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RENEWABLE ENERGY INSTITUTE

Recommendations for Power System Restructuring

Toward Further Deployment of Renewables

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Renewable Energy Institute

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About Renewable Energy Institute

Renewable Energy Institute is a non-profit think tank which aims to build a sustainable, rich society based on renewable energy. It was established in August 2011, in the aftermath of the Fukushima Daiichi Nuclear Power Plant accident, by its founder Mr. Son Masayoshi, Chairman & CEO of SoftBank Corp., with his own resources.

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*The websites cited in these Recommendations were last viewed on April 30, 2020, unless otherwise noted.

Introduction Nine years of electricity system reform

The main impetus for the full-fledged reform of Japan's electricity system was the nuclear disaster at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi Nuclear Power Plant in March 2011. With the severe accident and the subsequent scheduled power outages, the situation changed dramatically. In response, the Electricity System Reform Expert Subcommittee was established under the Agency for Natural Resources and Energy (ANRE), Ministry of Economy, Trade and Industry (METI) in February 2012, and reforms to the electricity system commenced. In its report (2013 Report) a year later, the committee announced a policy to realize "security of supply and reduction in supply costs" and "responding to global environmental issues" by "forming a new electricity system based on competition in the market" and introducing "diversified supply capacity including renewable energy"[1].

Before that, "in spite of the successive system reforms" based on the concept of power system restructuring, "de facto monopoly" persisted and "competition is insufficient"[2]. Due to the severe nuclear disaster, however, "the confidence in nuclear power […] was significantly undermined". Moreover, it was revealed that "the supply-demand adjustment fulfilled by the pricing mechanism […] doesn't work in a flexible manner", as was evidenced by the scheduled blackouts, and that "the wider utilization of the supply capacity […] had such limitations". After reflecting critically on these and other revelations, the decision was made to "implement a comprehensive reform" to the existing electricity system, which was characterized by "regional monopolies, through a vertical integrated system" and "ensuring a large-scale power sources", among others[3].

The 2013 Report clearly stated that to realize these principles of reform, the main pillars of the measures to be taken would be "full liberalization of entry to electricity retail business", "utilization of the market function", "Expansion/neutralization of transmission and distribution sectors", "measures to secure supply for the stable supply of electricity" and "shift to new regulatory authority", among others. Deregulation of the retail sector down to the household level is needed to provide consumers with the right to select their preferred power sources while simultaneously making consumer behavior a vehicle for balancing supply-and-demand. In addition, deregulation means that stable power supply is achieved through market mechanisms, so appropriate market systems are needed. Moreover, a major precondition for introducing competition into monopolized markets is unbundling the transmission/distribution sector to make power grid networks structurally neutral, as has already been done in progressive countries.

Nine years have passed since the nuclear disaster at TEPCO's Fukushima Daiichi Nuclear Power Plant, and since the 2013 Report, reforms have seemingly made steady progress; the Organization for Cross-regional Coordination of Transmission Operators (OCCTO) and the Electricity and Gas Market Surveillance Commission (EGC; it was only for electricity initially) were established in 2015, and full opening of the retail market was implemented in 2016. In April 2020, transmission and distribution were legally unbundled[4]. We, Renewable Energy Institute, basically agrees with the principles of the above reforms, but whether the individual measures taken thus far fully embody these principles, and whether in particular they are contributing to the deployment of renewables, whose conversion to a "main power source" is an urgent priority, needs to be more fully verified. This is the purpose of these Recommendations.

We will investigate the measures in the following order by assessing the current situation, making comparisons with Europe, North America and other regions, and making recommendations on this basis.

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[1] Electricity System Reform Expert Subcommittee, "Report of the Electricity System Reform Expert Subcommittee" (February 2013).
(https://www.meti.go.jp/english/policy/energy_environment/electricity_system_reform/pdf/201302Report_of_Expert_Subcommittee.pdf)

[2] Ibid., "Report," p.5.

[3] Ibid., "Report," pp. 5-7.

[4] TEPCO established TEPCO Power Grid in April 2016 before legal unbundling went into effect.

Chapter 1 investigates measures related to unbundling. Legal unbundling was just recently conducted in 2020, but here we will make recommendations on how unbundling should be structured in light of the original goal of establishing the neutrality of transmission and distribution networks, while touching on conduct regulations for legally separated transmission and distribution subsidiaries. We also make recommendations on strengthening the authority of the EGC, which is indispensable not only to the unbundling but also to the measures discussed in Chapter 2 and below.

Chapter 2 investigates the retail electricity market after deregulation. Many new power suppliers joined the market following the full opening of the market, but the former major power companies (the former General Electricity Utilities) have also strengthened their sales operations, so it is difficult to say that the benefit to consumers has increased. We next provide recommendations on ensuring the right of consumers to select their preferred power sources, which includes a discussion of the non-fossil fuel value market.

Chapter 3 looks into the current market system and evaluates the situation of competition in the generation sector. Transactions on the day-ahead market are increasing, but the former major power companies still have a large share of the generation sector. Recommendations are given on increasingly complex market systems, which include the "Baseload" market, futures market, capacity market and others.

Chapter 4 investigates grid operations by transmission and distribution operators. After the neutrality of transmission and distribution operators is secured, inefficient operations and operating rules preferential to existing long-term fixed power sources need to be reformed. We first look at the Japanese version of "Connect and Manage" and the master plan for grid development and then touch on the necessity of enhancing transmission networks and consider balancing mechanisms for promoting deployment of renewables.

In the final stages of writing these Recommendations, the novel coronavirus was becoming an increasingly serious global pandemic. With economic activity almost coming to a standstill, carbon dioxide emissions declined precipitously in a number of regions, and, as a byproduct of this, air quality improved considerably. While economic activity is expected to return to normal at some point, plans should certainly be made for reemerging with a more sustainable socioeconomic system, such as through the preferential deployment of renewables. We intend for these Recommendations to help promote impartial reforms to Japan's electricity system and facilitate the country's energy transition.

Chapter 1 Completing the unbundling and strengthening the authority of the independent regulatory body

This chapter looks into the unbundling, a key pillar of power system restructuring. Opening transmission networks to new market entrants is an essential condition of fair competition post-deregulation. Japan chose legal unbundling about 20 years behind the US and Europe, the adequacy of the structural regulations involved is examined. The role of the independent regulatory body needs to be considered, which has an impact on power system restructuring as a whole, and make recommendations on strengthening the authority of the current EGC.

Part 1 Types of generation–transmission separation and assessment of legal unbundling

1. Three types of unbundling

The most important pillar of electricity system reform is unbundling. Opening transmission networks where legal monopolies are maintained even after deregulation is essential to "the supply-demand adjustment fulfilled by the pricing mechanism" and to promoting "further utilization of distributed generation" such as renewable energy[5]. Though it is not impossible to independently operate a transmission grid and treat all users fairly without taking the structural measure of unbundling, in terms of practical business, it is difficult for companies to take actions that would leave them at a major disadvantage over the short term[6]. This is why unbundling is necessary – that is to say, why the competitive and monopolistic sectors of power utilities in the vertically integrated system must be separated[7].

Looking at examples from around the world, there are three types of unbundling (Figure 1-1). The easiest to understand is ownership unbundling. Ownership of transmission and other sectors is severed, and they become completely separate companies. The result is an independent transmission company that is neutral with regard to management of its transmission business. All power plants are equal users of the transmission network regardless of their owner or energy type. However, this involves splitting up existing, vertically integrated power utilities, a move the utilities strongly resist. Even so, many countries have taken the rational step of splitting up ownership as they have modernized their electricity systems.

The second type is legal unbundling. The transmission division in a vertically integrated power utility is made subsidiary as a separate entity from a legal standpoint. However, it can be readily assumed that pressure is sometimes put on transmission companies through their parent companies (holding companies) and that preference is inevitably given to "in-house" entities. For this reason, the nature of the separation is not entirely adequate, but there is less resistance from the power utilities compared to splitting up ownership, so the approach has been adopted by a number of countries as a first step in power system restructuring.

The third type is functional unbundling, generally seen in North America. This differs from legal or ownership unbundling which sticks to the physical attribution of generation and transmission facilities. Transmission facilities may belong to vertically integrated utilities, but the role of load dispatch instructions and other grid operations is assigned to an independent system operator (ISO). The ISO is similar to an NPO that is neutral with respect to the power utilities. Ownership and operation are functionally separated, which is understood as ensuring the openness of transmission networks.

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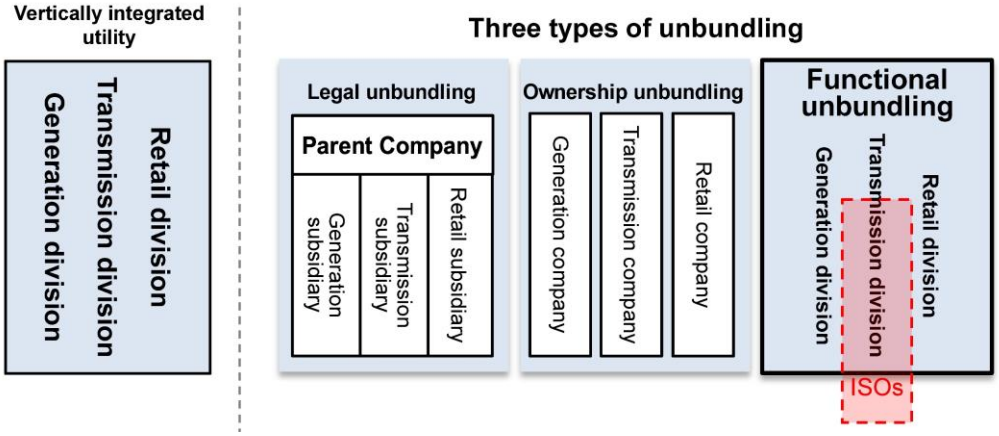
[5] Supra note 1, "Report," p.6.

[6] For example, it has long been pointed out that responses, in the positive or negative, to requests for grid connections by new market entrants have taken an unnecessarily long time and enormous sums have been demanded for the cost of connecting.

[7] In Europe, transmission companies, which have historically been the monopolistic division, were separate from distribution companies, so when unbundling, in many cases, only the transmission company was subject to separation of ownership, while the distribution company was separated on a legal basis. However, in Japan, transmission and distribution are combined, so they have been legally unbundled as transmission/distribution companies.

Figure 1-1 Three types of unbundling



Note: There are two types of legal unbundling, the holding company style and the affiliated company style (discussed later Figure 1-2). In both the ownership and legal approaches, there are cases in which only the transmission company is unbundled; the generation and retail division remain a part of the main entity.

Source: REI

2. Historical background of unbundling in Japan

As a part of power system restructuring that began in the 1990s, Japan attempted to open its transmission networks through behavioral regulations alone. With European countries generally splitting up ownership and North American countries separating functions, Japan decided to pass on all three approaches. An integrated generation and transmission system was cited as essential to stable power supply, but there can be no denying that an insistence on maintaining regional monopolies, the foundation of power utility management, was the number-one reason Japan did not carry out unbundling.

Following the Great East Japan Earthquake and the nuclear disaster at TEPCO's Fukushima Daiichi Nuclear Power Plant, however, even Japan began debating full-fledged power system restructuring, and discussions by the aforementioned Expert Subcommittee got underway on unbundling. As a result, the conclusions reached previously were overturned and recommendations were made that "it becomes necessary […] to take institutional measures for further neutralization (non-discrimination) in the transmission and distribution sector"[8]. Specifically, though ownership unbundling would be ideal, in light of Japan's power utilities' many years of private management in the post-war era, the decision was made to execute legal unbundling by 2020.

Thereafter, ahead of the other utilities, TEPCO carried out legal unbundling in 2016, and TEPCO Power Grid (TEPCO PG) was established. In May 2019, TEPCO PG announced a trial "connect and manage" initiative in Chiba Prefecture (discussed later), and independent projects are being carried out to a greater extent than by transmission and distribution operators in other regions. This represents major change compared to the period prior to 2011 when the vertically integrated system was the unquestioned status quo.

As to the question, however, of whether transmission networks have been opened up nationwide and are being utilized effectively, the answer continues to be no, they have not, not adequately enough. The problems have to do with available transmission capacities and the "first-come, first-served" rule, both of which are discussed in Chapter 4, but this is also proof that unbundling is absolutely essential as a structural reform. Parts 3 and 4 will look again at whether legal unbundling is an adequate option in light of the essential policy objective of fair and open transmission networks, and the next part will take up behavioral regulations seen as optimal when the legal approach is employed.

[8] Supra note 1, "Report," p.37.

3. Assessment of legal unbundling and the superiority of the ownership unbundling

First of all, with regard to the relationship between the legal and ownership approaches, legal unbundling is not an adequate network-opening measure from the standpoint of competition policy. The evidence is that most European countries that had public power utilities opted to unbundle ownership via government decree (public ownership rights exercised), with the exception of France and a few others. In Germany, which had private utilities like Japan, legal unbundling was conducted initially, but this was not enough to fully open its transmission networks, so in 2005, Bundesnetzagentur (BnetzA), the independent regulatory body, extended its oversight to transmission business, which brought about more rigorous behavioral regulations.

As a result, the major power utilities at the time, E.ON and Vattenfall included, were unable to continue their anticompetitive behavior and opted to split up ownership (sell off their transmission subsidiaries). As of April 2020, including Transnet-BW, which remains legally unbundled, transmission networks in Germany have been fully opened, and anticompetitive behaviors have reportedly been eliminated. Even in the case of private management, ownership unbundling is an option.

In Japan, even the 2013 Report cites "although ownership unbundling could be the plainest form of means for realizing neutrality, this will be an issue for future consideration if the effect of the reform proves insufficient."[9] If the results of legal unbundling are determined to be inadequate despite rigorous enforcement of its measures beginning from 2020, the ownership approach should be promptly adopted. Urging transmission companies (former major power companies) to open transmission networks based on this premise would no doubt contribute to the effectiveness of legal unbundling.

One other reference point in the German example is its integration of transmission companies. To achieve cross-regional operation, in essence, the scale needs to be enlarged by integrating transmission companies. In Germany before deregulation, there were eight power utilities in the vertically integrated system, but post-deregulation they were merged and acquired so that by the early 2000s, they had been integrated into four companies (which later had their transmission sectors split off to establish the independence of the transmission business). As a result, cross-regional operations, both within the country and across borders, made headway and even gave rise to international transmission companies such as TenneT that connects the Netherlands and Germany[10].

Japan as of April 2020 has nine transmission and distribution subsidiaries, excluding Okinawa. They vary in size and technical specifications. For cross-regional operation to be achieved, expanding the scope of transmission companies is an effective means, alongside the balancing activities of OCCTO, and this easily leads to ownership unbundling as well. This would not only further optimize transmission business overall in Japan, open transmission networks and create cross-regional networks, but is also likely to contribute as well to the healthy development of the transmission business and increased corporate value.

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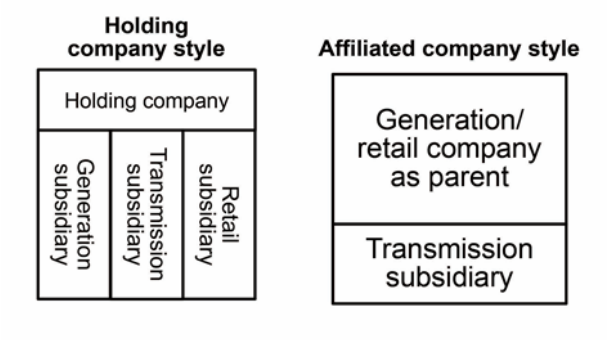
[9] Supra note 1 "Report," p.40.

[10] TenneT spans both countries geographically, but grid operations are split between companies.

4. Two types of legal unbundling in Japan

In all cases, it is important for the short term that legal unbundling be rigorous. There are two approaches used to legally separate transmission from other sectors (Figure 1-2). The first is the holding company style. A new holding company is established and the transmission (distribution), generation, and retail subsidiaries are placed beneath it. Although the holding company can influence the transmission subsidiary, formally it is on equal footing with the generation subsidiary and retail subsidiary, and the influence of its sister companies is limited.

Figure 1-2 Two types of legal unbundling



Source: REI

In the second approach, the affiliated company style, the transmission subsidiary is placed under an operating company, either the generation or retail company. The relationship between the two companies in this case is not symmetrical; the transmission subsidiary is influenced by entities with a direct interest in it, by the generation or retail business. Accordingly, from the standpoint of transmission business neutrality, the affiliated company style is less adequate than the holding company style. In this case, there is the added problem of it becoming difficult to legally separate generation and retail operations. The relationship in France between the major power utility EDF and its transmission subsidiary RTE corresponds to the affiliated company style.

TEPCO, which conducted legal unbundling in 2016, employed the holding company style. Among the former major power companies, Chubu Electric Power opted for the holding company style, but the other seven utilities used the affiliated company style. Under the revised Electricity Business Act, both formats are allowed, but in light of the fact that transmission networks have not been opened adequately, the holding company style should be made the general rule.

■Recommendation 1-1:
Execute legal unbundling with the holding company style, in principle

When legal unbundling is used, the holding company style should be the general rule, not the affiliated company style.

■Recommendation 1-2:
Seek for ownership unbundling and merge transmission/distribution companies

The extent to which transmission networks have been opened should be strictly monitored and regulations on conduct rigorously enforced, and if networks are not opened adequately, ownership unbundling should be promptly adopted. At the same time, transmission companies (subsidiaries) should be integrated over time from the standpoint of expanding inter-regional operations.

Part 2 Conduct regulations under legal unbundling

Even if separate companies are established and operation of multiple electricity businesses is prohibited by legal separation, as long as there is still a capital relationship with the parent company, this alone cannot guarantee the independence of the transmission business. Behavioral regulations that restrict personnel relationships and transactions between the two companies are extremely important for substantively ensuring the independence and neutrality of the transmission division. In Europe, which has been ahead of other regions in unbundling, splitting off ownership of the transmission division is the general rule, but legal unbundling is also tolerated under strict regulations[11]. The following considers behavioral regulations with respect to three points, personnel, preventing unfair transactions, and the compliance framework, while referring to the examples of France and Germany where legal unbundling has been adopted.

1. Regulations related to personnel

If executives and employees are allowed to freely serve at both the legally separated transmission company and generation or retail company, unbundling becomes a mere formality. For this reason, in Europe, and in Japan, concurrent positions are prohibited, but the two differ in the specifics.

First, Europe and Japan differ on the scope of personnel subject to regulations. In Europe, concurrent positions are prohibited for everyone involved in management at the transmission company, including directors and executive officers, and for all employees. In addition, people involved in management are restricted from participating in the companies of other divisions and in companies with extensive contractual relationships for a set period of time both before and after their appointments. Appointments are approved only after an independent regulatory body confirms they do not violate the regulations. Additionally, transmission companies have to be able to guarantee that they have procured the resources they need themselves, and this includes legal, accounting and IT personnel. They are prohibited from using employees of the generation or retail companies.

By contrast, in Japan, concurrent positions are restricted primarily for people involved in management, but "other employees" are not prohibited from working at both companies, so this is hardly adequate as a behavioral regulation (Table 1-1). For example, these "other employees" of the transmission company can participate in companies of other sectors and companies with extensive contractual relationships. Similarly, employees at in-group generation and retail companies other than directors and managers with "key roles" (Ministerial Ordinance for the Enforcement of the Electricity Business Act (Rules), Article 33.6) are able to work in the general transmission and distribution business. There is also an exception allowing concurrent positions for directors and managers otherwise subject to regulations "if there is no danger of hindering appropriate competitive relationships" (Rules, Article 33.4).

