the entire capacity (Figure 2), one reason for the poor usability of transmission lines.

Figure 2 Soma-Futaba Transmission Line: Long-term plan and ATC

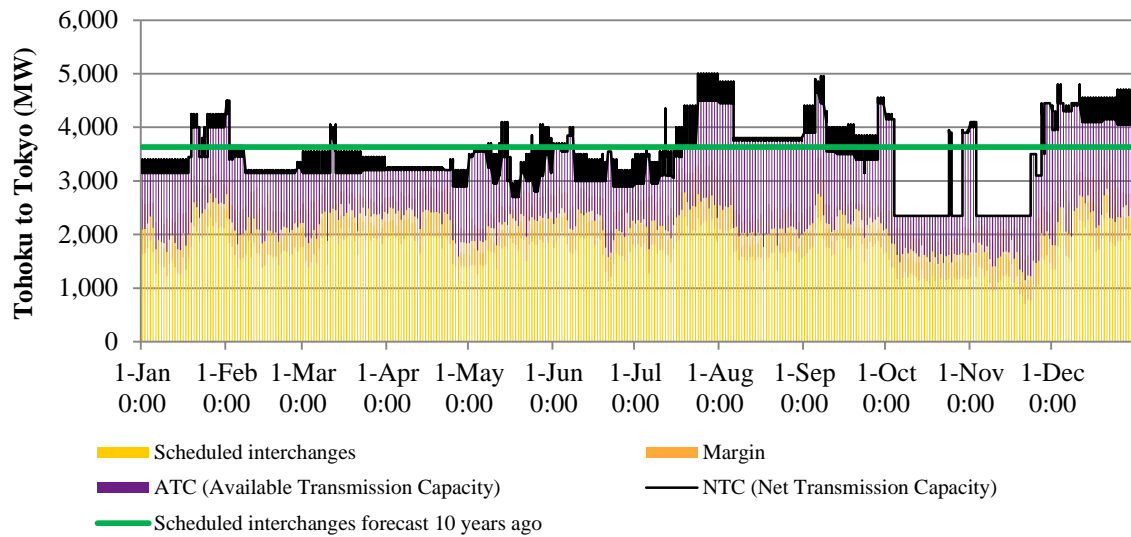


Source: OCCTO, adapted from "Grid Information Service" by REI. <https://www.occto.or.jp/keito/denkeito/index.html>

In practice, these scheduled interchanges are not fully used. Figure 3 shows the scheduled interchanges presented in 2005 (horizontal green line; scheduled interchanges forecast 10 years before) against the actual results in 2014 (January - December, 30-minute intervals), which indicates increases in ATC (purple) compared to those seen in Figure 2. Such excesses occur because, according to the ESCJ rules, which prohibit provisional reservation, scheduled interchanges for which users find no use must be released at least seven days before they are actually employed.⁶ However, unable to make a prediction about the release with any certainty, the renewable power operators cannot count on this for their power generation plan. As a result, scheduled interchanges are in fact provisionally reserved. In spite of the fact that it is also a problem in terms of the efficiency of transmission lines, no action is taken to revise the existing rules that give precedence to long-term planning.⁷

⁶ Any reduction made in the schedule after 5:00 p.m. of the day seven days before an actual day is subject to cancellation charges, such as "schedule change surcharge" and "charge for changes in declared volume." <http://www.tepco.co.jp/corporateinfo/provide/engineering/wsc/renkan-j.pdf>
⁷ Announcement of the Results of the FY2014 Review of Recognized Long-term Fixed Power Sources (Electric Power System Council of Japan) <http://www.escj.or.jp/obsolete/news/2014/20141219.html>

Figure 3 Actual ATC between Tohoku & Tokyo in 2014, and Long-term Scheduled Interchanges Forecast as of 2005



Source: OCCTO, adapted from "Grid Information Service" by REI.
<https://www.occto.or.jp/keito/denkeito/index.html>

2.3 Implicit auction in Europe

While in Japan, the "scheduled interchange" plays a central role in the operation of inter-regional transmission lines, Europe generally operates inter-regional transmission lines using an "implicit auction," which allocates users of inter-regional transmission lines rights of use based on contracts concluded in a spot market. In the first place, the region has several day-ahead spot markets in place (detailed later) connected together (market coupling), making electricity transactions across regions, and across national boundaries, quite common.⁸ Spot transactions allow contracts to be concluded based on marginal cost (the merit order - detailed later), with rights of use for transmission lines automatically assigned as a result.⁹

As a way of securing long-term employment of transmission lines (scheduled interchanges), a major practice in Japan, Europe has adopted explicit auctions for rights of transmission with a view to achieving transparency and fairness.¹⁰ Japan, at the moment, is hesitant to introduce the scheme mainly due to concerns over risks to investment in long-term fixed power sources.¹¹ In the first place, Europe puts up only a limited quota of the scheduled interchanges for auction, and the term is shorter, just the next one year, in comparison to ten years in Japan. That helps limit the provisional reservation of transmission line capacity, allowing implicit auctions to play a central role in achieving efficient employment of transmission lines, with due consideration paid to new entrants. In other words, Japan has yet to achieve the basic conditions for achieving inter-regional transmission operations, as the country adheres to the rules for

⁸ It should be noted that Japan, a country that has formed no international interconnections, consumes almost the same amount of electricity as that of Germany and France combined, which provides Japan with good potential for efficient inter-regional transmission operations solely from the domestic market.

⁹ Any excess in allocations over the operational capacity of the existing transmission lines would result in "market segmentation."