Table 1-1 Overview of prohibition on concurrent positions under revised Electricity Business Act

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="3">Specified related business companies (in-group generation/retail electricity companies, etc.*1)</th></tr>
<tr><th>Directors, etc.*3</th><th>Employees (3) playing an important role</th><th>Other employees</th></tr>
<tr><td rowspan="3">General electricity transmission and distribution company</td><td>Directors, etc.*2</td><td rowspan="3">Generally prohibited (Exception (1))</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Employees engaged in specified electricity transmission and distribution services (2)</td><td>Generally prohibited (Exception(4))</td><td>Not prohibited</td></tr>
<tr><td>Other employees</td><td>Not prohibited</td><td>Not prohibited</td></tr>
</table>

*1 In-group generation/retail electricity companies, etc. are generation companies and retail electricity companies within the same corporate group and entities that effectively control their management

*2 Directors, etc. at general electricity transmission and distribution companies: Directors and executive officers (refers to executive officers at a Company with Committees under the Companies Act, not operating officers)

*3 Directors, etc. at in-group generation/retail electricity companies, etc.: Directors, executive officers and other officers that execute business (Operating Officers at a partnership, etc.;not operating officers at a company.)

Source: EGC, "Proposal on revisions to Ministry of Economy, Trade and Industry Ordinance based on 'Details of conduct regulations introduced with legal unbundling of general electricity transmission and distribution utilities and transmission utilities'" (June 18, 2018). (https://www.emsc.meti.go.jp/info/public/pdf/20180618006b.pdf)

[11] Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC (Text with EEA relevance).

The second difference pertains to regulations on personnel transfers (personnel exchange) (Table 1-2). In Europe, there are certain regulations on the careers of people in certain executive positions both before and after appointments, whereas in Japan there are no such legal regulations.

Without this regulation, the same people can shuttle back and forth between the transmission company and the generation or retail company, so that the notion of a separate transmission company becomes meaningless. Transmission companies and generation/retail companies have to formulate and abide by a code of conduct on personnel exchange, consider the matter on their own initiative and take appropriate steps ("Guidelines on appropriate electricity transactions," Part 2 IV (2)-1③ and (2)-3③), but whether this is sufficiently effective and whether it is being monitored appropriately needs to be verified going forward[12].

As discussed above, there are two types of legal unbundling, the holding company style and the affiliated company style, and separation is most thoroughgoing with the former approach. Under the current regulatory system, the same regulations are applied in both cases, but different regulations could be applied depending on whether the generation or retail company is a sister company with no direct controlling relationship or it is the parent company with direct control. This pertains to points discussed further as well.

Table 1-2 Examples of legal conduct regulations related to personnel

	France	Germany	Japan
Limits on qualifications from post prior to appointment (Period considered in parentheses)	Some directors, etc. All executive officers (majority 3 years, minority 6 months)	All management members (majority 3 years, minority 6 months)	None (Voluntary initiative)
Concurrent positions prohibited	Some directors, etc. All executive officers All employees	All managers All employees	Directors, etc. and some employees (with exception)
Restrictions on employment for 4 years after appointment ends	Some directors, etc. All executive officers	All managers	None (Voluntary initiative)
Participation of regulatory body on appointment/dismissal of directors, etc.	Must report to the regulatory body (Effective if no objection from regulatory body)		For violations of prohibition on concurrent positions, corrective measures ordered by Minister of Economy, Trade and Industry
Regulations on remuneration for directors, etc.	Decision on criteria not affected by business or financial results of vertically integrated companies		None
Personnel independence	Legal affairs, accounting, and IT personnel, and accounting auditors must be independent (prohibition on shared personnel)		None

Source: REI based on the laws and regulations of the respective countries (as of March 2020)

[12] As to the specific content of the code of conduct, the EGC discussed the inclusion of disclosure of information on personnel exchange and the scope of personnel regulations. Refer to EGC, "Regulations on personnel exchange after legal unbundling (regulation on dual affiliation)," Document 9 of the 33rd EGC Meeting for System Design (September 20, 2017). (https://www.emsc.meti.go.jp/activity/emsc_system/pdf/033_09_00.pdf)

2. Regulations related to preventing unfair transactions

Preventing unfair transactions is an important pillar of measures to ensure the neutrality of the transmission sector and includes various actions such as information management (Table 1-3). In Europe, the information systems of the transmission company and its parent or sister companies must be strictly separated in order to ensure appropriate information management. Further, the transmission company is obligated to submit contractual information related to transactions with the parent or sister companies to the independent regulatory body. Even with regard to company names and trademarks, the transmission company uses a completely different name than the parent company or sister companies with which it has capital relationships (the former power utility) in order to completely eradicate the potential for confusion among consumers. For example, RTE is the transmission company of France's EDF; it was formerly called RTE EDF Transport SA, but the European Commission cited it for violating the EU directive, so the name was changed to RTE[13].

Japan's general transmission/distribution companies must appropriately manage information related to business operations under the revised law, but the regulations are lax compared to examples like France. Information systems may be shared if access for purposes other than those stated is prevented and access is restricted for each category of non-disclosed information. In addition, while there may be regulations on transactions between general transmission/distribution companies and generation and retail companies within the same group, the decision on whether to seek the approval of the Minister of METI is left up to the company. In France and Germany, approval from the independent regulatory body is needed for all transactions, so compared to this the role of Japan's regulatory body is minimal, a general characteristic of Japan seen in this and other cases (see Part 3 of this chapter). Regarding company names as well, unlike Europe, the general transmission/distribution company is allowed to use part of the name of the major power company. This inevitably causes confusion for consumers[14]. Even media outlets have sometimes reported on supply-and-demand balancing and solar photovoltaic (PV) output curtailment since April 2020 using only the name of the major power company, writing, for example, that it was implemented by such-and-such Electric Power Company. Any determination on whether the name can potentially lead people to mistakenly believe they are the same company needs to consider how that name is actually being used.

Table 1-3 Examples of legal conduct regulations related to information management and transactions

	France	Germany	Japan
Prohibition on discriminatory handling	Formulate code of conduct (approval by regulatory body)		Formulate rules (Report to METI)
Handling of commercial and financial transactions with vertically integrated companies	Report to regulatory body and obtain approval		After recording, report summary to METI. For transactions with different than normal conditions, obtain approval of METI.
Shared information systems	Prohibited	Prohibited (with very partial exception)	Tolerated with access restrictions based on purpose and information
Use of company name	Prohibited if could be confused with vertically integrated company		Trade names prohibited if could be misunderstood as the same company

Source: REI based on the laws and regulations of the respective countries (as of March 2020)

[13] Commission de régulation de l'énergie, "Délibération de la Commission de régulation de l'énergie du 26 janvier 2012 portant décision de certification de la société RTE" (2012), p.59. (https://www.cre.fr/Documents/Deliberations/Decision/decisions-de-certification) (in French)

[14] Statement of Committee Member Tatsumi at the 17th EGC Meeting for System Design (April 25, 2017), Minutes pp.24-25. (https://www.emsc.meti.go.jp/activity/emsc_system/pdf/017_gijiroku.pdf)

3. Regulations related to compliance systems

In France and Germany, transmission companies are obligated to establish an independent internal body for legal compliance and its monitoring (Table 1-4). The person in charge, the compliance officer, can participates in all meetings, has the authority to make proposals related to improving and implementing the code of conduct, and is obligated to report to the company. Appointment and dismissal require the approval of the country's independent regulatory body, and just like directors and other officers, the compliance officer is subject to restrictions on positions before and after appointment and is prohibited from holding concurrent positions.

Even in Japan, general transmission/distribution companies are obligated to establish a system for appropriate monitoring of business execution. For example, general transmission/distribution companies must establish a monitoring division and appoint a compliance supervisor independent of the generation and retail companies. The monitoring division monitors overall business operations, reports to the board of directors, and the compliance supervisor establishes a compliance system and monitors business operations from that standpoint. However, their authority is limited compared to the compliance officer in Europe; as an example, there are no provisions in the Act regarding proposing improvement or conducting internal investigations by them. The independence of the monitoring body and compliance supervisor has not been adequately ensured; decisions on appointment, dismissal and remuneration are left to the discretion of the company, and the independent regulatory body is not involved.

One example of a problem with compliance at a power utility occurred in September 2019 and primarily involved the management of Kansai Electric Company (KEPCO). It came to light that they had received more than 360 million yen offered by the former deputy mayor of a municipality where a nuclear power plant is located for a long period of time. Rigorous compliance should have been conducted on the basis of internal rules, but this case reveals both the difficulty and limits of a company's voluntary actions[15]. Behavioral regulations should be clarified to the extent possible at the legal level while referring to examples from Europe.

Table 1-4 Examples of legal conduct regulations related to compliance systems

	France and Germany	Japan
Supervisor	Compliance officer (title differs with the country)	Compliance supervisor, monitoring division
Supervisor appointment and dismissal, etc.	· Qualification limits, restrictions on concurrent positions and post-appointment employment · Needs approval by regulatory body	· Regulation prohibiting concurrent positions just like directors, etc.[Note] (Compliance supervisor) · Independent of generation/retail divisions (monitoring division)
Supervisor duties	· Monitor implementation of code of conduct · Formulate measures for implementation of code of conduct · Recommendation to internal bodies regarding measures · Create annual report and submit to regulatory body · Must report violations to the regulatory body	· Monitor compliance system (Compliance supervisor, monitoring division) · Create compliance system (compliance supervisor) · Report to board of directors, etc. (monitoring division) *Annual reporting of monitoring results, etc. to METI (as company) *No rules mandating notification of regulatory body
Supervisor's information access, etc.	Authority to attend all meetings, access information and enter areas	No special stipulations

Note: It was explained at the stage of system design that the compliance supervisor is an employee of the general transmission/distribution company, but as an "employee playing an important role" the company planned to apply the same code of conduct (limits on concurrent positions, etc.) as directors and other officers (refer to METI, Advisory Committee for Natural Resources and Energy, Strategic Policy Committee, Electricity System Reform Subcommittee, System Design Working Group, 11th session, "Document for submission to secretariat's office: Considerations on legal unbundling" (December 24, 2014), Document 8-5, p.18) . (https://www.meti.go.jp/shingikai/enecho/kihon_seisaku/denryoku_system/seido_sekkei/pdf/011_08_05.pdf). On this point, under the revised law, the duties of the compliance supervisor could also correspond to specified transmission and distribution operations for which ensuring the neutrality of operations is particularly necessary (Article 22.3.2), but the law is not clear on this point.

Source: REI based on the laws and regulations of the respective countries (as of March 2020)

[15] On March 29, 2020, METI issued a business improvement order to KEPCO that included formulating and implementing measures for fundamentally strengthening its compliance system and fostering a sound organizational culture that puts due emphasis on compliance with laws and regulations. For details, refer to: https://www.meti.go.jp/press/2019/03/20200316002/20200316002.html

■Recommendation 1-3:
Codify strict monitoring and conduct regulations for transmission/distribution companies

Regarding conduct regulations on transmission/distribution companies, transparency should be established through rigorous disclosure and strict surveillance conducted by the EGC. In addition, needed regulations should be codified centering on issues that currently only require voluntary action even though problems have been indicated, such as those related to personnel and compliance systems.

Part 3 Role of independent regulatory body and its enhancement of authority

As discussed in Part 1 of this chapter, one reason that in Germany the utilities themselves opted to split up ownership was behavioral regulations and surveillance by BnetzA, the independent regulatory body. The EGC was established in Japan in 2015 and should be lauded for playing an important role in monitoring the market. At the same time, there have been various problems with grid operations (see Chapter 4), and supervision of the transmission/distribution sector can hardly be called sufficient. The following considers the present and future of Japan's EGC while taking a brief look at examples of independent regulatory bodies in Europe.

1. Authority and regulations of Europe's independent regulatory bodies

Europe's independent regulatory bodies have strong authority. They are able to directly issue binding decisions with respect to electricity businesses and have the authority to gather evidence necessary for market surveillance and to levy fines (monetary sanctions up to 10% of the entity's annual turnover). In addition, the bodies are significantly involved in the utilization and enhancement of transmission networks and are responsible for approving transmission network enhancement plans, monitoring their implementation, and setting transmission rates or deciding standards for them. Regulations have also been established on their personnel in order to ensure the bodies' independence and neutrality.[16]

For example, in France, which has adopted legal unbundling, the Commission de régulation de l'énergie (CRE) conducts approval and surveillance of transmission network plans and regulates transmission rates; it also has the authority to gather evidence for market surveillance. Regarding personnel at the two independent bodies within the CRE (Collège, a council-like body, and CoRDiS, which handles dispute resolution between utilities and sanctions), there are rules at the legal level on member work histories, appointment and dismissal, length of appointment (6 years) and concurrent positions. In Germany, which has also opted for legal unbundling, BnetzA has nearly the same authority[17].

UK (except Scotland) has taken the ownership unbundling approach. The Gas and Electricity Markets Authority (GEMA), the independent regulatory body, and its executive organ, the Office of Gas and Electricity Markets (Ofgem), regulate electricity utilities through the issue of business licenses. These bodies have the authority to conduct investigations on violations of licensing requirements and other legal regulations, and they can also impose fines and other penalties. Ofgem is also responsible for regulating transmission and distribution rates. Regulations on personnel are clearly stated in the law. GEMA members are prohibited from engaging in business that would inhibit the impartiality of their public duties and from having any financial conflicts of interest.

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[16] Regarding the above, refer to supra note 11, "Directive 2009/72/EC," Chapter IX.

[17] The European Commission found in July 2018 that most decision-making criteria for transmission rates had been left up to the Federal Ministry for Economic Affairs and Energy, and that doubts were raised about its neutrality of BnetzA. European Commission, "Infringement - Internal energy market: Commission refers Germany and Hungary to the Court of Justice of the EU for failure to fully comply with the Third Energy Package" (July 2018).
(https://ec.europa.eu/commission/presscorner/detail/en/IP_18_4487)

2. Status of Japan's Electricity and Gas Market Surveillance Commission

The EGC in Japan, by contrast, has limited authority within the overall system, and personnel regulations are also different. First of all, with regard to authority, the EGC is authorized to collect reports and conduct onsite inspections necessary for surveillance, and when necessary to ensure fair electricity transactions, under certain conditions, it can make recommendations to electricity utilities and recommendations or proposals to the METI Minister. However, utilities and other entities are not legally obligated to comply with the recommendations, and the EGC does not have the authority to directly impose penalties. Likewise, the METI Minister is not obligated to respect the EGC's recommendations[18].

Additionally, OCCTO formulates the Inter-regional network development plans, but the EGC can only make recommendations on the supply plans created by electricity utilities that constitute development plan assumptions; it is not in the position to approve the Inter-regional network development plan itself[19]. In light of the fact that all electricity utilities participate in OCCTO, and that generators and retailers are also members, it goes without saying that monitoring the neutrality of OCCTO's operations is very important.

Next, with regard to personnel, while the exercise of independent authority by the EGC's Chairperson and other members is guaranteed, there are no provisions in the Electricity Business Act on status guarantees or a code of conduct. On this point, the EGC differs from other Japanese entities like the Securities and Exchange Surveillance Commission, Public Interest Commission and Radio Regulatory Council (so-called Article 8 commissions), which are equivalent in nature under the National Government Organization Act. The members of these commissions and councils are regulated by the founding laws of their respective organizations with provisions such as restricting dismissals, prohibiting concurrent positions in related businesses and limiting employment after retiring, although depending on the laws. Compared with these, the neutrality and independence of EGC members cannot be said to be systematically assured to the full extent possible.

Moreover, the positions of all EGC members are part-time positions. This came about because when the commission was established it was considered necessary to appoint members from a broad scope and include people who were only able to accept part-time positions in order to appoint those with the most up-to-date expertise within the constantly changing electricity market[20]. The need to appoint the best people is certainly not objectionable, but considering the scope and volume of duties of the EGC, making its members full-time should be considered. The Securities and Exchange Surveillance Commission and Public Interest Commission, whose role also is surveillance, appoint full-time members to carry out their business.

The duties of EGC require wide-ranging expertise, from economic analysis to legal affairs and engineering. The dedicated staff supporting the operations of the EGC also needs to be expanded in order to increase the independence of those operations.

Regarding the problem of KEPCO doling out gifts discussed in Part 2 of this chapter, the METI Minister issued a business improvement order in March 2020, when the ministry initially neglected to hear the opinion of the EGC in advance, which was necessary for it to do. Even worse, after the EGC's pointing out the error, approval documents had been improperly altered to cover up this procedural oversight[21]. This is a problem of compliance within the METI or the government as a whole, and, at the same time, can be said to be symbolic of the EGC's low level of independence as well as the procedural disdain for it within the ministry. From this perspective as well, the independence of the EGC urgently needs to be strengthened.

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[18] See the example of respecting the opinion of the Procurement Price Calculation Committee in the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities (Article 3.7).

[19] In the Bill for the Act of Partial Revision of the Electricity Business Act and Other Acts for Establishing Resilient and Sustainable Electricity Supply Systems, decided by the Cabinet in February 2020, a degree of authority is stipulated for METI with respect to the Inter-regional network development plans, and this has been added to the list of items for which opinions are heard from the EGC. The codification of the EGC's participation in inter-regional network development planning does represent a degree of progress. Refer to https://www.meti.go.jp/press/2019/02/20200225001/20200225001-2.pdf for details on the bill.

[20] METI, Advisory Committee for Natural Resources and Energy, Strategic Policy Committee, Electricity System Reform Subcommittee, System Design Working Group, 12th session, "Document for submission to secretariat's office: New administrative organization" (January 22, 2015), Document 6-6, p.11.
(https://www.meti.go.jp/shingikai/enecho/kihon_seisaku/denryoku_system/seido_sekkei/pdf/012_06_06.pdf)

[21] METI News Release, "Response to Inappropriate Procedures related to Business Improvement Order to Kansai Electric Power" (March 31, 2020). (https://www.meti.go.jp/press/2019/03/20200331010/20200331010.html)

■Recommendation 1-4:
Strengthen the authority and involvement of the EGC

To the extent possible under the National Government Organization Act, the EGC's authority should be strengthened, and this should include giving it the authority to make binding decisions from a standpoint independent of METI, as well as requiring METI to respect the EGC's recommendations. The EGC's involvement in areas related to new connections to transmission networks and network development planning and operations should also be strengthened, as should its oversight of OCCTO.

■Recommendation 1-5:
Strengthen key personnel and enhance the support staff at EGC

Regarding the Chairperson and other members of the EGC, regulations should be stipulated on status guarantees, concurrent positions and post-appointment employment, the positions should be made full-time, and the dedicated support staff should be enhanced to strengthen the organization's independence and specialization.

Chapter 2 Promoting competition in the retail sector and the market to realize decarbonized society

In Japan, deregulation of the wholesale market which allowed independent power producers to sell power to incumbent regional utilities began in 1995. The retail market deregulation was gradually introduced from 2000, however, due to the fact that transmission sector was not yet unbundled and de facto regional monopolies were maintained, competition did not make adequate headway. In 2000, the market opened for the large consumers with electricity contracts of 2,000kW or more (Extra high voltage, according to Japanese power system category), such as large factories and large-scale commercial complexes, and then in 2005 to consumers of 50kW or more (High voltage), such as mid-size factories and local governments. Nevertheless, in the ten years to 2014, there was only one case of "inter-regional supply", in which the incumbent utilities crossed their respective areas, and new market entry in deregulated sectors gained very little ground. As a result, full competition down to Low voltage, which includes the residential sector, was claimed to be unnecessary, and the debate was put off for a good period of time.

In 2011, however, the nuclear disaster at TEPCO's Fukushima Daiichi Nuclear Power Plant heightened demand for allowing consumers to choose their own electricity companies and power sources. In addition, intense price competition for large consumers, a sector that had already been deregulated shut out new market entrants, while the EPCOs' high electricity rates were maintained in the non-deregulated low voltage sector, which includes regular households. The low voltage sector accounted for an overwhelmingly high percentage of EPCOs' profits, which was also raised as an issue.[22]. This is one of the background factors to the power system restructuring touched on in the beginning, and one of the pillars of the three reforms in the Policy on Electricity System Reform[23] is full deregulation of the retail sector, which was implemented beginning in April 2016. Full retail deregulation is intended to promote the participation of small-scale consumers, such as regular households, in the electricity market, which had only been open to large consumers, and to provide diverse choices with respect to electricity companies and plans. In this chapter, the state of full retail sector deregulation now that four years have passed is investigated.

Part 1 For fair competition in the retail sector

1. Competition in the retail market

One metric for gauging the progress of competition in the retail electricity market is the market share of new retailers other than former major power companies or their subsidiaries[24]. Since the full deregulation of the retail sector, new retailers' share of electricity sales has been increasing at the nationwide level. Prior to full deregulation, their market share was just 3% to 3.9%, but in the three years and nine months since, it has risen to around 16%[25]. There are regions like Tokyo and Hokkaido where new providers account for around 20%, but looking at the situation by region and type of electricity contract, it cannot be said that deregulation thus far has been adequate.

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[22] The power utilities on average (from fiscal 2006 to fiscal 2010) sold 62% of their electricity by output volume to large consumers in the liberalized sector and 32% to residential customers in the non-deregulated sector, but their profits were precisely the opposite: 69% of profits came from the non-deregulated sector. TEPCO sold 62% by volume to large consumers and 38% to residential customers, but 91% of its profits came from sales to the non-deregulated residential sector. ANRE, "Revenue and Expenditure by Sector," METI, Advisory Committee for Natural Resources and Energy, Coordinating Subcommittee, 2nd Advisory Committee for Electricity Rate Reviews (May 23, 2012), Document 4-1, pp.4-5.
(https://warp.da.ndl.go.jp/info:ndljp/pid/11223892/www.meti.go.jp/committee/sougouenergy/sougou/denkiryokin/pdf/002_04_01.pdf)

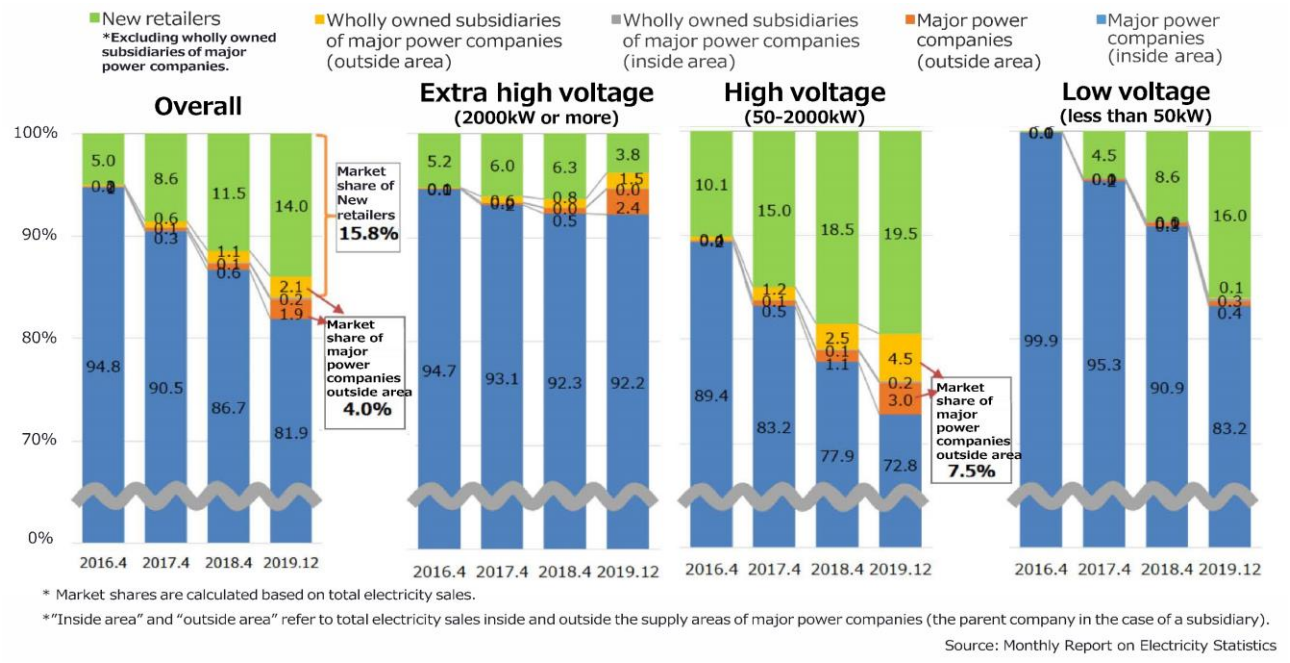
[23] Policy on Electricity System Reform (Cabinet Decision, April 2, 2013).
(https://www.kantei.go.jp/jp/kakugikettei/2013/__icsFiles/afieldfile/2013/06/20/20130402-01.pdf)

[24] In documents from the government's deliberative committee, there are statistics on major power utilities and new retailers, but in most cases, the category of new retailers includes wholly owned subsidiaries of the major utilities, so the actual state of the market is hard to determine. For example, TEPCO Customer Service Co., Ltd., currently the new provider with the largest share of the market overall, is a wholly owned subsidiary of TEPCO Energy Partner, Inc., which has operations in Tohoku, Chubu, Hokuriku and other regions.

[25] ANRE, "Progress on Full Liberalization of the Retail Electricity and Gas Market," METI, Advisory Committee for Natural Resources and Energy, Electricity and Gas Industry Committee, 23rd Meeting of Electricity and Gas Basic Policy Subcommittee (March 27, 2020), Document 3. (https://www.meti.go.jp/shingikai/enecho/denryoku_gas/denryoku_gas/pdf/023_03_00.pdf)

Figure 2-1 graphs changes in the market shares of retailers by sector from the start of full deregulation to December 2019. Looking at new retailers while excluding wholly owned subsidiaries of the major utilities, in the Extra high voltage (more than 2,000kW) sector, their share had climbed to 6.3% as of April 2018, but it has since fallen by over two percentage points to 3.8%. In the High voltage (50-2,000kW) sector, since April 2018, growth in new retailer contracts, when excluding the wholly owned subsidiaries of major utilities, has slowed. In the Low voltage (less than 50kW) sector, their share has nearly doubled since April 2018, and now new retailers have a 16.0% share of the overall market, though it has not risen to 20%. Based on the decrease of new retailers' market share in the extra high voltage sector, where electricity consumption (kWh, kilowatt-hours) is substantial, and the growth slowdown in the high voltage sector, concerns are raised over renewed monopolization by the former major power companies.

Figure 2-1 Retail market share by sector and type of power retailers



Source: ANRE, "Progress on Full Retail Liberalization of the Electricity and Gas Market," METI, Advisory Committee for Natural Resources and Energy, Electricity and Gas Industry Committee, Electricity and Gas Basic Policy Subcommittee, 23nd session (March 27, 2020), Document 3 (https://www.meti.go.jp/shingikai/enecho/denryoku_gas/denryoku_gas/pdf/023_03_00.pdf)

In the Low voltage sector, rate restrictions on former major power companies were left in place as a temporary measure until a certain level of competition could be established. This system (transitional rate regulations) was to be rescinded in fiscal 2020, but a review by the government's deliberative committee found that competition was not yet adequate, and so elimination of the system in fiscal 2020 was postponed[26].

[26] METI news release, "Designated Former Supply Zones Designated for Deemed Retail Electricity Providers" (July 3, 2019). (https://www.meti.go.jp/press/2019/07/20190703002/20190703002.html)

2. Problem of sales activities to retake customers and rate discounts by major power utilities

As retail deregulation has progressed, the sales activities of former major power companies that take back customers trying to switch from them to new retailers have frequently been pointed to as problematic. Sales activities to retake customers are employed when a customer wants to switch to a new retailer. They involve the retail division of the major power company using information received from the general transmission/distribution division that is needed for switching to prevent the switch by presenting the customer with a lower price than the new retailer. To retake their customers, they use information obtained to change the contract for purposes other than changing the contract, which has been pointed out as a possible compliance violation. Another problem is when a former GEU that controls the market proposes to the customer a large rate cut suspected of actually being below cost, which would constitute improper discounting.

In response, the EGC in December 2018 revised its Guidelines for Electricity Retail Sales, adding provisions that prohibit using contract switching information for sales purposes and stipulating the problematic nature of sales activities of this type aimed at keeping customers from switching[27]. In addition, priority monitoring of the retail market began in September 2019 (Table 2-1)[28], and new retailers are being called on to give information on examples of prices offered that are well below wholesale prices, regardless of whether or not they were offered during the switching period. The wholesale price is used as a yardstick because it means selling on the market would have resulted in a greater profit, which indicates that the act of selling at a lower retail rate is not economically rational, rather it is an attempt to drive new entrants from the market.

Priority monitoring of the retail market itself should be acknowledged as a step forward in the formation of fair competition in the retail market[29], but the current reporting-based approach has limitations. This is because most new retailers have a transactional relationship with a major power utility, and it is unclear whether the reports are in fact consistent with actual conditions. The commission needs to promptly consider not limiting the process to reporting but expanding it to direct interviews with consumers and major power utilities on a regular basis, or to institute a system with greater clarity that is not limited to a case-by-case approach. The Japan Fair Trade Commission is also working to gather information, adding to its website a place to submit information related to the electric power sector, for example, but this commission should also strengthen monitoring of actions that are potentially in conflict with antimonopoly law, such as granting inappropriately low prices to certain consumers.

Table 2-1 Entities subject to retail market priority monitoring

Utility category	Criteria for utilities subject to monitoring
Former GEUs and their affiliates	① Former GEU in the area ② Affiliates of former GEU in the area (ownership stake of 20% or more)
Retailer with prominet position in retail market	③ (Notwithstanding the above) retail electricity retailers with 5% or higher share in their area (based on the number of contracts or total electricity sales) for each voltage category (Extra high, high and low)

Source: EGC, “Concerning priority monitoring of the retail market” (September 18, 2019)
(https://www.emsc.meti.go.jp/info/business/monitoring/)

Note: “Former GEUs” means the former General Electricity Utilities, 10 vertically integrated major power companies in Japan.

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[27] METI, “Guidelines Concerning the Management of the Electricity Retail Business” (revised December 27, 2018). (https://www.emsc.meti.go.jp/info/guideline/pdf/20181227.pdf) Details are as follows. “When the current electricity retailer (the consumer’s retailer prior to the switch) obtains the information that the consumer will be switching to a new retailer (the consumer’s retailer after the switch) and takes actions to make the consumer cancel the application after they have already applied during the period between the time the consumer makes the switching application with the new retailer and the time the new retailer commences retail supply (except in cases in which a request has been received from the consumer; hereinafter, “Sales activities to take back the customer”), it has the potential to obstruct the switch and inhibit the sound development of the electricity business, and is therefore problematic.”

[28] EGC, “Concerning priority monitoring of the retail market” (September 18, 2019).
(https://www.emsc.meti.go.jp/info/business/monitoring/)

[29] On the results of monitoring, see EGC Executive Bureau, “Results of retail market priority monitoring and measures to prevent improper in-group support between generation and retail,” 46th EGC Meeting for System Design (March 31, 2020), Document 9. (https://www.emsc.meti.go.jp/activity/emsc_system/pdf/046_09_00.pdf)

A background as to why major power utilities are able to engage in improper discounting is the fact that they monopolize large-scale power sources whose investments have already been recovered. For example, in the case of KEPCO, it recommenced operations at Takahama Nuclear Power Plant Unit 4 in June 2017 and Unit 3 in July 2017, but immediately after, on August 1, 2017, it lowered rates by an average of 4.29% (4.9% in the liberalized sector), giving this restart and greater management efficiency as the grounds. In addition, in conjunction with the restart of Oi Nuclear Power Plant (Unit 3 in March 2018 and Unit 4 in May 2018), it lowered its rates again by an average of 5.36% (5.94% in the liberalized sector) as of July 1, 2018.

The former major power companies, which previously were monopolistic vertically integrated companies, own most of the large-scale power sources built in the era of the fully distributed cost method, and they include facilities with low marginal costs like hydropower. Additionally, adequate inroads have not yet been made in these energy markets with long-term bilateral contracts between the former wholesale electricity supplier (J-Power and the Japan Atomic Power Company) and the former major power companies. With the affiliated company style tolerated as a method for legal unbundling (see Chapter 1) and with the lack of incentives to separate generation and retail divisions, market surveillance needs to be strengthened to eliminate discrimination between in-group and out-group entities so that, going forward, improper in-group aid is not provided while leveraging the dominant position of the generation division (see the discussion of "equal footing" in Chapter 3). When this is done, further discussion needs to take place on analysis methods for surveillance of market control, which was considered previously in the process of power system restructuring (Table 2-2).

Table 2-2 Examples of analysis methods used in market surveillance in Europe and the US

Market structural analysis (potential for market control)	Market share	• General market monopolization index; approx. 25% is threshold for increased market power concerns • Need to appropriately consider region, electricity produced, capacity of generation facilities, seasonality and other factors
	HHI (Herfindahi-Hirschman Index)	• Sum of squared market share of market participants; measures relative concentration of market overall, not single companies
	PSI (Pivotal Supplier Index)	• Compares the capacity of a generator and the surplus supply in the wholesale market to determine whether or not a given generator is indispensable to meeting demand. The result is expressed as either 1 or 0; not fixed, differs with the time slot
	RSI (Residual Supply Index)	• Index developed by CAISO of the U.S.; similar to PSI, but expressed as continuous value, not 1 or 0 • Calculated by dividing the supply capacity remaining in the market after substracting a specified generator's capacity by the total demand
	RDA (Residual Demand Analysis)	• Measures incentive to exercise market power. Uses price elasticity of residual demand curve after substracting the supply curves bid in the market by other participants from the total demand
Business behavioral analysis (execution of market power)	Lerner Index	• Expresses exercise of market power by comparing market bid prices of generators with marginal costs • It is based on the premise that bids on competitive markets are based on marginal costs
	Net Revenue Benchmark Analysis	• Analyses net revenue to show whether abnormal profits being acquired from exercise of market power, and also evaluates whether incentives for investment are functioning by looking at whether it is possible for peak generation to recover fixed costs
	Economic Withholding	• Based on the view that being able to profit from the sale of electricity but not selling it constitutes the exercise of market power, compares output of generators profitable at market prices and actual generation output
	Physical Withholding	• Being based on the view that refraining from selling is the exercise of market control is equivalent to economic withholding. For physical withholding, the arbitrariness of generator outage rates are analyzed by comparing past results, excluding planned outages, etc.
Simulation analysis	Competitive Benchmark Analysis	• Simulates market prices in the case no companies exercise market power and all companies act in accordance with market prices, and compares this price with actual market prices
	Oligopoly Simulation Models	• Integrates market concentration, demand elasticity, supply curve bidding, forward contracts, transmission constraints and other indicators into one model,, and by using game theory and making adjustments with cost data, estimates market prices and the Lerner Index

Source: METI, Advisory Committee for Natural Resources and Energy, Strategic Policy Committee, Electricity System Reform Subcommittee, System Design Working Group, 3rd session, "Document for submission to secretariat's office: Activation of wholesale electricity market" (October 21, 2013), Document 4-2, p.47 (https://www.meti.go.jp/shingikai/enecho/kihon_seisaku/denryoku_system/seido_sekkei/pdf/03_04_02.pdf)

3. Distortions in the electricity market due to the "fairness" of nuclear decommissioning cost sharing

With full retail deregulation, a situation was created in which costs related to nuclear power decommissioning and damage compensation, which had been recovered by the former major power companies by tacking the costs onto retail rates, could no longer be recovered in this way due to consumers switching to new power suppliers or from the elimination of rate regulations. These costs include the enormous sum for damage compensation caused by the nuclear disaster at TEPCO's Fukushima Daiichi Nuclear Power Plant.

In response to this, the government, through the Policy Subcommittee for Acceleration of Electricity System Reform (Reform Acceleration Subcommittee), which met from 2016 to 2017, decided to retroactively add the cost of nuclear decommissioning and the nuclear disaster at TEPCO's Fukushima Daiichi Nuclear Power Plant to grid tariffs so that they would also be borne by new retailers (and, as a result, consumers)[30]. Collection of this "contribution" begins in October 2020 and is expected to be paid by all consumers over the next forty years at a cost of 0.07 yen per 1 kWh (average per household of 18 yen per month).

During the process of debating this unprecedented measure, a period of discussions were just for three months, a whole host of problems were raised, including the advisability of bearing a portion of the cost in the past, the advisability of having new power suppliers bear a portion of the cost even though they have no nuclear power facilities, the advisability of adding costs from the generation sector that have no direct relation to the transmission sector onto grid tariffs, and confusion[31] from changes to accounting rules that now allow costs related accidents to be mixed in with operating profit and loss[32]. However, these concerns were flatly rejected with the explanation that consumers used electricity from nuclear power in the past (received the benefit of it) and the charge would be collected from grid tariffs as it is the only regulated charge remaining. Expenses for nuclear decommissioning and compensation are supposed to be costs of the nuclear power business, and the generation divisions of major power utilities with nuclear plants are supposed to recover those costs from the utilities' retail division or retailer which are their customers, by incorporating the costs into wholesale prices. Under current conditions in which access to power sources by new retailers is limited, this special way of handling these costs means reduced procurement costs for the retail divisions of major power utilities, which alone handle nuclear power. In this regard, it is a major problem from the standpoint of competition in the retail market.

The problem related to fair power source access by retailers must be solved separately (see Chapter 3), but apart from this, the problem of the costs related to nuclear power plants is the idea to have all consumers bear costs related to a specific power source, even future consumers and consumers that do not use that power source, and even in a liberalized electricity market. Moreover, to recover these costs, even accounting rules are being changed, which on the whole distorts the electricity market. When the grid tariff system is revised in the future, this system should be changed as well.

■Recommendation 2-1:
Strengthen surveillance of improper discounting by major power utilities

In order to promote fair competition in the retail market, the EGC and the Fair Trade Commission should strengthen surveillance of improper discounting by major power utilities.

■Recommendation 2-2:
Revise the system of recovering past nuclear power costs through regulated grid tariffs

Regulated grid tariffs are originally intended to be charges for recovering costs related to transmission and distribution. The method of recovering nuclear power costs using grid tariffs should be revised.

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[30] METI, Advisory Committee for Natural Resources and Energy, Strategic Policy Committee, Policy Subcommittee for Acceleration of Electricity System Reform, "Interim Report of Policy Subcommittee for Acceleration of Electricity System Reform" (February 2017). (https://www.meti.go.jp/shingikai/enecho/kihon_seisaku/denryoku_kaikaku/pdf/20170209002_01.pdf)

[31] Eri Kanamori, "How special is the accounting system for nuclear power?" column for REI (December 2, 2016). (https://www.renewable-ei.org/en/column/column_20161221.php)

[32] Manabu Takano, "Damage Compensation, Decommissioning Costs, and Regulated Grid Tariffs related to Nuclear Power Providers," Shogaku Kenkyu (2018), No. 34, pp.121-144. (https://www.bus.nihon-u.ac.jp/wp-content/uploads/2019/08/34_TakanoManabu.pdf)

Part 2 Promotion of retail market reforms to realize a decarbonized society

1. Realization of a decarbonized society and the retail market

To realize a decarbonized society, the energy sector, the electricity system in particular by transitioning to renewables, is a key factor, and it is important to create a market for driving electricity itself in the direction of decarbonization. Rather than using price signals alone, the perspective of sustainability needs to be included as an additional evaluation metric in market transactions. The structure of Japan's current system makes coal competitive despite its high carbon emissions factor[33], so there needs to be a system that penalizes power sources with high carbon emissions factors on the electricity market. The main means of accomplishing this is introducing a carbon pricing scheme, but here we will leave aside discussion of systems related to society as a whole. This chapter takes up development of a retail electricity market that allows consumers to select their power sources, including regular households, which was made possible by full retail competition in 2016.

As shown in Figure 2-1, approximately 16% of consumers in the low voltage sector have already switched to a new retailer as a result of full retail competition. Cumulative switching rates in European countries that have carried out electricity system reforms are 66% in the UK (16 years since deregulation), 47% and 46% in Portugal and Belgium (four years and seven years since deregulation), and 25% to 30% in Czechoslovakia and Germany[34]. As was seen in the last chapter, the switching rate in the low voltage sector in Japan, four years since 2016, has made some progress.

However, at the same time, retail competition is limited to price, and doubt remains on whether consumers have adequate options when choosing a retail service. Since retail deregulation began, diverse service plans have emerged that combine electricity sales with cell phone, communication or gas services and allow consumers to accrue points, but in every case, they are only focused on price. Price certainly is a very important indicator, and according to questionnaires, its emphasis as a motivation for switching electricity companies is strongly rooted[35]. However, at the same time, most residential consumers want to know how the electricity they are using is generated[36].