¹⁰ Explicit and implicit capacity auction (Nordpool spot)
https://nordpoolspot.com/globalassets/download-center/pcr/how-does-it-work_explicit-and-implicit-capacity-auction.pdf

¹¹ The 4th meeting of the System Design Working Group;
http://www.meti.go.jp/committee/sougouenergy/kihonseisaku/denryoku_system/seido_sekkei_wg/pdf/04_05_01.pdf

employment of inter-regional transmission lines which give great precedence to long-term fixed power sources.

Against such background, REI offers the two recommendations below to achieve reasonable grid operation that integrates renewable power sources into the grid as a prerequisite.

Recommendation 3: Functions of OCCTO

As the first step for reforming Japan's electricity system, an institution engaged in inter-regional transmission operations, the Organization for Cross-regional Coordination of Transmission Operators (OCCTO) was established in April 2015. As a coordinating organization that all the electric utilities are engaged in, OCCTO is designed to get inter-regional transmission lines employed in an efficient manner and to promote the nationwide operation of grids. Given that the ESCJ failed to perform a sufficient role, OCCTO, standing neutral between the electric utilities, and backed with strong authority as the organization over them, is expected to work to deliver the reasonable employment of inter-regional transmission lines, the formulation of construction plans, and a smoother connection between grids.

REI greatly looks forward to seeing OCCTO fully functional and moving inter-regional transmission operations forward. Meanwhile, a little less than one year after its inauguration, it is too early to evaluate its achievements. We will carefully examine the contents of new rules, which are being prepared at the moment, for the employment of transmission lines, and performance of the organization in regard to grid access services. What is also critical here is that the EGC should exercise appropriate supervision over its services.

Recommendation 4: Implicit auctions held to employ inter-regional transmission lines

REI recommends that Japan also adopt implicit auctions for allocating capacity of the inter-regional transmission lines in place of the current rules that give precedence to existing long-term fixed power sources. Implicit auctions, used by Scandinavian countries, for instance, is designed to not allow any grid user to make provisional reservations based on a long-term plan. Not only does this mechanism achieve fairness in the employment of transmission lines, while promoting inter-regional transmission operations and serving as a solution to the output fluctuations of renewables, but it also enables the merit order across regions. The auction system should also be adopted as a way to secure the long-term employment of transmission lines, with some limited quota assigned to it.

OCCTO is now considering how to develop grids and manage TTC across regions, as well as how to secure the ability to perform adjustments across regions. However, employment of transmission lines, which are seen as vested interests in Japan, as described above, has yet to be placed on the agenda. To operate grids across regions with greater efficiency, the capacity of the inter-regional transmission lines should be opened to the market as soon as possible, via implicit auction, or some other relevant method, adopted to allocate rights of use to grid users.

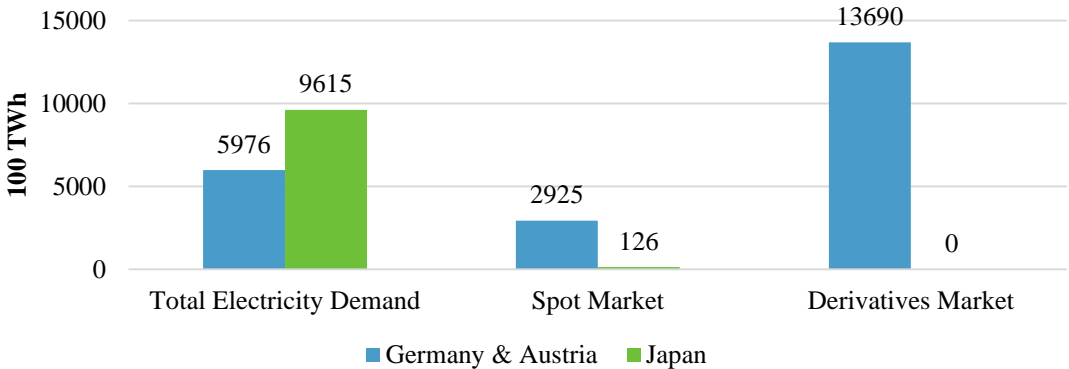
3. Integration of renewable energy into the wholesale electricity market

3.1 Electricity liberalization to stimulate market transactions

Once electricity trade is liberalized, transactions are carried out in the market based on the price mechanism. The market has a multi-layer structure as transactions are performed principally on the spot market, which deals with the actual demand for electricity to be consumed the next day while the real-time market carries out adjustments to balance the eventual supply and demand, with the futures market offering hedges against long-term risks. When a spot market is working appropriately, electricity would be supplied from a range of power sources in ascending order of marginal cost, achieving greater efficiency in employment of generation facilities according to the merit order. A real-time market developed on top of that to effectively balance supply and demand through demand response¹² or other processes would also help enhance the stability of supply. Even constant changes observed in the market price can be hedged to a certain degree on a futures market which has been set up for the purpose. To counter manipulation of the price upward or any other unfair practices, an independent regulator would have an important role to play in market surveillance.

Market trade of electricity has made great progress in Europe, especially Scandinavia, a group of countries which engaged in electricity system reform the earliest, as well as Germany and France, two markets with a tremendous demand for power. Based on the EU Electricity Directive, Europe intends to integrate the electricity markets all over the region and introduce competition, with several cross-border power markets having been set up so far. As a result, the spot market of Nord Pool, formed by the four Scandinavian countries, together with some others, dealt with 501,400 TWh in 2014, over 2.5 times the amount of 10 years before. In 2013, the share of spot transactions in electricity consumption stood at about 92% between four Scandinavian and three Baltic states, and about 45% between Germany and Austria.¹³

Figure 4 Comparison between Japan and Germany & Austria in electricity demand and market size



Note: Total electricity demand shown for Germany & Austria is from 2013. Figures shown for Japan are from FY2014.

Source: Adapted from EEX Annual Report (2014), Electric Power Investigation Statistics (FY2014), etc.

¹² Demand response refers to users taking some action, such as peak shaving, mainly when power is almost in short supply in response to a request typically made by a grid operator in order to help achieve a balance between supply and demand. The scheme is expected to be effective in saving higher-cost electricity generation, and achieving the flexibility needed to deal with variable power sources.

¹³ Spot transactions are quoted from the "Nord Pool Spot Annual Report 2014" and the "EEX Annual Report 2014." Power consumptions by country are from "Electricity Information 2015," IEA. Among the three Baltic states, figures for Latvia and Lithuania are estimates for 2012 found in "The World Factbook," CIA. The spot markets mentioned here are each operated commonly between two or more countries.

In contrast to Europe, Japan sees electricity transactions on the market remain quite small in scale (Figure 4). In FY2014, Japan Electric Power Exchange (JEPX), which opened more than ten years ago in 2005, dealt with spot transactions of about 12,600 TWh, or a mere 1.7% of the total demand. The small size of the wholesale electricity market makes flexible procurement of electricity between power sources difficult to achieve, one of the factors that hinders PPSs from acquiring a larger share.

Significant differences also exist between Japan and Europe regarding their market trade practices. Europe has had markets set up, separate from the generation and retail departments, trading sections dedicated to the optimization of market transactions and asset management to enable effective employment of the marketplace for efficient supply and procurement of fuel and electricity. Market participants prepare trading strategies by the type of power source, such as thermal, hydropower, and nuclear, using derivatives markets as well, to hedge risks of price fluctuation.

In Japan, short of active transactions in the market, vertical integration within a power company is still the dominant mode for power trades, with long-term direct contracts with the supplier left as practically the sole alternative. Under the regional monopoly scheme, the full cost principle for approved rates and the fuel cost adjustment mechanism allowed power companies to pass the inherent risks of price fluctuation on to the users at any time. Even after liberalization, markets have delivered little competition, where few users find any incentive to use the marketplace more actively for efficient procurement. So far, some power companies have declared their intention to set up or enhance a trading section for fuel procurement to cope with full liberalization of the retail business¹⁴, which shows that Japan has just got off the mark.

3.2 Purchase and direct sales of renewable energy

With the establishment of an integrated, competitive electricity market and increased employment of renewable energy in sight, Europe had long been considering the way to introduce renewables to the wholesale electricity market.

In Germany, transmission companies purchase renewable energy under the Feed-in Tariff (FiT) system to resell it in a spot market.¹⁵ Here, according to the priority dispatch rules set by EU Directive, renewable energy, which is inherently low in marginal cost, is given precedence over coal-fired and nuclear power in dispatch, which helps it secure recognition as a commodity to be traded in the market. Together with the increased share of renewables in overall power supply and higher FiT surcharge rates for residential users, on the other hand, the "merit order" effect works to drive down the spot price.¹⁶ This urges pursuit of a more market-relevant form of trading, in place of obligatory purchases by transmission companies. From 2012, power producers were allowed to choose direct sales to retailers and/or spot markets, which opened the way for the Feed-in Premium (FiP) system, a mechanism to pay power producers a premium on top of the ordinary market price. Amendments made to the registration process in 2014 have set direct sales to become the mainstream in renewable energy trade. Behind these moves lies the understanding that in Germany, where renewable energy accounts for more than 30% of the power consumption, the FiT system should be a tentative solution for reducing the cost of power generation, and that the phase of purchasing at a fixed price is coming to an end.

¹⁴ In April 2015, TEPCO and Chubu Electric Power Company established JERA, a joint venture engaged in the procurement of fuel and the construction of thermal plants.

¹⁵ By 2009, they automatically allocated renewables to retailers, depending on the amount of electricity they had sold.

¹⁶ An increased amount of renewable electricity, a power source with lower marginal cost, placed on the market, replacing thermal and other types of power, drives down the spot price.

Japan has also started discussions, with the assumption that from FY2017, transmission companies (grid operators) should be purchasers of renewable energy. Increased transactions are then expected in the spot markets. In principle, REI is in favor of this direction, although, given that Japan's market is currently quite small in scale and that it is likely to see any significant fluctuations in the market price, we believe that some solutions must be in place during the transitional phase, such as setting a ceiling on the price.

3.3 Need to secure flexibility in the electricity system

Faced with an increasing share of renewables, or variable power sources, such as wind and solar power, Europe is addressing a new challenge of how they can further expand the deployment of renewable energy while maintaining the supply-demand balance. Here, the key lies in "flexibility." A significant part of the supply-demand adjustment has so far been performed by hydropower and gas turbine combined cycle (GTCC) plants, among others, with their great adjustability for load following. In addition to these conventional flexible power sources, a combination of more diverse methods, such as enhancing the adjustability of coal-fired power plants, extended inter-regional transmission operations, and effective application of energy storage, should make the system of supply-demand adjustment more "flexible."