2. Power source disclosure status in Japan

When consumers choose a power source or supplier, they need to be provided relevant information. Electricity is a secondary energy, and it is not clear to consumers what is the source of their electricity – behind their plugs. For this reason, in order for household consumers in particular to make informed choices with sufficient information, the transparency of basic information on their electricity is indispensable, including information on the power source mix, location of generating plants, and emissions of carbon dioxide and radioactive waste.

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[33] Looking at prices per unit of carbon dioxide emissions, the price of industrial coal is one-fifth that of industrial natural gas. Ministry of the Environment, "Carbon Pricing Significance, Effects and Issues (Continued)," Ministry of the Environment Subcommittee on Utilization of Carbon Pricing, 4th session (November 22, 2018), Document 2, p.31 ((Reference) Tax rate per ton of CO_2 emissions by fuel including base price). (https://www.env.go.jp/council/06earth/cp04mat02.pdf)

[34] EGC, "Evaluation of competition in the electricity market," 77th session (April 5, 2017), Document 3-2, p.20. (https://www.emsc.meti.go.jp/activity/emsc/pdf/077_03_02.pdf)

[35] Refer to Dentsu Macromill Insight, "2018 Industry and Economy Research Commission Project (economy and industry policy and 4th industrial revolution related to research project costs) (survey project on selection behavior by consumer in electricity and gas retail liberalization) survey report" (December 18, 2018) (https://www.meti.go.jp/meti_lib/report/H30FY/000597.pdf), and MRI Research Associates, Inc., "2018 New Provider Switchover Survey by Region in the Residential Sector" (January 9, 2019). (https://www.mri-ra.co.jp/blog/2019/01/mifreport2019-1.pdf)

[36] In a survey conducted by the Japanese Consumers' Co-operative Union in April 2015, when asked if the power mix is one of the pieces of information needed to select a retailer, over 80% of people responded that it was information they needed, and, moreover, when asked if retailers should be required to disclose power mix information, close to 90% said that they should. Japanese Consumers' Co-operative Union press release on the survey findings, "Consumer awareness survey on formats for electric power going forward" (May 8, 2015). (https://jccu.coop/info/press_150508_01_01.pdf)

However, in Japan, even after full retail competition's introduction, such power mix labeling has not been made mandatory, and in the Guidelines Concerning the Management of the Electricity Retail Business[37] created by METI, it is merely recommended as a preferable action. When retail deregulation commenced in 2016, the government claimed that if this were recommended as a preferable action, retailers would have no choice but to follow suit, but currently there are still relatively large retailers that do not provide power mix information. For such retailers, there is no incentive to indicate the power mix, so when consumers choose a power source, they cannot do so on the basis on environmental impact.

As a result, in Japan, consumers are less concerned about the negative impact (negative externalities) of coal-fired power, and retailers tend to choose power sources more on the basis of surface costs than this problem. Actually, Japan currently is the only developed country in the world with plans to increase coal-fired thermal power facilities, and its policy of exporting to other countries has drawn international criticism.

Since beginning discussions on full-fledged power system restructuring in 2012, over these past few years, the situation surrounding climate change has changed significantly. The effects of climate change, increasing in severity with each year, are becoming tangible in Japan as well, in the form of torrential rainfall, typhoons, scorching heat and resulting damage. The Paris Agreement was reached at COP21 in 2015 and went into effect the next year, not even a full year later. Large-scale disasters continue to affect countries around the world, and calls are increasing for even stricter climate change targets. Targets for renewables are also being raised substantially in various countries. The deregulated retail market should be designed to lead consumers in the direction of these demands facing society as a whole.

3. Power source disclosure system in Europe and the US

Power system restructuring in Europe and some states in the US, which are a step ahead, long worked to establish a retail market that would facilitate the energy transition itself and also further enable consumers themselves to choose renewable options. There is a tendency to emphasize price[38], but with renewable tracking systems[39] and mandatory disclosure, transparent and highly competitive electricity markets, and climate change measures like a carbon tax and emissions trading schemes, there is a very substantial difference in the situation surrounding consumers. Such infrastructure needs to be developed through policy.

For example, the European Commission has made it mandatory by EU directive for member countries to develop tracking systems for renewables (Guarantee of Origin, GoO) to facilitate electricity transactions on the integrated EU market and to be able to gauge the relative achievement of renewable targets by each country[40]. Member countries manage electricity from renewables and engage in transactions with other countries using these GoOs. They are not simply digital data; they are actually bought and sold as well.

With this as the general trajectory of the most progressive electricity reforms, disclosure of electricity information was made mandatory for member countries by EU directive[41] in 2003. GoO information can also be directly used for this. Disclosing information protects vulnerable, small-scale consumers in the electricity market, and when information can be obtained on environmental impact, in the form of carbon dioxide emissions or radioactive waste, for example, it needs to be disclosed. Figure 2-2 is the example of the UK.

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[37] Supra note 27 "Guidelines Concerning the Management of the Electricity Retail Business."

[38] Agency for the Cooperation of Energy Regulators (ACER) / Council of European Energy Regulators (CEER), "Annual Report on the Result of Monitoring the Internal Electricity and Natural Gas Markets in 2014" (November 30, 2015). (https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER_Market_Monitoring_Report_2015.pdf)

[39] System that certifies the path the electricity has taken from generation to consumption, including the power source, generation technology, location and date of the generation, output amount, and sales and purchase amount.

[40] Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market, Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

[41] Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC.

Figure 2-2 Examples of electricity label in the UK

Appendix 3 Examples of label design

A3.1 The following examples illustrate the various label options that suppliers might want to use. These are not intended to constrain suppliers from branding their labels appropriately or supplementing with graphical information.

Option 1 – Label with contact details for environmental information

SupplierEnergy disclosure label
(relates to electricity supplied in the period April 2005 to March 2006)

Electricity supplied has been sourced from the following fuels:	% of total	
	Electricity supplied by SupplierEnergy	**Average for UK (for comparison)**
Coal	x%	33.4%
Natural gas	x%	39.3%
Nuclear	x%	20.6%
Renewable	x%	3.8%
Other	x%	2.9%
Total	100%	100%

Environmental Impact

For information on the environmental impact of your electricity supply visit www.xxxxx.xx.xx or call 0845 XXX XXX

Option 2 – Label with environmental information included

SupplierEnergy disclosure label
(relates to electricity supplied in the period April 2005 to March 2006)

Electricity supplied has been sourced from the following fuels:	% of total	
	Electricity supplied by SupplierEnergy	**Average for UK (for comparison)**
Coal	x%	33.4%
Natural gas	x%	39.3%
Nuclear	x%	20.6%
Renewable	x%	3.8%
Other	x%	2.9%
Total	100%	100%
Environmental Impact		
CO_2 emissions	X g per kWh	430 g per kWh
Radioactive waste	X g per kWh	0.0030 g per kWh
For more information on the environmental impact of your electricity supply visit www.xxxxx.xx.xx or call 0845 XXX XXX		

Option 3 – Label with individual product information and environmental information

SupplierEnergy disclosure label – Greenproduct
(relates to electricity supplied in the period April 2005 to March 2006)

Fuel Mix	% of total		
	Your electricity (Greenproduct)	**Electricity supplied by SupplierEnergy**	**Average for UK (for comparison)**
Coal	X%	x%	33.4%
Natural gas Including CHP: x%	X%	x%	39.3%
Nuclear	X%	x%	20.6%
Renewable Including: Hydro x%, Wind x%, Landfill gas x%, Other x%	X%	x%	3.8%
Other	X%	x%	2.9%
Total	100%	100%	100%
Environmental Impact			
CO_2 emissions	x g per kWh	x g per kWh	430 g per kWh
Radioactive waste	x g per kWh	X g per kWh	0.0030 g per kWh
for more information on the environmental impact of your electricity supply visit www.xxxxx.xx.xx or call 0845 123 456			

Option 4 – Label with product information and contact details for environmental information

SupplierEnergy disclosure label – Greenproduct
(relates to electricity supplied in the period April 2004 to March 2005)

Fuel Mix	% of total		
	Your electricity (Greenproduct)	**Average for SupplierEnergy**	**Average for UK (for comparison)**
Coal	X%	x%	33.4%
Natural gas Including CHP: x%	X%	x%	39.3%
Nuclear	X%	x%	20.6%
Renewable Including: Hydro x%, Wind x%, Landfill gas x%, Other x%	X%	x%	3.8%
Other	X%	x%	2.9%
Total	100%	100%	100%
Environmental Impact For information on the environmental impact of your electricity supply visit www.xxxxx.xx.xx or call 0845 123 456			

Source: Ofgem, "Fuel Mix Disclosure by Electricity Suppliers in Great Britain Guidelines" (October 2005) pp.20-21. (https://www.ofgem.gov.uk/sites/default/files/docs/2005/12/12340-282_05.pdf)

In the US, energy policy is generally determined by state governments, so the situation is different depending on the state. Currently, 16 states have fully deregulated markets and 14 have instituted partial measures for their electricity and gas markets.

For example, California, which has eligible renewable target of 60% by 2030 and clean energy target of 100% by 2045[42], has not deregulated the retail market for regular households[43], but it mandates certificates of origin (Power Content Labels) to promote consumer protection and environmental policy[44]. Texas, which is regarded as having the most deregulated market, fully deregulated its retail market in 2002 and mandates certificates of origin from the standpoint of market transparency and consumer protection[45] (Figure 2-3 shows examples from these two states).

[42] SB-100 California Renewable Portfolio Standard Program: emissions of greenhouse gases (Senate Bill No.100, Chapter 312, approved by Governor and filed with Secretary of State, September 2018). (https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100)

[43] California Direct Access Program. SB-695 Energy: rates (Senate Bill No. 695, Chapter 337, approved by Governor and filed with Secretary of State, October 2009). (http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200920100SB695)

[44] All retailers are required to provide consumers with accurate, reliable, and easy-to-understand information related to the energy they use. AB-162 Disclosure of sources of electrical generation (Assembly Bill No.162 Chapter 313, approved by Governor and filed with Secretary of State, October 2009), (http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=200920100AB162), and SB-1305 (Senate Bill No.1305 Chapter 796, approved by Governor and filed with Secretary of State, October 1997), (http://www.leginfo.ca.gov/pub/97-98/bill/sen/sb_1301-1350/sb_1305_bill_19971009_chaptered.html).

[45] Article 25.475 (General Retail Electric Provider Requirements and Information Disclosures to Residential and Small Commercial Customers) and 25.476 (Renewable and Green Energy Verification) of Electric Substantive Rules.(https://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/Electric.aspx) Also refer to Public Utility Commission of Texas, "The Electricity Facts Label, What It Is and How It Will Help You Shop for Electricity." (https://www.puc.texas.gov/industry/electric/rates/facts/efl_brochure.pdf)

In addition, over 20 states have instituted certificates of origin and made disclosure mandatory through such programs as fuel mix disclosure, fuel mix and emissions disclosure, environmental information disclosure, environmental disclosure programs, and fuel mix and environmental characteristics disclosure[46]. The reasons given include consumer protection to ensure informed choice for small-scale consumers like regular households, transparency and efficiency in the electricity market, and environmental considerations[47].

Figure 2-3 Examples of US electricity labels

California

Version: July 2019

2018 POWER CONTENT LABEL		
(Insert Retail Supplier Name)		
(Insert Website URL for PCL Posting)		
ENERGY RESOURCES	**Power Mix**	**2018 CA Power Mix****
Eligible Renewable	**0%**	**31%**
Biomass & Biowaste	0%	2%
Geothermal	0%	5%
Eligible Hydroelectric	0%	2%
Solar	0%	11%
Wind	0%	11%
Coal	**0%**	**3%**
Large Hydroelectric	**0%**	**11%**
Natural Gas	**0%**	**35%**
Nuclear	**0%**	**9%**
Other	**0%**	**<1%**
Unspecified sources of power*	**0%**	**11%**
TOTAL	**100%**	**100%**

* "Unspecified sources of power" means electricity from transactions that are not traceable to specific generation sources.
** Percentages are estimated annually by the California Energy Commission based on the electricity generated in California and net imports as reported to the Quarterly Fuel and Energy Report database and the Power Source Disclosure program.

For specific information about this electricity product, contact:	**(Retail Supplier Name)** **(Retail Supplier Phone Number)**
For general information about the Power Content Label, please visit:	http://www.energy.ca.gov/pcl/
For additional questions, please contact the California Energy Commission at:	Toll-free in California: 844-454-2906 Outside California: 916-653-0237

Texas

Electricity Facts
Retail Electric Provider ABC, Certificate #00000, Family Electricity Plan
Serving the State of Texas

Electricity price

Average monthly use:	500kWh	1,000kWh	1,500 kWh
Average price per kilowatt-hour:	**(¢)**	**(¢)**	**(¢)**

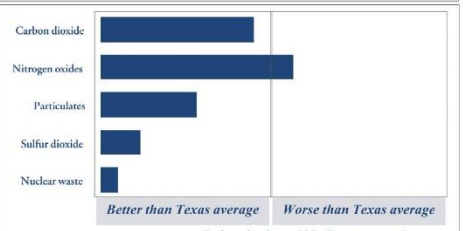
Contract

Minimum term: (months) Penalty for early cancellation: ($)
See Terms of Service statement for a full listing of fees, deposit policy, and other terms.

Sources of power generation

	This product	*Texas (for comparison)*
Coal and lignite	___%	___%
Natural gas	___%	___%
Nuclear	___%	___%
Renewable energy	___%	___%
Other	___%	___%
Total	**100%**	**100%**

Emissions and waste per kWh generated



Source: California Energy Commission, "Power Content Label Template," Updated August 2019 (https://ww2.energy.ca.gov/pcl/documents/), and Wilhite, Harold, "An assessment of experiences in the U.S.A. with power and emissions disclosure information for energy consumers," CICERO Report 2007:2, Center for International Climate and Environmental Research, 2007, figure 4 (https://pub.cicero.oslo.no/cicero-xmlui/handle/11250/191984).

[46] According to Database of State Incentives for Renewables & Efficiency (DSIRE, https://programs.dsireusa.org/system/program), 25 states have policies on generation disclosure (as of May 1, 2020).

[47] Refer to National Council on Competition and the Electric Industry, "Electric Product Disclosure: A Status Report" (July 2002), (https://www.raponline.org/wp-content/uploads/2016/05/rap-sedano-electricproductdisclosure-2002-07.pdf), and Bird L.A., "Understanding the Environmental Impacts of Electricity: Product Labeling and Certification," NREL (NREL/TP-620-33475) (February 2003), (https://www.nrel.gov/docs/fy03osti/33475.pdf).

4. Challenges in purchasing renewables

The problems of power source procurement by former major power companies and new power supplier and tracking system in connection with retail deregulation are not problems related only to small-scale consumers like residential customers.

Over the past few years, with momentum from the Paris Agreement going into effect, even in Japan there is a rapidly accelerating movement led by corporations, local governments and other consumers to demand electricity that does not emit greenhouse gases and to try to use electricity from 100% renewable sources. With the participation of over 30 Japanese companies, the RE100 campaign is part of this movement[48]. Electricity retailers that sell the power are responding to these calls by beginning to offer 100% renewable plans.

Looking at power source plans offered by each company, there are clear differences between former major power companies and new suppliers. The former major power companies provide electricity plans centering on power from hydropower plants operated by their groups[49], but new suppliers either combine electricity certificates from renewables or procure from non-FiT power plants, facilities outside the feed-in tariff scheme.

In terms of procurement costs, the former major power companies clearly have an advantage. This was touched on in Chapter 3 as well, but most hydropower plants operated by the former major power companies or former wholesale electricity utilities have been in operation for some time, and depreciation has already been completed. There are also problems when viewed from the additional standpoint of environmental value[50]. At the same time, new retailers bear the cost of purchasing certificates in addition to electricity procurement costs. In order to maintain a fair competitive environment, measures such as separating the generation and retail divisions of major power utilities and making power sources available on the market need to be carried out, and the situation whereby cheap electricity from hydropower plants is supplied only within the same group needs to be changed structurally.

Moreover, going forward, surplus electricity from residential solar PV for which the FiT purchase period has ended ("graduate" FiT) will be supplied in large quantities. Electricity that has graduated FiT is expected to be recognized as renewables and be sold by an increasing number of providers as a 100% renewable energy plan. Most surplus electricity from residential solar PV has long been purchased by the former major power companies, so the former major power companies buy graduate FiT electricity at an average of around 8 yen per 1 kWh, which means they can procure renewable power at prices cheaper than the wholesale market's spot price (which averages approx. 10 yen (fiscal 2018)). New retailers need to present higher prices than that and have contracts changed, which means their procurement costs are higher.

Since April 2020, the environmental value (benefits from not emitting greenhouse gases) of renewable power supplied through transmission and distribution networks must be registered in the form of non- fossil fuel certificates, in principle[51], and this also applies to electricity generated by the former major power companies' hydropower sources and non-FiT and graduate FiT sources. Non-fossil fuel certificates can be traded on the market and used in bilateral contracts between generators and retailers. For most electricity from hydropower plants operated by the former major power companies and J-Power, bilateral contracts are expected to continue the same as before, but there is a high likelihood that the amount of non-fossil fuel certificates coming onto the non-fossil fuel value market will be limited.

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[48] Campaign to promote use of renewables by large corporations led by the Climate Group and CDP. With companies like Apple and Google participating, use of renewable electricity is increasing. CDP Japan, "RE100 Technical Criteria: Technical Note on Procurement Methods for Renewable Power, January 2018." (http://media.virbcdn.com/files/db/53c22ceaf91bdd54-RE100TechnicalCriteria_Japanese20200317.pdf)

[49] The plans include TEPCO Energy Partner, Inc.'s "Aqua Premium," KEPCO's "Hydropower Eco Plan," and Kyushu Electric Power's "Renewable Energy Eco Plan," which combines hydropower and geothermal.

[50] When a cost is paid with respect to the environmental value of renewables, it is necessary to distinguish between power sources for which depreciation has already advanced and will not generate new environmental value and power sources that have been newly built and provide additional environmental value. In Europe and the U.S., the common approach is to not recognize the additional environmental value of power sources like old, large-scale hydropower plants.

[51] In the METI's guidelines, this does not apply to electricity for which environmental value has been actualized and isolated by another scheme, an exception that applies to green power certificates and the like. METI, "Guidelines on Revising Existing Contracts related to Non-Fossil Fuel Value Markets (Draft)," Footnote 3, METI, Advisory Committee for Natural Resources and Energy, Electricity and Gas Industry Committee, Electricity and Gas Basic Policy Subcommittee, System Review Working Group, 35th sessions (October 28, 2019), Document 3-2, p.1.
(https://www.meti.go.jp/shingikai/enecho/denryoku_gas/denryoku_gas/seido_kento/pdf/035_03_02.pdf)

Non-fossil fuel certificates have the fundamental problem of the power source not being labeled, as was discussed above. Without a mechanism for tracking the electricity from power plant to purchaser, it is impossible to know the type of environmental impact of the electric power (or certificate) purchased. The RE100 also recommends tracking and has urged the ANRE to make tracking possible for non-fossil fuel certificates. A tracking system limited to a portion of non-fossil fuel certificates is currently in the testing phase. Going forward, non-fossil fuel certificates will constitute a common mechanism for certifying the environmental value of Japan's renewable power, so a system that allows all non-fossil fuel certificates to be tracked needs to be established as soon as possible.

In addition, under the current Electricity Business Act, the entities able to sell electricity to consumers are limited to those retailers registered with the government, but in contrast with this, many progressive countries and regions in Europe and North America allow power purchase agreements (PPA) to be concluded directly between companies, which are the consumer, and the generator. For consumers, there are more ways to procure electricity and it also becomes easier to purchase renewable power that better meets the consumer's requirements. Generators are able to diversify who purchases their electricity, so a healthy competitive environment is fostered. This can be expected to help reduce generation costs for renewables and also to reduce electricity costs for the nation overall. Japan should also make PPAs possible between consumers and generators.

■Recommendation 2-3:
Institute systems and mechanisms that make it easy for consumers to choose renewable power

To make it easy for consumers to choose renewable power, systems need to be instituted such as power source tracking, mandatory labeling of power sources and carbon dioxide emissions by retailers, and a mechanism that allows consumers to directly conclude power purchase agreements with generators.