In Europe, for instance, coal-fired power plants, which have so far taken continuous operation as a given, are required to shorten start-up time and lower conditions for minimum load operation, among others, and techniques for coping with power increases at short intervals have been developed. As well as improved power plants, the previously mentioned inter-regional transmission operations help to increase flexibility as this matches supply capacities under diverse conditions according to demand. High expectations are held for demand response, an adjustability mechanism on the user side, as the ability has been left underused compared to the level seen in the United States. Some argue that along with conventional pumped-up power plants, studies should be conducted on batteries and other storage functions, and from a longer-term perspective, Power to Gas (P2G), a method to store power in the form of a gas.

Indeed, output suppression of renewable energy may be one option to achieve higher flexibility, but in Europe, thanks to the precedence given to those methods mentioned above, suppressed capacity accounts for 1-2 % of the annual output. Namely, structural reform of the electricity system is transforming the conventional scheme that ties the function of supply-demand adjustment to specific types of power plants, such as pumped-storage and petrothermal, into a more flexible mechanism designed to employ a diverse range of solutions that may even involve the network and user sides, and maintain balance within the system as a whole.

Meanwhile, as such a mechanism results in a lower utilization rate of conventional power sources, such as gas-thermal plants, the issue of "capacity mechanism" has come up for discussion (See Column). What lies behind this is the drastic changes in the roles that power sources have to play between them as shown by the fact that the term "base load electricity source" a synonym for long-term fixed power source, is now outdated. In a sense, that's the flip side of the fact that remedial measures for the market are needed on the business crisis of major power companies which had made erroneous judgments regarding investment in the types of power sources.

As shown above, in contrast to Europe, which is working to integrate renewables into the market on the premise that the wholesale electricity market is working properly, Japan has yet to see any functioning market in the first place, and only with a limited amount of renewables adopted so far. Renewables are denied priority dispatch, and the spot market does not see many transactions executed.

REI offers the four recommendations stated below, on what should be done to integrate renewables into the market in Japan, a country with an absolutely different premise than Europe.

Recommendation 5: Enhancement of wholesale markets in size and diversity

The first thing Japan must do at the moment is to have a well-functioning wholesale market from the standpoint of electricity liberalization. The task should start from expanding the spot market almost to the size of Europe's. For that purpose, power companies, the dominant owners of power sources, must be fully committed to the surrender of capacity and participation in auctions as purchasers.

The introduction of the licensing system and the shift to a schedule-based balancing mechanism in April 2016 may result in some increase in surplus power placed on the market as short account (*Tamadashi*) and/or leased out (*Kiridashi*). At the same time, before the market achieves sufficient liquidity, a period should be designated for intensive effort to expand the market, when the EGC must implement supervision and guidance more rigorously. What is important here is to pay attention not only to the amount of capacity surrendered but also to whether, and how much, capacity is placed on the market from power sources which are fully depreciated and therefore more cost-competitive, like hydropower.

The next thing that must be secured is diversity in the market. A real time market can be set up even before legal unbundling becomes obligatory. A futures market should also be opened quickly. That is expected to allow operators, regardless of their size, to more actively engage in strategic risk hedging and trading, procuring fuel and electricity with greater efficiency in the allocation of resources.

Recommendation 6: Steps to integrate renewable energy into the wholesale electricity market

Japan, a late starter in renewable energy, should maintain the basic framework of the FiT system, for the time being. Namely, grid operators should be obliged to purchase renewable power for a certain period, say, 20 years, at a fair price set to enable the generators to recover the investments they made. Electricity so generated should be sold on the spot market. These stable investment environments should promote the adoption of renewables. A disproportionately large share of industry solar power plants and increased surcharges, problems that have come up in Japan, should be dealt with through improvements in implementation of the scheme, such as reconfiguring the timing of facilities being certified, modifying frequency of prices being revised, and cracking down on improper projects.

On the other hand, from a medium-term perspective, the increased amount of renewable energy introduced will have to be traded on the market. Following the example of Germany and other countries, direct sales would be one of the options for market integration Japan can choose from in the future. However, that requires, as an essential prerequisite, a properly functioning market. For instance, the spot market must achieve a certain depth, and the futures market must offer a hedge option against the risk of price fluctuations.

In addition, essentially, what should be recognized is that a mechanism to get the negative externalities of fossil fuels (emission of greenhouse gases) in terms of climate change internalized, delivers an ideal solution to fuse market trading into environmental policy. In other words, Japan should also adopt a full-fledged carbon tax and/or emissions trading system, among others, to develop an environment that allows market participants to engage in ordinary transactions while indirectly encouraging them to adopt more renewable energy.

Recommendation 7: Priority dispatch based on merit order

With the EU Electricity Directive, Europe has adopted priority dispatch for sources of renewable energy, and in its foundation lies the principle that electricity should basically be dispatched according to merit order. That is, power sources are placed on the market in order of lower marginal cost. As a result, that allows renewables to be traded first, leaving output suppression merely as the last resort. Unlike Japan, the EU has no specific order set between the power sources for output suppression. Japan maintains dispatch rules that give precedence to long-term fixed power sources, such as nuclear, as well as hydro and thermal, over wind and solar.¹⁷ Based on the principle mentioned above, Japan should also integrate market trading into grid operations to achieve efficient dispatching control.

Table 1 Japan's transmission service guidelines on the order of priority for dispatch between power sources

(1)	Output suppression of thermal power plants (power sources subject to online adjustment) & pumping for pumped-storage hydropower
(2)	Output suppression of thermal power plants (power sources other than those subject to online adjustment)
(3)	Employment of transmission lines for inter-regional transmission operation (inter-regional frequency adjustment)
(4)	Output suppression of bio-energy generation
(5)	Output suppression of variable renewable power sources (Solar & wind)
(6)	Employment of non-firm power interchanges on a nation-wide basis (Non-firm inter-regional transmission operations based on instructions from OCCTO)
(7)	Long-term fixed power sources (nuclear, hydro & geothermal)

Source: "Transmission Service Guidelines" OCCTO. Effective on April 1, 2016

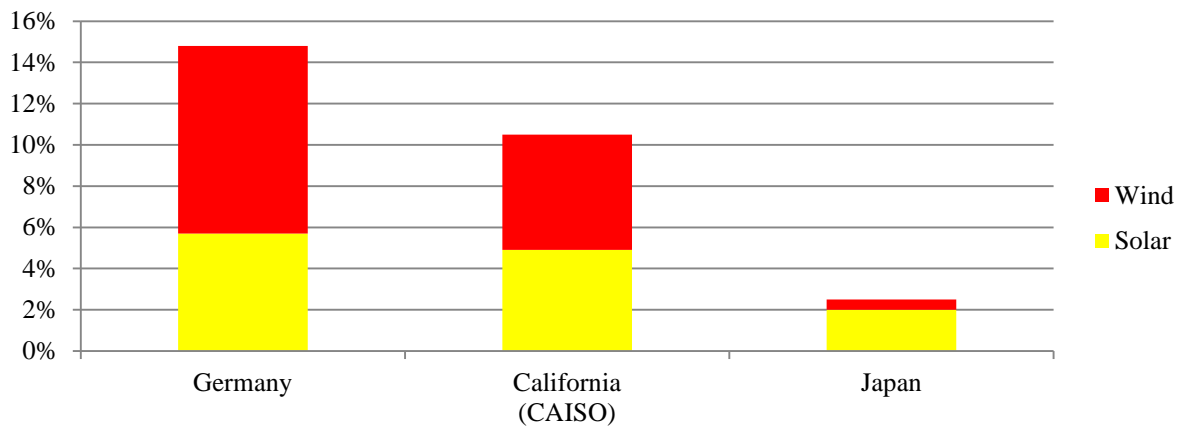
Recommendation 8: Market design to help make the electricity system more flexible

Regardless of how much variable renewable energy is to be deployed, greater flexibility of the electricity system is desirable from the viewpoint of supply stability. The first step should be to enable the market mechanism to work properly. Specifically, a real time market should be set up quickly. Japan has a plan to open this type of market in FY2020, when unbundling is to be inaugurated. Studies should get started as early as possible to prepare a market design that can deliver great transparency and fluidity, taking into account the experience of other countries.

Second, from a medium and long-term perspective, the level of flexibility needed to deal with a larger share of variable renewable energy should be estimated in order to examine whether there are any relevant arrangements that should be adopted, also taking into consideration what other countries have experienced. The capacity market may be among such examples (See Column). It should be noted, however, that such arrangements have only been experimented with by countries and regions that assume quite a large amount of renewables is to be employed. Germany and California each boasts a penetration ratio four to six times larger than Japan's at the moment (Figure 5), with two or three times the current level set as the target for 2030. Japan should learn from these models, and start preparing a market design at an appropriate time.

¹⁷ "Transmission Service Guidelines" OCCTO, April 1, 2016

Figure 5 Shares of solar and wind power in electricity in Germany, California, and Japan
(2014; *Fiscal year for Japan)



Source: Adapted from data from ANRE & CAISO.

Column: Does Japan need the capacity mechanism?

Some of the countries going ahead with the liberalization of electricity and/or employment of renewable energy are considering whether to introduce, or have introduced, the capacity mechanism. This is a general term given to policy programs designed to evaluate a power plant in terms of the value (kW) it has as supply capacity available to balance supply and demand, and complement the income it earns when selling electricity (kWh) in the market. With a large amount of variable renewable energy to be introduced, and/or the decommissioning of nuclear and coal-fired power plants, the system may suffer a shortage of flexibility, or supply capacity itself. Such expectations present an argument for the need for some arrangements that will help make the recovery of investment in power sources more predictable, and consequently secure supply capacity.

Under the integrated system of generation and transmission, and a statutory monopoly, a single power company was responsible for controlling all the power sources, including those with a rather low load factor as a result of frequent load following, to balance supply and demand. Power companies were allowed to feel indifferent to the profitability of individual power sources because the system was designed to secure them some profit earned from power sources as a group. After liberalization, however, the market needs some mechanism to evaluate in some way the value of a power source likely to go with a lower load factor due to a higher marginal cost despite its ease of load following which is helpful for greater system flexibility. Specifically, such mechanisms are roughly classified into "capacity market," adopted by California, the United States, and the United Kingdom, and "strategic reserve," picked by Germany and Sweden.

For instance, CAISO, the grid operator for California, with a view to raising the ratio of variable renewable energy it employs, is introducing in phases a mechanism to evaluate the flexibility capacity of the entire electricity system, and oblige its retailers to secure it (Flexible Capacity Requirement).

It should be noted, however, that different countries and regions all have different backgrounds, and they will not necessarily need any capacity mechanism soon after the electricity market has been liberalized. As has been pointed out before in this report, Japan lags behind, both in measures to stimulate market transactions and in the employment of renewables. The share of variable renewable energy introduced stands as low as some 3%, with the target set for 2030 at below 10%. Under the circumstances where more than 80% of electricity is produced using fossil fuel, none should feel any need for a capacity market. Any capacity mechanism introduced in a rough-and-ready manner would hinder the efforts to improve operation for greater flexibility, leaving out-of-date power sources retained, and hamper movements to develop the optimal fuel mix for the future.