■Recommendation 2-4:
Monitor non-fossil fuel value transactions within major power utilities

When renewable power is bought or sold, non-fossil fuel value transactions from the generation division to the retail division of the former major power companies need to be monitored so that major power utilities do not have a unilateral advantage, and, in some cases, structural measures such as separating the generation and retail divisions of major power utilities need to be considered.

■Recommendation 2-5:
Create a system with non-fossil fuel certificates that are valid internationally

A system equivalent to power source tracking should be established and power source information should be clearly indicated on non-fossil fuel certificates. At the same time, criteria need to be established for power source sustainability to make the system applicable internationally.

Chapter 3 Promoting competition and market system reform in the generation sector

A precondition for promoting competition in the retail sector, as discussed in Chapter 2, is competition in the generation sector. Full deregulation of the generation sector was achieved in 2016, and in 2020 legal unbundling was introduced, so more competitive conditions in the generation sector are seemingly being developed. This chapter discusses whether competition is actually progressing, whether the day-ahead market is functioning, and how the "Baseload market" and the capacity market should be structured.

Part 1
Competition in the generation sector and the status of the day-ahead market

1. Competition in the generation sector

In the generation sector in Japan, for a long period of time post-war, the generation divisions of the former major power companies as the vertically integrated utilities, along with J-Power and the Japan Atomic Power Company as the wholesale electricity suppliers, were responsible for power supply under a legally monopolistic system. However, with amendments to the Electricity Business Act in 1995, deregulation of the generation sector commenced, and independent power producers (IPP), including steel companies, paper and pulp companies, and gas companies, entered the industry and began wholesale supply to the former major power companies. Through electricity system reforms that took place after the nuclear disaster at TEPCO's Fukushima Daiichi Nuclear Power Plant, the retail sector was fully deregulated in April 2016, and, at the same time, wholesale supply regulations were eliminated to bring about complete deregulation of the generation sector.

In light of where things stand today, has the oligopolistic grip of the former major power companies and other existing providers on power sources been loosened. According to the ANRE's Electric Power Statistics, as of September 2019, power sources owned by the former major power companies, former wholesale electricity utilities and their wholly owned subsidiaries totaled approximately 213 GW, accounting for around 80% of those owned by the registered generation business utilities[52]. Compared to three years prior to full deregulation of generation segment, the oligopolistic state has not been changed. Most of the power sources of the former major power companies are facilities developed based on the fully distributed cost method from the era of legal monopolies, and as such they have an overwhelming competitive advantage in the generation sector.

Even after the legal unbundling in 2020, generation segment and retail segment continue to be allowed to be members of the same corporate group. Moreover, almost all major power utilities have opted for the affiliated company style (see Chapter 1), so even legally they continue to exist as a single company. Through this system, the generation divisions of the former major power companies supply electricity on a priority basis to their own retail divisions, so they are still incentivized to hold back supply from other companies. Under such conditions, new retailers have no choice but to procure the limited power sources that are made available in the wholesale transaction market, and it is highly likely that the market is being manipulated by the controlling entities that form an oligopolistic market of power sources.

In connection with this, the Competitive Electricity and Gas Market Research Group, which is the personal research group of the EGC's Chairperson, presented specific concerns on the following two points in its interim summary released in August 2018[53]. Eliminating these concerns will be important going forward.

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[52] Other than the power sources owned by the registered generation business utilities, it exists 28GW of power facilities (1MW and more) for self-consumption and 51GW of power plants under the FiT scheme nationwide (as of September 2019). Considering that a number of power plants under the FiT scheme were owned by non-registered generation business undertakings, total generation capacity in Japan is assumed more than 300GW.

[53] EGC Competitive Electricity and Gas Market Research Group, "Interim Summary" (August 9, 2018), p.16. (https://www.emsc.meti.go.jp/activity/emsc_studygroup/pdf/180809_report.pdf)

- The first concern is that the wholesale electricity market will not work well due to internal transactions within the former major power companies or long-term contracts and that liquidity will decrease.
- The second concern is that competition in the wholesale market and retail market will be distorted due to internal assistance between generation divisions and retail divisions within the controlling entities (the former major power companies).

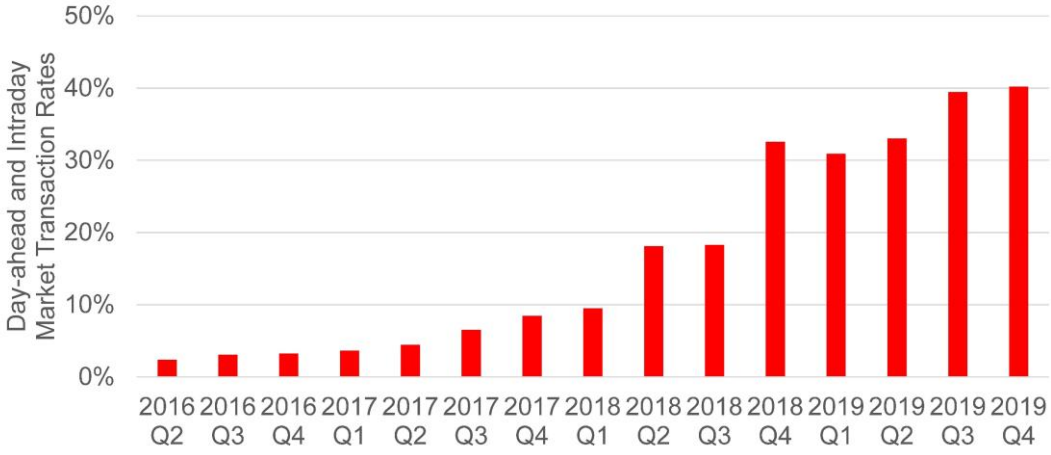
2. Day-ahead market and effects of gross bidding

Regarding eliminating the oligopoly on power sources, forced sale, the measure taken by other countries, has the potential in Japan to provoke a major backlash, so this option does not look feasible, at least for the short term. Given this, it would be possible to appropriately bridge generation and retail through electricity markets, and specifically through the day-ahead market. Japan's day-ahead market was established in 2005 and supplied electricity to new Power producer and supplier (PPS) and others, but until recently the transaction volume had been extremely limited (around 1% of total electricity sold). Almost all of the remaining 99% was OTC or internal transactions through the former major power companies and like entities, and both the wholesale and retail markets remained stagnant.

The government in response eliminated wholesale regulations in April 2016 and efforts were made to make the former major power companies supply power sources to the market and increase liquidity. For example, of the power sources supplied by J-Power to the former major power companies, over 0.6GW has been made available on the market as of December 2019 (approximately 4% of the 16.37 GW in power output it owns)[54]. The generation divisions of the former major power companies are also voluntarily providing power to the day-ahead market on a marginal cost basis, making available all surplus power sources, conducting gross bidding and reducing reserve capacity.

Of these, gross bidding refers to former major power companies buying back the same amount of electricity with the day-ahead market price even when their generation divisions supply to their retail divisions. This initiative was progressively launched starting in spring 2017, and the former major power companies are offering 20% to 30% of total electricity sales to gross bidding[55]. The state of gross bidding is monitored by a dedicated committee of the EGC, and from October to December 2019, sell bids totaling 32.1 TWh were made, and 32.0 TWh was contracted (approximately 19% of total electricity sales by the former major power companies)[56].

Figure 3-1 Ratio of day-ahead market and intraday market transactions to total electricity sales



Source: REI from electricity transaction reports and Japan Electric Power Exchange (JEPX) data

[54] EGC Executive Bureau, "Report on Monitoring of Voluntary Initiatives and Competition (October-December 2019)," 46th EGC Meeting for System Design (March 31, 2020), Document 12. (https://www.emsc.meti.go.jp/activity/emsc_system/pdf/046_12_00.pdf)

[55] EGC Executive Bureau, "How to proceed with gross bidding going forward," 28th EGC Meeting for System Design (March 29, 2018), Document 4. (https://www.emsc.meti.go.jp/activity/emsc_system/pdf/028_04_00.pdf)

[56] Supra note 54 "Report on Monitoring of Voluntary Initiatives and Competition (October-December 2019)."

As a result of these continuing efforts, as of 2019, approximately 30% of total electricity sales is traded on the day-ahead market or intraday market (Figure 3-1), but the former wholesale electricity utilities providing power sources and gross bidding by the former major power companies are ultimately only voluntary initiatives, and it is uncertain how long they will continue. In addition, the generation divisions of major power utilities have thus far been more in the position of simply supplying electricity to their retail divisions rather raising profits by maximizing their assets, and in supplying to the wholesale electricity market, the retail division acts as go-between, so the skill and experience of the retail division undeniably has the potential to impact gross bidding. As was pointed out in Chapter 2, sales activities by retail division of the former major power companies are also being ramped up. Going forward, competition policy needs to be strengthened so that adequate supply capacity is appropriately provided to the market by the generation divisions of the former major power companies, which continue to maintain an oligopoly, and if competition does not improve, structural measures need to be considered.

3. Structural measures to promote competition in the generation sector in Europe and the US

Europe and the US, which have promoted electricity deregulation since the 1990s ahead of Japan, including unbundling, have taken structural measures and other steps to promote competition in the generation sector.

In the US, state governments are responsible for energy policy and the structure of the electricity business varies with the state. In some states, vertically integrated private or public power utilities have regional monopolies, while other states have privatized everything and have extremely competitive electricity markets. A portion of the states are actively promoting electricity system reforms such as full retail deregulation; New York in particular has carried out progressive system reforms, deregulating its wholesale electricity market in 1997 and its retail market in 1998. When its retail market was deregulated, private electricity utilities were requested to sell generation facilities in order to promote competition. The state succeeded in activating power source procurement in the market, which promoted competition and restructuring in the electricity business[57].

In the UK, the electricity business was conducted by the state-owned Central Electricity Generating Board (CEGB) under a legal monopoly, but based on the Electricity Act of 1989, the government split the company into private companies, one transmission operator, 12 distribution operators, and three generators, and began deregulation of the retail sector as well. Most of CEGB's thermal generation divisions have been taken over by National Power and PowerGen and its nuclear generation divisions by Nuclear Electric. After beginning liberalization in 1990, the UK introduced a mandatory pool system by which all electricity generated was bid on and sold on the wholesale electricity market, but wholesale prices did not go down, so in 1996, the government requested that approximately half of the generation facilities of National Power and PowerGen be sold to other companies, and they were subsequently sold. Thereafter, both companies continued to see business profits deteriorate in other divisions and reduced their generation facilities. Their share of capacity, which initially was close to 80%, was just under 30% in 2000. As a result of these market restructuring, wholesale electricity prices in the UK is said to have declined by 40%[58]. Even today, the UK has asymmetrical regulations on major generators and retailers (the Big 6), called the Market Making Obligation and the Supplier Market Access rules, in order to ensure liquidity to the wholesale electricity market.

As a result of these measures to promote competition, transaction volume on the day-ahead market in Germany and the UK, which have mechanisms for wholesale electricity transactions that are similar to Japan, is approximately 50% of intraregional transactions, and in Scandinavia, the figure is over 90%[59]. In France, which is even more oligopolistic than Japan, the figure is around 25%.

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[57] The Institute of Energy Economics, Japan, "FY2015 Power Source Siting Promotion Survey Project (Survey of Trends in Domestic/Foreign Electric Power Markets) Survey Report," (February 2016), p.66. (https://www.meti.go.jp/meti_lib/report/2016fy/000099.pdf)

[58] AT Kearny, "Changes in the Business Environment in Liberalized Markets Overseas and Prospects for Japan's Electricity Market," Advisory Committee for Natural Resources and Energy, Electricity and Gas Industry Committee, Electricity and Gas Basic Policy Subcommittee, 5th sessions (March 30, 2016), Document 5-1 (https://www.meti.go.jp/shingikai/enecho/denryoku_gas/denryoku_kihon/pdf/005_05_01.pdf), Hisao Kibune, "Electricity Reform in the UK: Before and After NETA: Outcomes and Assessment," The Nagoya Gakuin Daigaku Ronshu - Social Sciences (2003) Vol. 40, No. 2, pp.19-37 (https://core.ac.uk/download/pdf/80045851.pdf), Jiro Sugitaira, "UK: Electric Power Liberalization, Regulatory Reform, and Corporate Strategy," Energy Economics (April 2003), Vol. 29, No. 2 (Collection information as indicated in The Institute of Energy Economics, Japan list of articles in the journal (https://eneken.ieej.or.jp/publication/index.html#journal) (https://eneken.ieej.or.jp/data/pdf/513.pdf).

[59] Mitsubishi UFJ Research and Consulting, "Survey Report on the Structure of Electricity Futures Markets" (FY2017 project on commercial transaction optimization and product safety) (March 2018). (https://www.meti.go.jp/meti_lib/report/H29FY/000116.pdf)

■Recommendation 3-1: Further expand the day-ahead market

While the day-ahead market appears to be expanding in recent years, gross bidding is a voluntary initiative, so going forward uncertainty remains. The EGC should strengthen market surveillance and take steps such as making gross bidding mandatory in order to further expand the day-ahead market.

■Recommendation 3-2: Consider future structural measures

If competition is not promoted in the generation sector and adequate liquidity is not secured in the wholesale electricity market, structural measures should be considered, including selling off generation facilities, as has been done in the US and Europe, and separating the generation and retail divisions of the former major power companies.

Part 2 The “Baseload market” and electricity futures market

1. Current state of the “Baseload market”

Bidding on a new base load market began in 2019 to supply large hydropower, nuclear power, coal-fired power and other power sources owned by the former major power companies and the former wholesale electricity utilities with the explanation of “promoting competition in the generation sector and facilitating power source procurement by retailers” in particular. New retailers had previously asked for steps to be taken to address the oligopolization of baseload power sources, which are a source of cheap late-night electricity, that are owned by the former major power companies and other entities because this was inhibiting competition. In response, the base load market was started as a type of forward market and transactions between the former major power companies and new retailers began.

A total of three auctions were held in 2019, and, on a weighted average basis, bids were won at the following prices: 12.45 yen/kWh for the Hokkaido area, 9.55 yen/kWh for the East Japan area, and 8.64 yen/kWh for the West Japan area (Table 3-1). In each case, contract prices were lower than the average spot price in each area in fiscal 2018, but they were considerably higher than the prices that were expected for baseload power sources by the new retailers. This is evidenced by the contract volume being just 534.3 MW on a total area basis. Supposing these sources generated electricity 24 hours a day, 365 days a year, which is equivalent to approximately 4.68 TWh, it would not even meet 1% of annual electricity consumption in Japan. The former major power companies are originally required to supply a maximum of 90.0 TWh, which is around 10% of annual electricity consumption, so even with this being the initial year of the program, the low level of the contract volume is clear. Regarding the bid price of the former major power companies, they are based on average generation costs, not marginal costs, but going forward, ex post facto monitoring by the EGC will be important.

Table 3-1 Results of transactions on the “Baseload market” (transferred volume in FY2020)

Area	Total contract amount (MW)	Weighted average contract price (yen/kWh)	FY18 average area price (yen/kWh)
Hokkaido	27.8	12.45	15.03
East Japan	308.6	9.55	10.68
West Japan	197.9	8.64	8.88

Source: REI based on EGC, “Results of the Baseload market surveillance” (December 9, 2019).
(https://www.emsc.meti.go.jp/info/public/pdf/20191209001a.pdf)

Furthermore, there is another issue on the baseload market. When the market share (electricity sales volume) of new retailers that are not former major power companies reaches around 30%, the former major power companies and former wholesale electricity utilities are no longer required to make additional supply to the baseload market. Further, even in terms of the amount supplied to the market each fiscal year, the amount has been decreasing in stages as the adjustment factor has been negotiated in line with the state of retail competition. At the very least, there needs to be careful discussions on this matter from the standpoint of promoting competition.

2. Current state of electricity futures market

Forward markets, including the baseload market, handle commodity transactions within a three-year timeframe, but in order to activate electricity market transactions, having a means to hedge price fluctuation risk is essential. Liquidity has been increasing in the day-ahead spot market, but volatility in transaction prices is a major risk for retailers. Also, forward markets are on a spot basis, and net settlement using offsetting transactions is not allowed. A futures market solves these problems.

In September 2019, Japan established an electricity futures market on the Tokyo Commodity Exchange, and transactions commenced on a trial basis. Four types of commodities are listed, 24-hour futures (base load) and weekday 12-hour futures for the East and West Japan areas, the transaction unit is set at 100 kWh per month, and transactions may be for up to 15 months in advance. Transaction volume in the first month after the market began operating on September 17 was just 93 units, and there were even days when no transactions were made[60]. This was due in part to the short preparatory period of one month from approval to commencement, the lack of participation by the former major power companies, and the minimal amount of sell offers. However, transaction volume began to increase from around the end of 2019, primarily in East Japan, and, for example, there were around 200 to 300 units of monthly transactions completed (over 1,300 in January 2020) for East Japan base load futures[61].

Electricity day-ahead prices have traditionally tended to be strongly affected by oil, LNG and other resources prices, and the futures market is expected to serve as a hedge against this. However, the former major power companies have passed off this risk of fluctuations in the resource prices to consumers to a certain extent through the fuel cost adjustment system, and most new retailers have also adopted this system. If renewable energy deployment increases going forward and there is an increase in retail utilities that do not apply the fuel cost adjustment system, there will be less volatility in transaction prices, so use of the futures market is expected to expand further as its importance increases.

3. Market systems in Europe for promoting competition

In Europe, which is ahead of other regions in electricity deregulation, the electricity futures market has an almost 20-year history and has been fully established as a regular system. Transactions are conducted on a large scale with the participation of not only electricity providers but brokers, traders and financial institutions. For example, in the Northern Europe, which, as mentioned before, has the most liquid spot market in the world, transaction volume on the futures market (financial transactions) is five to ten times greater than the day-ahead market (spot transactions)[62]. Through this, generators and retailers, which handle actual demand, are able to easily hedge risk, and this as a result is helping expand the day-ahead market and stabilize retail prices.

At the same time, systems like the baseload market are unique to Japan. As an exception, France, which has an oligopolistic electricity market, has established a system called ARENH that is similar to Japan's baseload market. In France, nuclear power accounts for 70% of total power output, and 80% of total power output is supplied by EDF, a state-owned entity (2018)[63], so promoting competition had been an issue. For this reason, ARENH was introduced in 2010, and a portion of total power output from nuclear power (up to 25%) is sold to new retailers at a fixed price of 4.2euro cents/kWh[64].

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[60] "Electricity Futures Market Stagnation Continues; One Month After Listing, Investor Participation Not Progressing," Nihon Keizai Shimbun digital edition (October 17, 2019). (https://r.nikkei.com/article/DGXMZO51094780X11C19A0QM8000?s=3)

[61] Tokyo Commodity Exchange historical data. (https://www.tocom.or.jp/jp/historical/dekidaka.html)

[62] Supra note 59, "Survey Report on the Structure of Electricity Futures Markets," p.15.

[63] Refer to RTE, "Electricity Report 2018," (February 2019) p.5 (https://bilan-electrique-2018.rte-france.com/wp-content/uploads/2019/02/BE-PDF-2018-1.pdf), and EDF, "2018 PERFORMANCE," p.18(https://www.edf.fr/sites/default/files/contrib/groupe-edf/engagements/rapports-et-indicateurs/2019/edfgroup_performance-2018_en.pdf).

[64] CRE, "Accès régulé à l'électricité nucléaire historique," (décembre 11, 2019). (https://www.cre.fr/Electricite/Marche-de-gros-de-l-electricite/acces-regule-a-l-electricite-nucleaire-historique) (in French)

Also, in Europe, disclosure of transaction information also helps to promote competition. For example, the London Energy Brokers' Association independently compiles bilateral transaction information and releases it as the LEBA Index[65], creating conditions that allow participants to monitor trends in the overall market. This makes it easy to invest and bid, and even in cases in which prices are being manipulated by controlling utilities, such actions are easy to identify. A transparent market leads to increased market participants, and as a result also contributes to the formation of a fair wholesale electricity market.