4. Full liberalization of the retail market and expanded adoption of renewable energy

4.1 Retail business and renewable energy in other countries

One of the significant elements for reform of the electricity system is liberalization. As well as the liberalization of wholesale, it includes the freeing of retail transactions with end-consumers. Some developed countries in Europe and US started liberalizing their retail markets in the 1990s, seeing not only competition growing beyond the conventional service areas but also new electricity rates and renewable retail products placed on the list, promoting collaboration between the electricity sector and other businesses to propose new services.

In the United Kingdom, for instance, gas companies entered the electricity retail business after full liberalization in 1998 to offer gas in combination with electricity at a discounted rate.

Earlier than Europe, the United States set up the "Green Power Partnership (GPP) Program," which offers renewable energy options. Consumers can choose renewable electricity from the options on a retailer's list. Even in areas with no such options on offer, retailers can trade "GPP certificates," which consumers can buy. The country has recently seen "Community Choice Aggregation" (CCA)¹⁸ appear, a strong program that allows municipalities to choose renewable energy for their entire area.

Energy saving is also pursued through a diverse range of initiatives. For instance, Schönau Electricity Company (EWS), a supplier famous as having been set up by the citizens of a German city, offers on its list a lower basic charge than the major power companies, combined with a higher variable rate as a mechanism to encourage saving. In the United States, demand response has evolved from arrangements designed to automatically control the temperature setting of residential air conditioners. A peak saving initiative may deliver participants some incentive, which virtually lowers the electricity rate.

As seen in these cases, liberalization brings not only simple price competition but also a race for the value of renewable energy and energy saving, having consumers' opinions heard through the market mechanism. What is crucial as a prerequisite for this is to have a developed environment that enables consumers to exercise their choice in an appropriate manner.

In Europe and the United States, power producers and retailers are obliged, from the viewpoint of promoting fair market competition and protecting consumers, to disclose information about their fuel mixes¹⁹, and display their emissions of greenhouse gas or radioactive waste, among others. Their systems are designed to enable consumers to exercise their choice in the retail market as well as facilitate renewables and energy saving.

¹⁸ Under CCA, a municipality aggregates the electricity demand for households and businesses to procure renewable power for its entire area and deliver to its users. Procured for a municipality as a whole, electricity with a higher share of renewables becomes available at a lower rate. The scheme enables municipalities to offer options at the same rate as before with a higher share of renewable electricity and at a slightly higher rate for pure renewable power, among others. For instance, when a household moves into a city with a CCA program, they are at first obliged to enter into a contract for the program, but are then allowed to opt out.

¹⁹ For renewable energy, Europe adopted the "Directive on Electricity Production from Renewable Energy Sources" (Directive 2001/77/EC) in 2001, deciding to have the member states establish a Guarantee of Origin (GoO) scheme to promote electricity transactions and differentiate renewables from other power sources, as well as protect consumers. Disclosure and labeling of power sources was made obligatory by the "Second Electricity Directive" (Directive 2003/54/EC), adopted in 2003, taken over by the "Third Electricity Directive" (Directive 2009/28/EC), 2009, which maintains the obligation clauses. In the United States, more than half the states, including California, Colorado, Iowa, and Texas, have adopted obligatory disclosure of power source composition or similar arrangements.

4.2 Lagging retail liberalization in Japan and electricity retail business for renewables

In 2000, Japan liberalized parts of the electricity market for heavy consumers, such as large-scale factories and buildings with contracts of 2,000 kW (special high voltage), before more sections were freed in phases. However, since contracts of 50 kW or more (high voltage), a segment mainly for medium-scale factories and local governments, were liberalized in 2005, residential and other low-voltage users had long been left behind in the regulated market.

The halt was attributed to the state of regional monopoly with no foreseeable change seen in the last ten years, conditions where liberalization covering even residential use would have brought little benefit to consumers. During this period, the share of new entrants to the market stayed at around 3%. Between 2005 and 2013, "cross-border supply," a mode of competition between the major power companies across regions, was seen only in a single case. In fact, however, the reason for the slow progress lies not in any difficulty in liberalizing the larger part of Japan's market, but in the lack of thoroughness seen in unbundling and other measures introduced to promote competition and reform the system.

Conventional power companies control not only the transmission, or "distribution," but also the "production" and "sales" as a monopoly in a given region, while new entrants have to do with what little "production" capacity they have, and start from scratch to expand "sales." In environments with only underdeveloped markets for trading "products" (Specific Issue 3) and a lack of appropriate access to "distribution" channels (Specific Issue 1), new entrants find it difficult to compete with conventional power companies and expand "sales." Such competitive environments can be redressed through system reform which includes structural measures.

The Great East Japan Earthquake, which occurred on March 11, 2011, and the accident it caused at the Fukushima Daiichi Nuclear Power Plant acted as a trigger to move further forward discussions on the reform of Japan's electricity system after 20 years of inertia. A range of research has revealed that in liberalized sectors, conventional power companies compete keenly with new entrants on pricing to drive them out, while in regulated sectors, such as residential use, they maintain high rates and secure profits.

With this background, Japan has decided, as a critical element of system reform to be conducted in stages, that the retail sector, including residential use, is to be fully liberalized from April 2016.

With full liberalization of retail in April 2016 in sight, businesses have already started active marketing. At present, more than 220 retailers have registered. At least among those who have responded to us so far, around 30% have some plan to, or are considering whether to, engage in the retail business for residential users. (The figure may increase as many of them have yet to respond.) However, at least at the moment, most of them are concentrating their advertisement efforts on the possibility of rate reductions. On most of their price lists, the greater discount is offered to customers, the more electricity they consume. Some also point out that as Japan maintains a policy which is tolerant to the construction of new coal-fired power plants, electricity liberalization may come with a great increase in coal consumption, at least if the current state of things remains the same.

Like other countries, Japan must take account of some institutional restrictions that the renewables retail business finds placed on its success. First, Japan only saw significant growth of renewable energy after the FiT system was introduced, and as a consequence, most renewables transactions, except for large-scale hydropower generation, are conducted under the system. Anyone who intends to engage in the "renewable energy retail business" must rely mainly on "FiT power sources" for procurement. The FiT system is subsidized by the state and supported by surcharges levied on all electricity consumers. Selling power sources available

under the system as if they had any special value means that their environmental value is "sold twice". The issue has been settled by labeling this type of power as "FiT Electricity" when put on sale. However, the labeling has made the system all the more difficult to understand. Power sources left outside the framework of FiT must also be developed, in the first place.

Second, "avoided cost," once set at the average variable cost of thermal power, is now based on the price in the wholesale electricity market. This pricing mechanism is reasonable from the standpoint of securing fairness in the burden that consumers must bear in the form of surcharges, and Germany has also adopted a similar scheme. On the other hand, retailers must assume the risk of fluctuations in the procurement price. Some also express concerns that the spot market is too small in size. The market must be analyzed, especially to understand what impact the new scheme may have on small-scale retailers. At the same time, appropriate consideration must be given to surcharge increases caused by declines in avoided cost.

From the standpoint of exploiting the retail market to have more renewable energy employed, REI offers the two recommendations below.

Recommendation 9: Obligatory disclosure of easy to understand "fuel mix labeling" information helpful for consumer choice

In contrast to Europe and the United States, which introduced obligatory fuel mix labeling at the same time as liberalization, Japan merely refers to fuel mix labeling as "desirable,"²⁰ stopping short of obliging. The Ministry of Economy, Trade and Industry (METI) insists this labeling is effectively obligatory. In fact, however, retailers have been quite active in advertisement campaigns they launched in April, and only 30% of them specify their fuel mix as a percentage in their advertisement materials.²¹ Most of the websites they have set up to compare electricity options also fail to disclose the fuel mixes or to carry information on CO₂ emissions.²²

Labeling must also be given in a uniform, plain format. Under the current scheme, a fuel mix label is obliged to come with an "FiT Electricity" statement, mentioned above, as well as a description of the wholesale power market and other types of electricity, such as imbalance electricity, which is difficult for ordinary consumers to understand at a glance. Even when a fuel mix is presented by an operator on its website, for instance, it can often be found on a page placed somewhere rather deep into the site.

The government should specify a uniform, plain format of labeling, or take other relevant measures, to establish a system that saves operators labeling cost while helping consumers understand the labels and compare options easily.

Recommendation 10: Establish a green electricity market

While promoting FiT electricity, a study should also be conducted on how renewable energy can be employed on a larger scale through the retail business.

Green electricity schemes of other countries have been mentioned before. Japan also adopted the "Green Electricity Certificate"²³ in 2000. However, it stands as nothing more than a voluntary initiative, where businesses and others aspiring to do good for the environment

²⁰ "Guidelines for Electricity Retail Business," January 2016, Ministry of Economy, Trade and Industry

²¹ In the case of TEPCO's service area, which has seen the largest number of new entrants. Source: "Only 30% of Suppliers Disclose Fuel Mix," March 26, 2016, The Tokyo Shimbun newspaper

²² Kakaku.com website (as of April 1, 2016), etc.

²³ See, for instance, the website of the Green Energy Certification Center (<http://eneken.iej.or.jp/greenpower/jp/index.html?20160125>).

purchase and publish some "certificates" for the electricity they consume themselves. Green Certificates bring their holders no benefit in the form of eligibility under the Act on the Rational Use of Energy (Energy Saving Act) or other official arrangements.

The fundamental factor that lies behind this is the fact that Japan has no system designed to internalize environmental value in the market, like carbon pricing (Recommendation 6). The United States have developed, in addition to the trading of environmental value, a wide range of Green Power Partnership (GPP) programs, including the Green Electricity Certificate, to satisfy the needs of consumers since the electricity sector was liberalized. Given that retail business liberalization has now been started, with the expectation of renewables being the energy of choice, Japan should also consider recognizing the existing Green Certificate as official, integrating it into the formal system.

5. Roles an independent regulator should have to perform

What is crucial in reform of the electricity system is to secure the effectiveness of surveillance and regulation of market transactions to promote sound competition in the market and neutrality in the management of the transmission section. In Europe and the United States, electricity liberalization and system reform was carried out together with the establishment of a new independent regulator designated to monitor the competitive environment of the market and promote competition, as well as regulate and oversee the transmission sector to secure the public interest.

An independent regulator must be free of stakeholders in the market, of government departments responsible for planning and/or industrial development, and of politics. European and US regulators are equipped with the great expertise they need to perform their services, such as supervising the transmission business and retail market, having made great contributions to secure the independence of the transmission service and promote competition in the wholesale and retail markets.