■Recommendation 3-3: Reform the "Baseload market"

The "Baseload market" has just begun, but contract prices are high and volume is low. The EGC should strengthen market surveillance and if conditions do not subsequently improve, reforms should be considered in connection with bid prices and other areas.

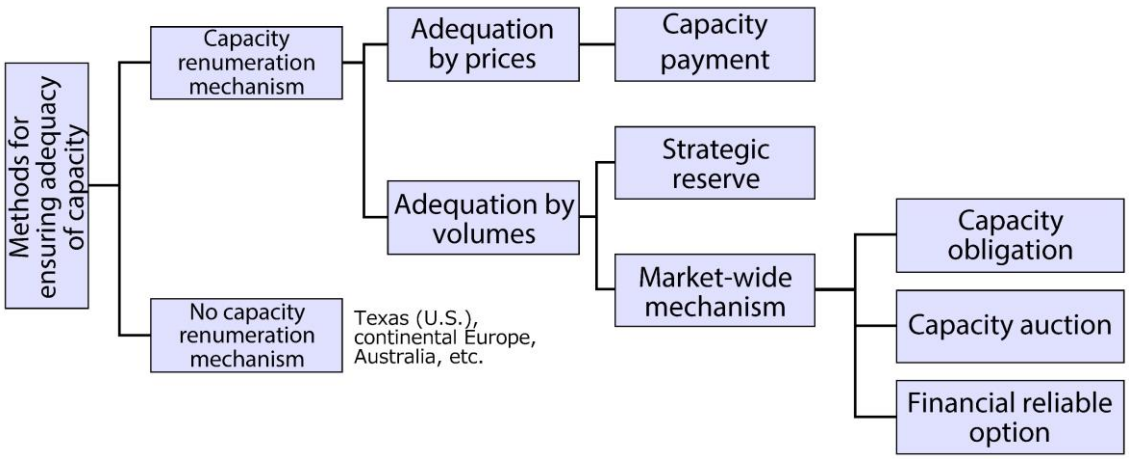
Part 3 Concept of capacity market and decarbonization

1. Diversity of capacity mechanisms

The 2013 Report recommended creating a mechanism for ensuring the supply capacity necessary for stable electricity supply. This is because, supply and demand of electricity must be balanced, but it takes time build new power plants to secure supply capacity. The market systems discussed in Parts 1 and 2 of this chapter are all systems for relatively short-term electricity (kWh) transactions, but the capacity mechanisms discussed in this part are for the purpose for securing the long-term adequacy which ensure reliable electricity supply at all times.

There are various types of capacity mechanisms (Figure 3-2). As past precedent, in the 1990's, "capacity payment" systems were introduced in the UK, Spain and other countries to pay preset prices for supply capacity at generation facilities. However, pricing capacity appropriately is difficult, and in the UK the system was abolished in 2001.

Figure 3-2 Types of capacity mechanisms



Source: The Institute of Energy Economics, Japan, "FY2016 Electric Power Grid Related Facility Formation Survey Project (Survey on Overseas Capacity Mechanisms)" (March 2017) Figure 1-1. (https://www.meti.go.jp/meti_lib/report/H28FY/000724.pdf)

[65] Toru Hattori, "Liquidity in the Wholesale Electricity Market and Trading Volume in Spot Market in the Major European Countries," CRIEPI Research Report Y16003 (2017), p.7. (https://criepi.denken.or.jp/jp/kenkikaku/report/detail/Y16003.html)

There is another method called capacity setting. Capacity setting does not set official prices; rather it involves mandating that retail electricity providers secure a certain amount of capacity, and capacity prices are then determined by the market. There are several types of capacity setting.

First is a system called strategic reserve capacity. This system addresses supply capacity shortages in emergency situations while supply-and-demand balancing is basically left up to the wholesale electricity market. Power plants procured as strategic reserve capacity are on standby for emergencies only and cannot sell their electricity. Given this characteristic, strategic reserve capacity involves making payments for maintaining power plants that have aged following full depreciation. The countries adopting this system include Sweden and Germany.

A major market mechanism is a system for ensuring regular supply capacity, not reserve capacity. A major market mechanism basically begins with mandating that retailers secure supply capacity. There are a number of ways to secure this supply capacity. They include a distributed capacity market (mandated securement of supply capacity) through which retailers procure electricity from generators, including via bilateral agreements, and a centralized capacity market (capacity auction) in which grid operators stipulate the supply capacity necessary for the overall market and conduct an auction for the entire amount.

2. Discussion of Japan's capacity market design

Japan plans to establish a centralized capacity market through which bidding will take place to procure supply capacity several years in advance, based on projections for the amount of capacity that will be needed to meet the country's overall electricity demand. Based on the results of the auction, the capacity value paid to generators will be determined, and the expenses will be paid by retail providers and, ultimately, by electricity consumers.

Behind the decision to introduce this capacity market were government doubts about leaving the securing of supply capacity up to the functioning of the wholesale electricity market[66]. However, it is possible to economically incentivize the securing of supply capacity by using market functions. Specifically, forming a "Balance Responsible Party" (BRP) from generators and retailers and having that party assume responsibility for supply-and-demand balancing creates as a matter of principle the incentive to economically align supply and demand at present and in the future as well. For example, there are concerns that when future supply capacity is projected to be insufficient, electricity procurement costs will spike. A BRP would bear this economic burden, so there would be an incentive to mitigate this risk by securing necessary supply capacity in advance[67]. In this way, it would be possible to have a system for securing supply capacity without relying on a capacity mechanism.

However, in Japan's current wholesale electricity market, the former major power companies own almost all power plants (see Part 1 of this chapter), so it cannot necessarily be called competitive. In such a market environment, having generators and retailers form a BRP and incentivizing the securing of supply capacity within this could, conversely, also promote enclosure of power sources. Accordingly, first of all, Japan should eliminate the oligopoly in its generation market. Next, it will be essential to enhance the various functions of the wholesale electricity market for the future.

At the same time, there are questions about whether a capacity market is really the best way to ensure supply capacity. This is because many issues have been pointed out with regard to the capacity market's system design and operation.

The first issue is whether the system operator will be able to set capacity appropriately for the market as a whole. If capacity is set at inadequate levels, supply shortages will result, and if levels are too high, then generators will be overpaid, which would improperly increase electricity rates[68]. In addition, it has been shown that the centralized option tends to increase capacity costs on a per kWh basis[69].

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66 METI, Advisory Committee for Natural Resources and Energy, Electricity and Gas Industry Committee, Electricity and Gas Basic Policy Subcommittee, System Review Working Group, "Interim Summary (2nd)" (December 2017), p.39. (https://www.meti.go.jp/shingikai/enecho/denryoku_gas/denryoku_gas/seido_kento/pdf/20171226_01.pdf)

67 At the same time, if an upper price limit is set, for example, on the wholesale electricity market, the risk of electricity procurement costs spiking would be reduced, so there would be less incentive for the BRP to secure necessary supply capacity. Under these conditions, the validity of introducing a capacity mechanism is established.

68 Aiko Azuma, "Capacity Mechanism System Design in Germany," Electricity System Reforms and Renewable Energy, Nippon Hyoron Sha (2015).

69 Toru Hattori, "On Choice and Implementation of Capacity Mechanism–Coping with the Uncertainty associated with the Institutional Design– ," Electricity Economics Research (2015), No. 61, pp.1-16.

The second issue is the difficulty of system design. To conduct an auction, various parameters have to be provided in advance, and system design becomes complex as a result. This complexity can make the system susceptible to various defects[70].

The third issue is system risk. Given the difficulty of system design for capacity markets, it is possible the design will be changed repeatedly, and if capacity setting is impacted by political motives and the motives of the electric power industry, capacity prices will become even harder to predict[71].

The fourth issue is that depending on the system design the same capacity value would be paid for new power plants as old, fully depreciated plants. Power plants that have been fully depreciated should have almost no fixed costs, and it is possible that maintenance costs will be covered by the market alone. Paying an additional capacity price under such circumstances would inevitably lead to an increase in electricity rates.

The fifth issue is that with variable renewable energy (VRE) like solar PV and wind power increasing, flexibility will be important for balancing supply and demand, but a centralized capacity market will not necessarily be able to meet this need. This is because on centralized capacity markets only capacity is evaluated, not flexibility, and capacity is determined beginning with the cheapest available without regard to the relative degree of flexibility.

In particular, the final issue is whether the market would be consistent with an energy policy directed at realizing a decarbonized society. The following section will discuss the issue of consistency between capacity markets and decarbonization policy in more detail.

3. Inconsistency with decarbonization policy

The view that has been underrepresented in discussions of capacity mechanisms in Japan is whether policy allowances will be made for realizing a power source mix for a decarbonized society.

The biggest issue is that no carbon emission hurdles have been put up for power sources potentially participating in the capacity market. Japan has targets of reducing greenhouse gas emissions by 26% by 2030 compared to 2013, and by 80% by 2050. However, as of April 2020, essentially no systems exist that would ensure the achievement of these targets[72]. In fact, the Ministry of the Environment has expressed concerns about this situation and will establish new criteria for environmental impact assessments and create new standards for new coal-fired plants[73]. However, based on these new standards from the Ministry of the Environment it will still be possible to build new coal-fired power plants, and there will be no regulations on existing coal-fired plants.

Under these conditions, allowing all thermal power plants to participate in the capacity market provides an economic incentive to power plants that are difficult to tolerate environmentally, which not only endangers achievement of the aforementioned greenhouse gas emission targets but also gives the wrong investment signal to investors and generators. Particularly, once a power plant is built, the generator attempts to fully utilize its asset over several decades, so capacity markets have a strong impact on the long-term power source mix. Based on this, as will be discussed below, in fact in the UK, a mechanism for maintaining consistency with decarbonization policy is incorporated into the capacity market system plan.

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[70] Supra note 69 “On Choice and Implementation of Capacity Mechanism.”

[71] Supra note 69 “On Choice and Implementation of Capacity Mechanism.”

[72] In the “Standards of judgement for business operators related to the rational use of energy in factories, etc.” (METI Notification) under the Act on the Rational Use of Energy (so-called Energy Conservation Act), the standards of judgement are stipulated as, when new thermal power plants are built by generation providers, annual efficiency not substantially lower than the average generating efficiency on the receiving end of dedicated thermal power facilities in Japan, and further, generation efficiency of thermal power being premised on the energy mix in 2030 (indicators A and B). However, these judgement standards are not mandatory.

[73] “Ministry of the Environment Promoting New Standards, State-of-the-Art Facilities for New Coal-Fired Thermal Plants,” Nihon Keizai Shimbun digital edition (March 28, 2019). (https://www.nikkei.com/article/DGXMZO43011380Y9A320C1EAF000/)

Likewise, the major problem, as mentioned above, is the lack of consideration given to how to ensure flexibility to accommodate large deployment of VRE, solar PV and wind power. VRE has also a certain amount of capacity value, so when this increase, capacity demand at peak times will decrease. At the same time, in cases like this, there will need to more highly flexible power facility capacity and demand response capability. This contradiction cannot be handled with the usual capacity mechanisms[74].

4. Capacity market designing example in Europe and the US

In response to the above two problems, in Europe and the US, several mechanisms have been introduced for each. First, as an example of ensuring consistency between the capacity market and decarbonization, the UK has the Emissions Performance Standard. The UK established a centralized capacity market under the Energy Act 2013 (EA 2013) with a view to abolishing coal-fired power by 2025 and increase investment in highly flexible gas-fired power. At this time, in 2015, the Emissions Performance Standard was introduced to curb the increase in coal-fired power. The country established an emissions factor standard of 450 g/kWh for new thermal power plants and put restrictions on annual carbon dioxide emissions to make it nearly impossible for new coal-fired plants to participate in the capacity market (EA 2013 Chapter 8.57)[75]. From these conditions, the Emissions Performance Standard has been rated as effective[76].

The second example is from California, which since 2015 has implemented its Flexible Resource Adequacy program to ensure supply stability while accommodating mass deployment of VRE[77]. The program mandates that retailers secure flexible capacity necessary in the service area of the California Independent System Operator (CAISO) to manage grid reliability. Necessary flexible capacity is here defined as capacity that can accommodate time slots with the most variability over three consecutive hours each month. CAISO's necessary flexible capacity in 2015 was 7,861 MW in August, the lowest, and 11,212 MW in December, the highest. The capacity needed to have this flexibility is allocated to each retailer and must be secured by them.

As discussed above, various points must be considered on how to secure appropriate supply capacity and how to incentivize it. Considering that Japan must directly engage in decarbonization initiatives going forward, focusing only on supply capacity quantity and not at all on quality is highly questionable. Japan in particular has almost no effective market mechanisms or regulations, like carbon pricing, to achieve its reduction targets by 2050.

Capacity mechanisms are a system directly linked to the future long-term power source mix. Unless measures are quickly taken to ensure consistency with decarbonization policy, the wrong capital investment will be promoted and it may put a future burden on providers as well. The government should, as soon as possible, incorporate measures regulating carbon dioxide emissions into its capacity mechanism and shift the focus of system design to securing flexibility to complement the increased deployment of VRE.

■Recommendation 3-4: Design a capacity mechanism consistent with decarbonization policy

For ensuring consistency with decarbonization, the system should be designed to ensure flexibility in the market so that the regulations on carbon dioxide emissions can be incorporated into the capacity mechanism and that mass deployment of renewable energy can be accommodated.

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[74] Fang, X., Hodge, B. M., and Li,F., "Capacity market model considering flexible resource requirements," preprint, presented at the IEEE Power and Energy Society General Meeting, August 5-10, National Renewable Energy Laboratory (2018).(https://www.nrel.gov/docs/fy19osti/70162.pdf)

[75] Legally, power plants that install CCS are exempt from the standard for a certain period of time (EA 2013 Chapter 8.58), but since the cost is high, there have been no cases of this being made commercially viable.

[76] UK Department for Business, Energy & Industrial Strategy, "Capacity market and emissions performance standard review, *Summary of call for evidence responses*" (2019), pp.32-33. (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/784315/cm-and-eps-review-summary-of-cfe-responses.pdf) At the same time, an annual CO_2 emissions standard has been set with base load coal-fired power in mind, so there has been criticism that this will not effectively regulate coal-fired plants, which are expected to operate during times of peak load.

[77] California Public Utility Commission, "Decision adopting local procurement and flexible capacity obligations for 2015, and further refining the resource adequacy program," Decision 14-06-050 (2014). (http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M097/K619/97619935.PDF)

Addendum:

In September 2020, while the English translation of this report was underway, the results of the first capacity market auction were announced.

The auction is to provide the capacity for FY2024, while the total contracted capacity of 167.69 GW, the contracted price is 14,138 JPY/kW, and the total amount is 1,598.7 billion JPY, which is 1.5 times as much as expected. Although it will be borne by retailers, major electric power companies will be able to absorb it in the power generation segment, so there are concerns about the large burden for new power retailers that do not have power plants. This is the money that power consumers will ultimately bear in the form of electricity rates, which will be an increase of about 2 JPY/kWh.

As pointed out repeatedly in this report, along with the incomplete unbundling, the fact of oligopoly in the generation and retail segments, and the existence of "internal and external discriminations" within the major power companies, will have a major impact on this problem.

A review of the bidding process as well as this year's results are absolutely crucial for adjustments. In the first place, it might be requisite that discussing whether a capacity market is necessary to be introduced. We continue to keep a close eye on the future of the capacity market.

Chapter 4 Realizing fair and rational grid operations

A major pillar of electricity system reform, unbundling was conducted in April 2020. It is intended to reduce overall electricity prices by having marking participants, including generators and retailers, respectively, engage in supply-and-demand balancing and to effect the further utilization of distributed power sources such as renewables by enabling the fair use of transmission and distribution networks by these market participants. In addition, it enables transmission companies to focus primarily on managing their transmission businesses. In this chapter, we discuss access to transmission networks by new power sources, which is one factor in grid operations by transmission companies that is restricting expanded deployment of renewables, cross-regional development across areas of the transmission companies, and supply-and-demand balancing utilizing a market mechanism.

Part 1 New initiatives for grid connection

Eight years have already passed since the feed-in tariff scheme (FiT) was introduced in July 2012. And deployment of renewables in Japan, led by solar power, has been steadily increasing. Even with further growth in renewables expected going forward though, there are a number of restrictions that are making it difficult for new renewable sources to be introduced. They include, for example, delayed grid connection when there is not enough available capacity on transmission lines nationwide, output curtailment on solar PV and wind power in the Kyushu area, and demands that storage batteries be installed for new connections in Hokkaido. These and other factors are making the environment surrounding the renewable business even more challenging. However, as these problems continue to be addressed it has become clear that these limitations are not intrinsic to deployment of renewables itself but rather are being caused by the difficulty new power sources, including renewables, have in connecting to the grid as a result of inefficient operating practices. Going forward, a more efficient, highly transparent grid operation system is sought to be built while ensuring fairness between existing power sources and new power sources. In this part, we focus the discussion on grid connection by new power sources with a view to realizing fair and rational grid operations.

1. Lack of "available capacity" on transmission lines

With new connection applications by renewable power facilities, primarily solar PV, increasing, available transmission capacity at points where power plants connect to transmission lines nationwide, and capacity on higher voltage transmission lines, have been insufficient, which often results in these new facilities being unable to connect to the grid. General transmission providers release available transmission capacity figures for their regions, and in regions with zero available capacity, grid enhancement costs must be borne for new connections and grid enhancement work must be conducted, which takes as long as a decade or more.

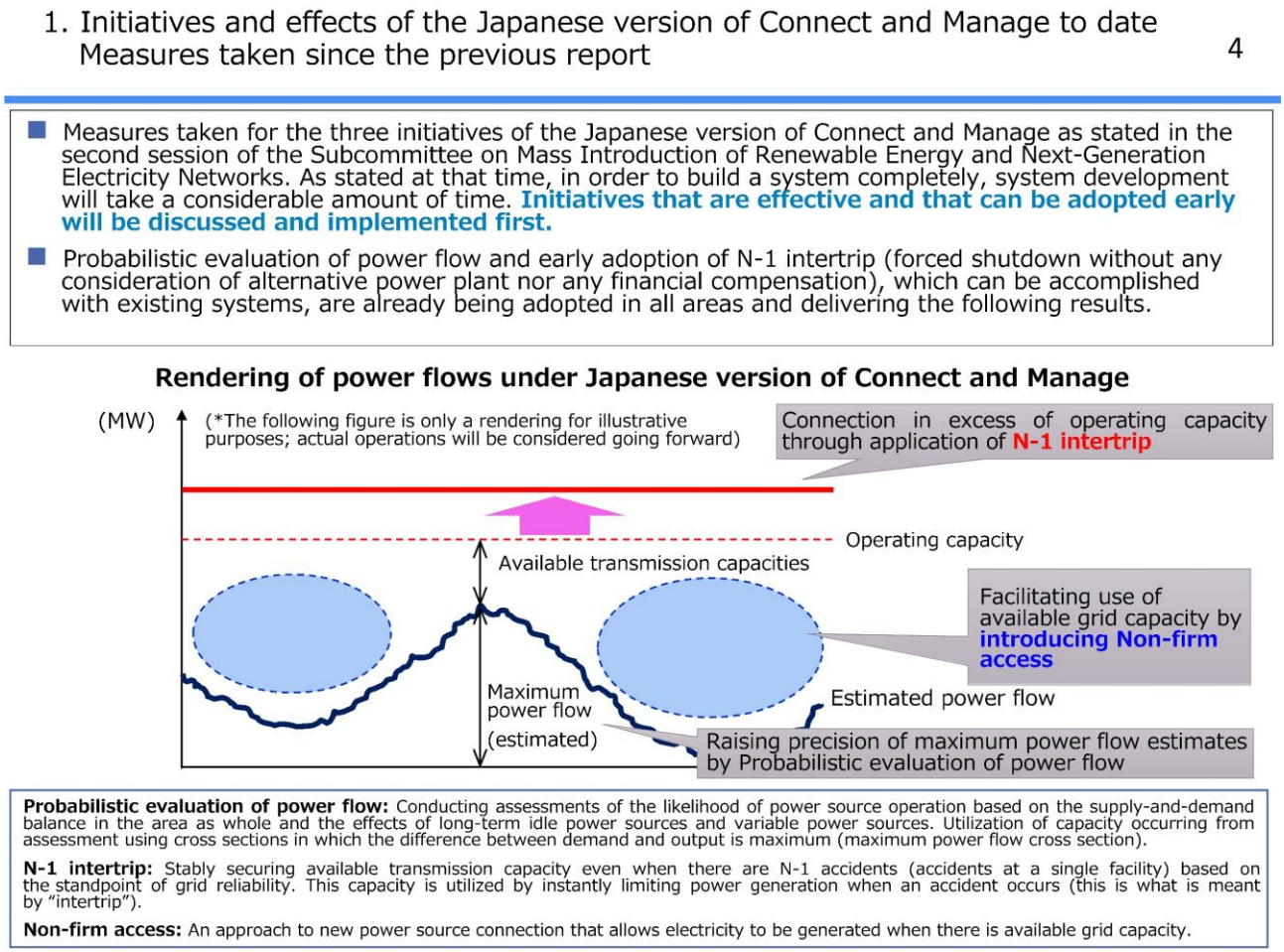
In the background as to why available capacity on transmission lines is insufficient and connection by new power sources is delayed is the “first-come, first-served” rule for power source connection. According to a summary of the situation prepared by the Electric Power System Council of Japan, which was ended in 2015 and its role taken over by OCCTO, when a new power source would connect to the grid, considerations had to be made to constantly ensure that power facilities already connected to the grid were not restricted; that is to say, to ensure that already connected power sources were able to generate electricity at maximum output. Despite the fact that the actual generating output of each power source varies with supply-and-demand conditions, the weather, and other factors, grid capacity always had to be allocated to existing power sources based on their maximum output. This meant that new power sources could not use this allocated capacity even temporarily, and in regions with insufficient grid capacity, it meant waiting for transmission networks to be reinforced.