In Germany, for instance, where eight major power companies, regional monopolies, had a market share of about 80% between them under the integrated generation-transmission system, the retail market was all liberalized at one time in 1998, with more than 100 new operators entering the market. The generation and transmission sectors were also legally unbundled. However, in contrast to the major power companies, which underwent a series of mergers and consolidations to get more competitive, most of the new entrants, exposed to high wheeling rates and fierce price competition in the retail market, were forced to withdraw. Later, a review revealed that as of 2004, the majors, which include the transmission businesses, had been consolidated into four companies, with a concentration ratio of 95%, a state of oligopoly, and electricity rates at a level as high as back in the days of the regulated market. In this context, the Federal Network Agency, an independent regulator for postal, railway, and other network services, was given the role to supervise and monitor the transmission service. The Agency supervises transmission networks regarding their neutrality of operation, wheeling rates for the appropriateness of their determined level, and construction plans for transmission networks for renewable and other sources of power for their smoothness of implementation. The fact that some of the operators, previously legally unbundled, have later been unbundled again in ownership demonstrates the established neutrality in the transmission business.

To perform the roles mentioned above, independent regulators are granted a range of authorities. The Federal Network Agency in Germany is authorized to conduct investigations and seize evidence as part of market surveillance. The Agency may impose surcharge on operators for violating the rules, and has the power to get transmission companies' licenses revoked. The Office of Gas and Electricity Markets (Ofgem), the market regulation commission in the United Kingdom, also has investigation of licensing conditions violations and imposition of penalties as part of its duties, exercising great authority over the operators. Such authorities granted to regulators are at the root of the power they can wield to effectively supervise the transmission service, or a monopolistic enterprise.

Japan also set up the Electricity Market Surveillance Commission in September 1, 2015, as an independent regulator (renamed as the Electricity and Gas Market Surveillance Commission (EGC) on April 1, 2016). As an Article-8 body under the National Government Organization Act, an organization treated in a similar manner to advisory councils that report directly to the Minister of Economy, Trade and Industry, the EGC is composed of five part-time commissioners appointed to implement rigorous behavior regulation, among others, to monitor

the fairness of electricity transactions and secure neutrality of the transmission sector. In expectation of the great contribution that the independent regulator should make to reform of the electricity market, REI offers the three recommendations below.

Recommendation 11: Enhanced authority for the Electricity and Gas Market Surveillance Commission

The Electricity and Gas Market Surveillance Commission (EGC) may state opinions to the Minister of Economy, Trade and Industry on wheeling rates to be approved and/or retail electric utilities to be registered, and make proposals to the Minister on the measures they should take regarding electricity service. The EGC may also give electric utilities and/or the Minister recommendations, based on the law. These are the important roles that the EGC should perform when any problem arises that may throw into doubt the fairness of electricity transactions or the neutrality of the transmission section.

However, no opinions stated by the EGC are legally binding on the Minister. Recommendations the EGC may give to the Minister are referred to by the law as merely "necessary," with no other specification given.

To enable the EGC to state opinions and give recommendations with greater effectiveness, the Commission should be given, as seen in its counterparts in other countries, greater authority to, for instance, have its opinions respected in policy-making and get operators' registrations revoked when they refuse to follow recommendations provided by the EGC.

Recommendation 12: Effective supervision of the Organization for Cross-regional Coordination of Transmission Operators

In Japan, rules for grid access, dispatch, and output suppression, among others, are currently administered by the Organization for Cross-regional Coordination of Transmission Operators (OCCTO). As stated before, these rules serve as prerequisites based on which renewables enter the market. As in Europe, these rules should preferably be applied with precedence given to renewables over other conventional power sources. ("Equitable" administration does not always result in "fair" treatment.)

In Japan, OCCTO is also responsible for grid access service and the preparation of inter-regional transmission development plans. To have grid networks operated based on the public interest, regardless of power generation, OCCTO should preferably prepare grid development plans based on facilities development plans presented by the transmission companies, who should be obliged to build what they have planned.

Despite the critical roles OCCTO is expected to perform, as stated here, the Organization is formed as an authorized cooperation composed of electric utilities. The EGC should conduct a careful review of the rules set by OCCTO in order to perform effective supervision, with the relevant policy viewpoints taken into account.

Recommendation 13: Greater independence and neutrality secured for the Electricity and Gas Market Surveillance Commission

A regulator can execute its power in a fair and neutral manner only when it sees its own independence and neutrality secured. Other countries prohibit the members of an energy regulatory commission, in order to maintain its independence, from having any interest, directly or indirectly, in businesses operating in the energy sector, or serving as member of any other advisory council or similar organization.

In Japan, Article-8 commissions organized for other sectors also have set some rules regarding guarantee of status and/or service discipline to secure their independence and neutrality. For instance, the Securities and Exchange Surveillance Commission (SESC) has rules that explicitly state that none of its members shall be dismissed against their will, and rules prohibiting them from leaking any secrets in relation to their duties or engaging in any political activity to secure fairness and neutrality in the judgments they make. Members of the Radio Regulatory Council (RRC), appointed on a part-time basis, have rules set about their dismissal and resignation, as well as confidentiality obligations, obligations to give their undivided attention to duty, restrictions on political acts, and restrictions on jobs they are allowed to take after resignation, among others.

The EGC has rules that explicitly state that the chairperson and other members shall be independent in performing their duties, with no stipulations set, however, regarding the guarantee of status or service discipline they need for secured independence, or fairness and neutrality, respectively. Especially for securing the independence and neutrality of the EGC, some rules must be established for its members in terms of guarantee of status and service discipline. The Secretariat of the EGC actively employs external experts, such as attorneys and certified public accountants, a practice that should be rated highly. In future, with the greater expertise they are acquiring, the Secretariat should be explicitly prohibited from accepting people seconded from METI or the power companies.

Recommendations for Reform of the Electricity System
For Establishing an Electricity System with a significant share of Renewable Energy

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