2. Japanese version of “Connect and Manage”

With the shortage of available capacity on transmission lines becoming a problem nationwide, OCCTO began a new initiative, the Japanese version of Connect and Manage, as a new way to manage power source connections (Figure 4-1). The organization plans to apply it to all areas in 2022. The Japanese version of Connect and Manage is comprised of three new initiatives.

The first is Probabilistic evaluation of power flow. Probabilistic evaluation of power flow means revising the practice of allocating grid capacity to existing power sources on a maximum output basis and using instead simulations of actual power flows. Grid capacities over-allocated to existing power sources would be revised by this, which can be expected to increase available capacity. This practice commenced in April 2018 and has resulted in increasing available capacity nationwide by approximately 5.9 GW[78].

Figure 4-1 Initiatives for Japanese version of "Connect and Manage"



Source: OCCTO, "OCCTO Considerations on Japanese version of Connect and Manage," METI, Advisory Committee for Natural Resources and Energy, Energy Conservation and New Energy Committee, Electricity and Gas Industry Committee, Renewable Energy Mass Deployment and Next-Generation Network Subcommittee, 11th session (December 26, 2018), Document 2, p.6. (https://www.meti.go.jp/shingikai/enecho/denryoku_gas/saisei_kano/pdf/011_02_00.pdf)

The second initiative is N-1 (N minus one) intertrip. On Japan's power grid, stable transmission is possible even when there is an accident at a power plant. For example, two transmission lines are established for one route, but when everything is functioning normally only the capacity of one is utilized; the other's capacity is kept for backup. N-1 power control refers to increasing the amount of capacity that can be used in normal times by controlling connected power sources (stopping them, for example) when there is an accident on a transmission line. Applying N–1 intertrip provides major benefits, an estimated increase in available capacity nationwide of approximately 40.4 GW[79].

[78] OCCTO, "OCCTO Considerations on Japanese Version of Connect and Manage," METI, Advisory Committee for Natural Resources and Energy, Energy Conservation and New Energy Committee, Electricity and Gas Industry Committee, Renewable Energy Mass Deployment and Next-Generation Network Subcommittee, 11th session (December 26, 2018), Document 2, p.6. (https://www.meti.go.jp/shingikai/enecho/denryoku_gas/saisei_kano/pdf/011_02_00.pdf)

[79] Supra note 78, "OCCTO Considerations on Japanese Version of Connect and Manage," p.9.

The third initiative is Non-firm access. Whereas N-1 intertrip increases available capacity for new connections by making it possible to control power sources when a grid accident occurs, Non-firm access increases available capacity for connection on the condition of output curtailment when there is a major increase in the output of solar PV or wind power during normal times. According to estimates made ahead of a Non-firm access trial conducted by TEPCO PG, when 5 GW of renewables sources was added to Chiba's Shin-Keiyo Line and Shin-Sawara Line, annual curtailment time was found to be less than 1%[80]. TEPCO PG has since announced trials in Chiba and northern Kanto ahead of other transmission operators[81].

3. Cases of overseas grid integration of renewables

As discussed above, applying the Japanese version of "Connect and Manage" is expected to effect progress toward eliminating the problem of shortages in available transmission capacity on the grid. However, these measures are only the first step toward making grid operations efficient.

In connection with "Connect and Manage," "N-1 intertrip" and "Non-firm access" have been discussed, but the connections considered in conjunction with power source control have only been new connections; controlling existing power sources has not been considered. In other words, measures to increase the efficiency of the operations of existing power sources, which account for the vast majority of power plants, are being put off until later and have not been adequately discussed. Developing new connection management methods that include existing power plants is indispensable to building a more efficient and fair electricity system.

In addition, though applying "Connect and Manage" is expected to expedite grid connection by new power sources, as of the present, the initiatives have been positioned as only temporary measures until grid enhancement is completed, and ultimately, grid enhancement is seen as being needed in each region.

When existing power sources are factored in, the aforementioned estimates on the effects of "N-1 intertrip" and estimates for "Non-firm access" trials by TEPCO PG suggest the possibility of major increases in available capacity as well as additional connection by new power sources. Moreover, considering that increasing the efficiency of operations at existing power sources may further amplify these effects, grid connection methods will need to be developed for new power sources that are not conditioned on new transmission line enhancements.

Specifically, a methodology founded on forming more flexible grid facilities is needed, in which the instances of power source control for grid congestion and its elimination that occur while continuing to move forward with grid connection by new power facilities is made the key indicator, and grid enhancements are only commenced when this indicator exceeds a certain threshold. This method would make it possible to avoid transmission line enhancement altogether in certain regions, and the enhancement process to begin quickly when it becomes necessary. The grid could be expected to be developed in accordance with how transmission lines were being used.

Looking at examples of grid operations overseas can help us think about solutions to Japan's own problems. For example, Germany has a congestion management system that controls all power sources, including existing sources. It uses a "priority access" approach that gives priority to renewable power sources for use of the grid. With no fuel costs, solar PV and wind power are traded on the wholesale market on a priority basis ("priority dispatch"), and grid congestion management is conducted in order to maximize use of these resources based on this approach. The background to this is the cost of controlling already connected thermal power output when power flows on transmission lines are projected to exceed capacity due to increased generation by solar PV and wind power facilities. In Germany, this operation is called "re-dispatching." In this way, in Germany, through priority access and re-dispatching, solar PV and wind power are used on a priority basis. The Japanese version of "Connect and Manage" has not considered operating measures for existing power sources such as Germany, and it is feared that this could hinder the fair opening of transmission networks.

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[80] TEPCO Power Grid, Inc., "Summary of Trial Initiatives in Chiba" (August 9, 2019). (https://www4.tepco.co.jp/pg/consignment/retailservice/pdf/shikotekisetsumeikai.pdf)

[81] TEPCO Power Grid, Inc., "Summary of Non-Firm Access Applied to Kashima Grid" (January 24, 2020). (https://www.tepco.co.jp/pg/company/press-information/press/2020/1527228_8615.html)

Japan in the past did consider “re-dispatching” when its version of “Connect and Manage” was being planned. However, for existing power plants with connection contracts premised on the “first-come, first-served” approach, it was thought it would be difficult to apply new operating rules, and this is why re-dispatching was put off. In Germany’s case, when re-dispatching applies to existing power sources, there is a mechanism to compensate for costs that are incurred as a result of this so that the existing power sources are not disadvantaged. As a result, it becomes possible to optimize grid operations in a manner that includes existing power sources. In order to switch to an operating method for a physically optimal electricity system while respecting contracts that are already in place, it would be effective to use the economic tool of compensation. In planning N-1 intertrip as a part of the Japanese version of “Connect and Manage,” discussions took place on how to distribute the economic burden of generation constraints.

However, when incorporating an economic means such as compensation into the system, it goes without saying that careful discussion is needed on the new burden that will occur and its fairness. In the example of Germany, we just looked at, as of 2016, compensation for re-dispatch actually conducted to avoid power flow congestion totaled 220 million euros, and compensation for output curtailment totaled 643 million euros, so not a small amount has been paid out to cover costs. At the same time, new power sources are able to connect to the grid without waiting for new, large-scale transmission line enhancements, and when transmission lines are enhanced going forward, the burden of re-dispatch and output curtailment is expected to decrease. In order to make the Japanese version of “Connect and Manage” more efficient, quantitative analysis needs to be conducted on the impact on future grid enhancement plans while assuming the introduction of re-dispatching and other measures.

■Recommendation 4-1:
Expand full application of the Japanese version of “Connect and Manage” and apply it to existing power sources

The Japanese version of “Connect and Manage” should be fully applied as soon as possible by all grid operators to address the problem of shortages in available grid capacity. In addition, the system should be improved to create a more rational connection management method that includes existing power sources.

Part 2 Rational enhancement of transmission networks

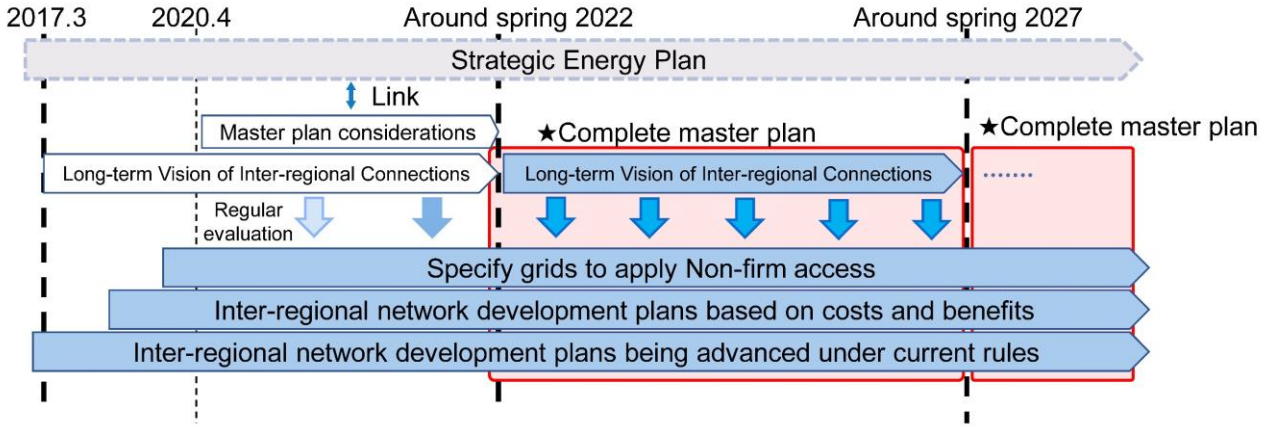
1. Importance of systematic transmission network design

Grid connection problems surrounding renewables in Japan at present stem from existing rules related to transmission networks, as discussed in Part 1. If connection rules were changed so as not to disadvantage new market entrants, which, in this context, are renewable power generators, there would still be plenty of room to deploy renewables without damaging supply stability. However, as the rate of VRE sources increases, the operating rules discussed in Part 1 of this chapter need to be applied, inter-regional operations need to be expanded, and transmission network enhancements also need to be put on the table. Practically, it takes a decade or more to build a transmission line, so the bulk transmission lines and interconnectors (both regional and international) must be enhanced or built in a planned manner from a national-level perspective.

An example thus far of OCCTO considerations related to transmission networks is its Long-term Vision of Inter-regional Connections established in March 2017. As a part of this, power flow simulations were conducted under certain conditions, and the cost of inter-regional connection enhancements was compared with the benefits of reduced fuel costs at existing thermal power plants, but it was determined that there would only be small benefits from these enhancements. As a result, for the foreseeable future, importance will be placed on maximum effective utilization of existing facilities and inter-regional merit order operations; and regarding interconnection enhancements, it was stated: “Efforts will be directed to the formation of optimal facilities rated comprehensively for power source costs and power flow costs while also based on government policy and the characteristics of each power source.” Thereafter, considerations were made on enhancing inter-regional connections such as Hokkaido-Honshu interconnection facilities (so-called the New-new Hokkaido-Honshu HVDC Link), among others, upon the blackout in the Hokkaido area, and cost-benefit analyses performed for route selection and the like. However, there was no discussion on inter-regional interconnection enhancement based on the assumption of nationwide expansion in the utilization of renewables.

In response to this, METI, Advisory Committee for Natural Resources and Energy's Subcommittee on Electric Power Resilience for a Decarbonized Society announced a policy of discussing long-term grid development from the standpoint of utilizing the potential of renewables nationwide. The subcommittee's interim report released in August 2019 stated the following: "From the standpoint of promoting mass deployment of renewable power sources while limiting the burden on citizens, going forward, in response to individual connection requests from power sources, it will be important to shift from considering 'pull'-based grid formation on a case-by-case basis to OCCTO and general transmission and distribution operators initiating considerations of power source potential and forming the grid in a planned, 'push'-based manner. "[82] Going forward, a master plan will be established for nationwide grid development[83], based on which individual transmission lines constructed (Figure 4-2).

Figure 4-2 Schedule of master plan design



Source: Cross-regional Network Development Committee Executive Office, "Concerning Period Grid Development Formation (Considerations on New Long-Term Cross-Regional Grid Policy)", Cross-regional Network Development Committee, 45th session (December 10, 2019), Document 1, p.5. (https://www.occto.or.jp/iinkai/kouikikeitouseibi/2019/files/seibi_45_01_01.pdf)

2. Necessity of open discussions on identifying broad social benefits

METI is also envisioning the large-scale deployment of renewables in the master plan, but most importantly, it has to develop a plan that differs from the conventional approach of operating the grid, which emphasizes large-scale power plants generated by fossil fuels and nuclear power geographically remote from consumers and transmitting large amounts of electricity. Moreover, in order to make maximum use of renewables that have not yet been fully deployed in Japan, i.e. offshore wind power, considerations need to be made on how to make the grid suitable for these renewables.

When projects that have a multifaceted impact are initiated and entirely new plans are formulated, such as medium/long-term inter-regional grid construction plans (the master plan in this case), cost-benefit analyses need to be conducted, assumptions made in advance on the various effects and impacts, and priorities determined on this basis.

[82] METI, Advisory Committee for Natural Resources and Energy, Subcommittee on Electric Power Resilience for a Decarbonized Society, "Interim Report" (August 2019), p.7. (https://www.meti.go.jp/shingikai/enecho/denryoku_gas/datsu_tansoka/pdf/20190730_report.pdf)

[83] The master plan is comprised of the Long-term Vision of Inter-regional Connections and the Inger-regional network development plans primarily formulated by OCCTO to date.

In the aforementioned cost-benefit analysis conducted in 2017 as a part of the Long-term Vision of Inter-regional Connections, the main benefit of inter-regional connections was discussed only in terms of total generation costs and the effects brought about by the inter-regional connection, only in terms of eliminating market fragmentation. In addition, the benefits from deployment of renewable energy are only included as a part of generation costs, and its contribution to reducing carbon dioxide emissions, which purportedly is one of the country's policy goals, was not evaluated as a social benefit[84]. Looking at precedents, Europe has conducted broad-ranging cost-benefit analyses in developing inter-regional grids, ENTSO-E, a group of transmission system operators, clearly positions increased deployment of renewables as climate actions and thus a benefit, and it assesses this as an effect that can be brought about through transmission grid construction[85]. Similarly, Ofgem in the UK has made promotion of decarbonization an evaluation axis for interconnectors[86].

As can be seen in these precedents, cost-benefit analysis (or, cost-effect analysis) is conducted from a social perspective based on a broad recognition of the benefits and effects brought about for society as a whole. Defining benefits is strongly related to how social value is defined, so it is extremely important to have discussions on what is defined as value. At the same time, it is also correlated with examination policies for regulated grid tariffs, so it is essential that such discussions take place at the national committee level and transparency is ensured.

From this standpoint, in the process of formulating the master plan, the matter of defining benefits and their scope for cost-benefit analysis should be discussed not only by OCCTO alone but with multiple leading experts involved as well, and opinions from the general public should also be broadly heard.

3. Cost burden for grid formation

Up to this date, the cost of building and enhancing transmission lines has been covered by regulated grid tariffs collected from power consumers within their service areas by the general transmission/distribution operators that build the transmission lines. However, with the expansion of cross-regional transmission network operations, the benefits of the transmission lines simultaneously extend nationwide. In this sense, there needs to be a mechanism for sharing costs nationwide in line with the nature of the benefits. As increased deployment of renewables is a policy goal for the country as a whole, the grid development costs to achieve it should be shared nationwide as well. Even in government deliberations, the benefits of inter-regional connection enhancement are divided into three categories[87], and from the standpoint of the burden on beneficiaries, it has been indicated that the portion of benefits brought about by cross-regional merit order will generally be shared nationwide[88]. In terms of the concrete policies, use of Japan Electric Power exchange (JEPX) price difference revenue[89] and use of a renewable energy surcharge under FiT system have been proposed[90].

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[84] Cross-regional Network Development Committee Executive Office, "(Long-term Vision) Concerning Cost-Benefit Analyses," OCCTO Cross-regional Network Development Committee, 27th session (November 2, 2018) Document 1-(2). (https://www.occto.or.jp/iinkai/kouikikeitouseibi/2017/files/seibi_27_01_02.pdf)

[85] ENTSO-E, "2nd ENTSO-E Guideline For Cost Benefit Analysis of Grid Development Projects *FINAL –Approved by the European Commission*" (September 27, 2018). (https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/tyndp-documents/Cost%20Benefit%20Analysis/2018-10-11-tyndp-cba-20.pdf)

[86] Ofgem, "Cap and floor regime: Initial Project Assessment of the GridLink, NeuConnect and NorthConnect Interconnectors" (June 19, 2017). (https://www.ofgem.gov.uk/system/files/docs/2017/06/ofgem_window2_ipaconsultation_june_2017.pdf)

[87] Three contributions: Greater stable power supply, increased transactions from cross-regional merit order, and mass deployment of renewable energy. Supra note 82, "Interim Report," p.19.

[88] Supra note 82, "Interim Reports," p.19.

[89] The day-ahead market is originally used to determine a system price applicable nationwide, but when there are restrictions on regional interconnection capacity and electricity cannot be sent across areas, the price is calculated for each area (market splitting), which produces different prices for different areas. Presently, the product of multiplying the contracted amount via the regional interconnection by this price difference is accumulated at JEPX as the market price difference reserve.

[90] This is one of the revisions in the Bill for the Act of Partial Revision of the Electricity Business Act and Other Acts for Establishing Resilient and Sustainable Electricity Supply Systems. The bill is a cabinet decision (February 25, 2020), and as of April 2020, it is expected to be enacted by the 201st Diet. METI news release, "Cabinet Decision on the Bill for the Act of Partial Revision of the Electricity Business Act and Other Acts for Establishing Resilient and Sustainable Electricity Supply Systems" (February 25, 2020). (https://www.meti.go.jp/press/2019/02/20200225001/20200225001.html)

Of these, use of JEPX's price difference revenue is rational in that revenue caused by capacity shortages on inter-regional connections is allocated to investment in the transmission enhancements. European system allows revenue from transactions that span interconnectors to be used for interconnector operation, maintenance and investment in new interconnectors.

By contrast, use of a renewable energy surcharge is problematic. Regulated grid tariffs are determined via examination in an open venue in order to promote cost-efficient business operations by general transmission/distribution operators, and grid reinforcement costs are strictly checked as a part of this. However, with a renewable energy surcharge, naturally no such examination is planned, and it is possible that general transmission/distribution operators will not be incentivized to reduce costs. In addition, even though enhancements will be made using a renewable energy surcharge, it must be admitted that after the enhancements power sources other than renewable energy also may benefit as a result. For example, after grid enhancement, when a new thermal power plant applies to connect to the grid in that region, it does not follow that the enhanced transmission lines will always be used only by renewables. Even under the regulated grid tariff system, it is possible to add a national cost-sharing mechanism, and the advantages of introducing another system are not at all clear.

Even supposing a renewable energy surcharge is adopted, there needs to be a framework whereby cost-efficient enhancements are conducted after ensuring the broad participation of stakeholders and the transparency of procedures. Specifically, the scope of recognized effects of promoting the deployment of renewables, from which the renewable energy surcharge would be collected, needs to be strictly analyzed and determined. From this standpoint as well, evaluation via cost-benefit analysis, as discussed in Part 2 above, is extremely important, and it cannot be emphasized enough that these discussions need to take place with broad input from the nation's citizens. Moreover, a framework is needed for disclosing enhancement cost information and conducting strict examinations so that cost-efficient grid development is carried out.

■Recommendation 4-2:
Formulate a master plan based on sufficient consideration of a broad range of benefits

In formulating the master grid plan, opinions on benefits need to be broadly heard and discussions on them need to take place at the national level. The benefits brought about by deployment of renewable energy should be considered as a part of this.

■Recommendation 4-3:
Create a cost-efficient, rational framework for grid enhancement cost sharing

The cost of enhancing inter-regional connections should be shared nationwide and JEPX price difference revenue should be promptly utilized. The renewable energy surcharge approach is problematic, but even supposing it were adopted, strict analysis of the effects of renewable energy deployment needs to be conducted along with disclosure and close examination of cost information.

Column:

Approaches to setting charges for grid strengthening
– Generation Side Basic Wheeling Charge, G-Charge

A "Generation Side Basic Wheeling Charge, G-Charge" is a system that allocates a portion of the cost of grid formation to generation facilities that connect to the grid through the mechanism of a basic charge. As of April 2020, the details of the system's design are currently being discussed by the government committee and other bodies, but it has been proposed that the system cover a portion of the fixed costs of the bulk transmission lines and that charges be set based on generation facility capacity, with, basically, a single charge being uniformly applied to all power sources of 50 kW or greater.

Overseas, there are countries with similar systems, but what is problematic about the current proposal for Japan's system is that charges are uniformly applied on a kilowatt basis to all power sources. Variable renewable energy sources such as solar PV and wind power, as well as hydropower, whose output changes with the season, would have a higher burden of charges on a kilowatt-hour basis compared to coal-fired power and nuclear power, and this burden is expected to be big enough to affect competitiveness. For example, if the charge currently proposed is applied, solar PV costs would rise by 1.5 yen per kilowatt-hour. In the UK, it has been pointed out that charges on a uniformly kilowatt basis inhibit promotion of variable renewable energy, and in Germany, charging the generation side is prohibited[91].

In case that grid users are made to bear appropriate costs, a method could be applied in which a certain level of basic charge is collected based on the maximum amount used (kW) and then usage charges are set based on amounts used (kWh) while guaranteeing stable revenues for general transmission and distribution providers. Not all power sources use the bulk power grid in the same way. As a general rule, the closer the connecting power source's voltage is to the voltage of the bulk power grid, the greater the possibility is that the power source of the main grid will be used. Conversely, power sources that connect to high or low voltages have a limited possibility of using the bulk power grid. In this sense, a setting higher basic charge for the higher the voltage of the grid being connected to could be one of methods.

When introducing the "Generation Side Basic Wheeling Charge" it is necessary to discuss the pros and cons of setting the charge for renewables under feed-in tariff system. And it's crucial to conduct quantitative analyses on its impact on multiple markets, based on several scenarios, not exclusively with uniformly kilowatt-based charge but also with other types of charge methodologies. The introduction of the system needs to be carefully debated.

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[91] Refer to the following materials.

ACER, "Practice report on transmission tariff methodologies in Europe" (December 23, 2019). (https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Practice%20report%20on%20transmission%20tariff%20methodologies%20in%20Europe.pdf)

ACER, "Opinion No 09/2014 on the appropriate range of transmission charges paid by electricity producers" (April 15, 2014). (https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2009-2014.pdf)

ENTSO-E, "ENTSO-E Overview of Transmission Tariffs in Europe: Synthesis 2019" (June 2019). (https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/mc-documents/190626_MC_TOP_7.2_TTO_Synthesis2019.pdf)

Thema consulting group, "Review of the Swedish transmission grid tariff model, commissioned by Svenska kraftnat" (April 11, 2019). (https://www.svk.se/siteassets/aktorsportalen/elmarknad/tariff/review-of-the-swedish-transmission-grid-tariff-model---final-report.pdf)

National grid, "TSUoS guidance for generators" (April 2019). (https://www.nationalgrideso.com/document/138046/download)

Ofgem, "Project TransmiT: Decision on proposals to change the electricity transmission charging methodology," (July 24, 2014). (https://www.ofgem.gov.uk/sites/default/files/docs/2014/07/project_transmit_decision_on_proposals_to_change_the_electricity_transmission_charging_methodology.pdf)

Part 3 Balancing supply and demand to accelerate high integration of renewables

How supply and demand is balanced, a core aspect of grid operations, is beginning to change significantly due to power system restructuring. Balancing system of power supply-and-demand prior to the reforms involved the central dispatching offices of the former major power companies sending operating instructions to their own power plants and the former wholesale electricity utilities based on the constantly fluctuating their own power demand. The power plants then conducting operations in accordance with these instructions from the central dispatching offices. However, with the full deregulation of wholesale and retail market, grid operations have been transferred to the general transmission/distribution operators in all areas with the exception of Okinawa area, independent transmission/distribution companies are responsible for balancing of power supply and demand.

The general transmission/distribution companies balance power supply and demand within their areas, and, ultimately, they are obligated to provide stable supplies of electricity. Introducing a market mechanism as a means to this end is proposed in the 2013 Report and the balancing market is scheduled to launch in 2021. In addition, with the increase in grid connection by distributed renewables due to the FiT system, addressing output variability is starting to become necessary. In this part, we consider mechanisms for balancing system of power supply and demand aimed at increased deployment of renewables going forward from the viewpoint of realizing rational grid operations.

1. Supply and demand balancing mechanisms under electricity system reform

Utilization of a market mechanism for balancing supply-and-demand, as proposed in the 2013 Report[92], is based on the thinking that it would minimize the amount of balancing for a given area as a whole by the utilities having an economic incentive to assume responsibility for balancing while also accommodating the overall increase in participants from full opening of wholesale and retail market.

In terms of specific initiatives, primarily, the following four initiatives are being introduced or planned for introduction.

The first is an introduction of planned value balancing mechanism. Generators and retailers submit to OCCTO their planned values for demand and generation amounts for every 30 minutes by one hour prior to actually supplying the electricity, and operations are conducted so that demand and generation amounts accord with the planned values. This system was introduced in April 2016. Differences between planned values and actual values (excess or deficiency) incur an imbalance charge. For generators and retailers, attempting to limit imbalance charges acts as an incentive, and supply-and-demand balancing is conducted through this.

The second is creating an hour-ahead intraday market. In order for generators and retailers to limit their imbalance charges in conjunction with the introduction of planned value balancing, they had to keep actual values as close to planned values as possible. This necessitated a mechanism for balancing on the demand side and the supply side until a point very close to the actual time of supply, which led to the creation of an hour-ahead intraday market. Even prior to full deregulation, there was a four-hour-ahead intraday market in operation, but transactions were primarily only on weekdays (no transactions from 1:00 p.m. on Saturday to 1:00 p.m. on Monday), and the minimum transaction unit was 1 MW per half-hour. The hour-ahead intraday market addressed issues that made the four-hour-ahead intraday market difficult to use. According to documents from METI, transactions on the hour-ahead intraday market are currently relatively active even at night[93].

The third initiative is creating a balancing market. The balancing market is in which grid operators (transmission/distribution companies) secure power supplies to balance supply-and-demand, such as absorbing frequency fluctuations, after one hour before of actual supply and demand (gate closure) when generators and retailers can submit their plans to OCCTO. Prior to power system restructuring, operating instructions were provided to power plants within the same company, but with unbundling of incumbent power utilities, the concept of in-company power plants was eliminated, so grid operators have had to secure power sources for balancing of power supply and demand. On the balancing market, grid operators will procure power sources for balancing from power

[92] Supra note 1, "Report," p.27.

[93] EGC, "Activation of the Hour-Ahead intraday Market," 35th EGC Meeting for System Design (December 17, 2018), Document 5. (https://www.emsc.meti.go.jp/activity/emsc_system/pdf/035_05_00.pdf)

generators via a market mechanism and conduct operations accordingly. It is expected that procurement will take place across areas and that demand response will be utilized. The balancing market is slated to commence operations in 2021.

The fourth initiative is linking per-unit imbalance charges with the balancing market. When the balancing market is functioning adequately, it can be thought that the price will reflect balancing costs after gate closure, so imbalance charges will be set based on this. However, establishing the balancing market will take time, so as a prior measure, using the spot market and hour-ahead intraday market price to settle imbalances prices is being allowed. Going forward, with commencement of the balancing market, imbalance settlement charges are expected to be linked to the balancing market.

Of these four new mechanisms, the first, second and fourth are about balancing by generators and retailers, but with the third, the balancing market, transmission/distribution companies are primary. In addition, output prediction for renewable power plants introduced under the FiT system is the responsibility of transmission/distribution companies, a fact closely connected to the growth in renewables. The following focuses on how the balancing market should be structured to increase deployment of renewables.

2. Japan's balancing market and European market

For Japan's balancing market, preparations are currently underway to allow for five types of balancing reserve transactions starting in fiscal 2021 (Table 4-1). These balancing reserves are divided into primary reserve, secondary reserve and tertiary reserve. Secondary and tertiary reserves are further subdivided into two types depending on the time from instruction to response and the length of time it can continue. All the products are set as either upward reserve or downward reserve.

Table 4-1 List of balancing market products

	Primary Reserve	Secondary Reserve type 1	Secondary Reserve type 2	Tertiary Reserve type 1	Tertiary Reserve type 2
English name	Frequency Containment Reserve (FCR)	Synchronized Frequency Restoration Reserve (S-FRR)	Frequency Restoration Reserve (FRR)	Replacement Reserve (RR)	Replacement Reserve-for FIT (RR-FIT)
Instruction/control	Offline (own terminal control)	Online (LFC signal)	Online (EDC signal)	Online (EDC signal)	Online
Monitoring	Online (partial offline possible*2)	Online	Online	Online	Dedicated line: Online Simple instruction system: Online
Line	Dedicated line*1 (Not necessary if monitoring is offline)	Dedicated line*1	Dedicated line*1	Dedicated line*1	Dedicated line or simple instruction system
Response time	10 seconds or less	5 minutes or less	5 minutes or less	15 minutes or less*3	45 minutes or less
Duration	5 minutes or more*3	30 minutes or more	30 minutes or more	Product block time (3 hours)	Product block time (3 hours)
Parallel necessity	Required	Required	Optional	Optional	Optional
Instruction interval	– (own terminal control)	0.5 - several tens of seconds*4	1 - several minutes*4	1 - several minutes*4	30 minutes
Monitoring interval	1 - several seconds*2	Approx. 1-5 seconds*4	Approx. 1-5 seconds*4	Approx. 1-5 seconds*4	1 - 30 minutes*5
Amount capable of being supplied (maximum bid amount)	Amount for which output can be changed in 10 seconds or less (upper limit of GF range from the standpoint of device performance)	Amount for which output can be changed in 5 minutes or less (upper limit of LFC range from the standpoint of device performance)	Amount for which output can be changed in 5 minutes or less (upper limit of range that can be adjusted online)	Amount for which output can be changed in 5 minutes or less (upper limit of range that can be adjusted online)	Amount for which output can be changed in 45 minutes or less (upper limit of range that can be adjusted online (including simple instruction systems))
Minimum bid amount	5 MW (1 MW if monitoring offline)	5 MW*1, 4	5 MW*1, 4	5 MW*1, 4	Dedicated line: 5 MW Simple instruction system: 1 MW
Increment (bid unit)	1kW	1kW	1kW	1kW	1kW
Downward/upward classification	Downward/upward	Downward/upward	Downward/upward	Downward/upward	Downward/upward

*1 Whether or not to connect a simple instruction system and central dispatch system are currently being considered by the government from the standpoint of cybersecurity, so consider again based on this.
*2 Necessary to provide numerical data after the fact (consider data acquisition and provision methods, etc. going forward)
*3 Okinawa area sets this individually based on the unique circumstances of its area.
*4 Even if it becomes possible to connect a central dispatch system and simple instruction system, separate considerations are necessary for the monitoring communication protocol and monitoring interval, etc.
*5 Up to 30 minutes; also allowed to be aligned with period of collection by generators/aggregators.

Source: Balancing Market Planning Subcommittee Executive Office, "Direction and Summary of Subcommittee's Discussions," OCCTO Study Committee on Regulating and Marginal Supply Capability with Long-Term Supply-Demand Balance Evaluation, Supply-Demand Balancing Market Subcommittee, 16th session (January 29, 2020), reference document, p. 23. (https://www.occto.or.jp/iinkai/chouseiryoku/jukyuchousei/2019/files/jukyu_shijyo_16_04_sankou.pdf)

It is difficult to do a simple comparison between the balancing markets overseas and in Japan. In Europe, a reference for introduction of Japan's balancing market, the types of products on the market differ with each country. ENTSO-E, whose members are transmission system operators in European countries, lists balancing reserve used and transmission companies in each country define product categories for the balancing market depending on the types of power sources connected to the grid, past circumstances, and other factors in accordance with ENTSO-E guidelines. In Europe, examples of balancing reserve transactions between transmission companies in different countries are still in the verification stage.

Japan is aiming to operate inter-regional balancing that goes beyond the individual areas served by each transmission company. Kansai area, Chubu area and Hokuriku area have begun inter-regional operations for tertiary reserve as of March 2020, ahead of the opening of the balancing market[94]. Inter-regional operation of power supply-and-demand balancing is expected to reduce balancing costs going forward, but for the time being, it is limited to tertiary reserve only; whether or not there is a need to include primary and secondary reserves will be determined upon discussions on whether they need to be inter-regional based on their characteristics.

3. Supply and demand balancing market challenges

Issues will likely become clear when the balancing market goes into operation (currently April 2020), but it can already be assumed that balancing reserves related to the FiT system will be an issue. In particular, the system for when a retailer purchases FiT electricity (FiT imbalance scheme 1) could cause balancing costs to increase.

Tertiary reserve type 2 is used for balancing in connection with the FiT system. When retailers handle electricity from FiT power plants, this reserve is used to address cases in which differences arise between planned values and actual values from practical time schedules. This is called "Replacement Reserve for FiT," which is defined as balancing reserve for output prediction differences at FiT power plants.

When retailers (including the former major power companies' retail divisions) purchase electricity from FiT power plants certified before FiT law amendments from April 2017, the retailers can also utilize this electricity as supply capacity for in-company demand. When demand procurement plans are formulated with this deemed as in-company supply, retailers must submit their next-day plans to OCCTO by noon the previous day, but considering procurement for shortages through JEPX and others, planned output values from FiT power plants need to be known by the morning of the previous day at the latest.

FiT power plant supply plans are formulated by the general transmission/distribution operators, So, the general transmission/distribution operators must present them to the retailers at a stage prior to the morning of the day before, so notification is actually made by 4:00 p.m. two days before or 48 hours prior. For this reason, the general transmission/distribution operators must create planned amounts based on output predictions for solar PV and wind power plants as much as 56 hours prior to actual time. VRE output can be predicted with precision the closer it gets to the generation time, but accurate predictions 56 hours in advance are quite difficult. For example, in Tokyo area, over 35% of every half-hour plan from April to October 2017 were either over by 900 MW or more or under by 700 MW or more. Such large differences in plans and results are occurring in other areas as well[95].

In the balancing market, the portion equivalent to this difference between planned values and actual values is procured through tertiary reserve type 2. The amount procured is the total amount of differences between two-day-ahead (two days before) predicted values and actual values net of the difference between predicted values and actual values at gate closure. To put it another way, as long as there is no fundamental change in the methods used to formulate FiT power plant supply plans after the market is launched, the equivalent of the maximum value of the large amount of deviation with two-day-ahead plans will be the amount that is procured—this situation can be expected to occur.

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[94] Chubu Electric Power Co., Ltd., Hokuriku Electric Power Company, and Kansai Electric Power Co., Inc. press release, "Inter-Regional Supply-Demand Balancing Initiative Commences to Further Increase Efficiency Through Transmission/Distribution Division Partnership" (March 12, 2020). (https://www.chuden.co.jp/publicity/press/3272601_21432.html)

[95] EGC, "Impact of Output Prediction Deviations for Solar PV in Supply-Demand Balancing Operations by General Transmission and Distribution Operators," 25th EGC Meeting for System Design (December 26, 2017), Document 8. (https://www.emsc.meti.go.jp/activity/emsc_system/pdf/025_08_00.pdf)

In addition, there is also the problem that almost all balancing for FiT power plants is conducted only with tertiary reserve type 2. For example, Germany has not even established a market equivalent to tertiary reserve type 2, and Germany's transmission operators conduct balancing for FiT power plants through transactions on the intraday market and other mechanisms.

In other words, taking a look at Japan's tertiary reserve type 2 shows balancing capacity being procured through the market, but actually, it is mechanism for balancing the total amount of discrepancy in predictions connected with the FiT system and excludes other balancing mechanisms.

Going forward, if renewable power generators were to plan generating output themselves, it would reduce utilization of tertiary reserve type 2 and reduce balancing costs procured by transmission/distribution operators; that is to say, it could possibly reduce the costs borne broadly by general electricity consumers. As of the present, it would be not easy, either technically or systematically, for variable renewable power generators to predict output amount and play a role in supply-and-demand balancing, but in order to substantially increase renewable energy, it will be important for these power plants to also contribute to the framework for power supply-and-demand balancing. Therefore, the following two points are recommended.

The first is the participation of renewable power plants in the balancing market.

Since 2016, renewables have been a participant in power supply-and-demand balancing in Spain. In the country's Deviation Management and Tertiary Regulation, service is provided of 10 GW or more and, in the Secondary Regulation, around 200 MW is provided[96]. In Belgium, Denmark, Estonia, Finland, Sweden, the Netherlands, Poland, and the UK as well, wind power participates in the balancing market[97], and in Japan's balancing market, there needs to be a mechanism by which all power plants, including VRE, provide power supply-and-demand balancing functions.

The second is introducing an intraday market that is easier to use on the assumption that tertiary reserve type 2 will be abolished.

In order to more accurately predict supply amounts for VRE, predictive precision needs to be increased and there needs to be a market system the functions up until immediately prior to gate closure. For example, in Europe, a single price auction is conducted through an initiative (XBID) that integrates intraday markets throughout Europe[98]. This auction system differs from transactions in the continuous session format adopted by Japan's intraday market, and transaction personnel do not need to continuously monitor bidding, so it has the advantage of more participants being able to use the market up to a time closer to gate closure. Even after the day-ahead market is cut off at noon the previous day, intraday market auctions are held a total of six times, and with regard to contract timing, there is a broad range, from opening at 17:00 the previous day and contracting at 21:00, to opening the same day at 12:00 and contracting at 15:00. On the European Power Exchange (EPEX SPOT), which is participated in by countries including Germany and France, intraday markets in the continuous session and auction formats exist side by side[99]. This would be a good reference point for Japan's market. Regarding tertiary reserve type 2 established to accommodate the FiT system, it should be abolished in the future by transitioning to the generators themselves performing power supply-and-demand balancing, and the balancing market should be focused on functions such as preparing for accidents and other such events.

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96 Based on an interview with the Spanish Wind Energy Association (AEE) (conducted October 2018).

97 International Renewable Energy Agency (IRENA), "Innovative ancillary services" (2019) p.16. (https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Feb/IRENA_Innovative_ancillary_services_2019.pdf?la=en&hash=F3D83E86922DEED7AA3DE3091F3E49460C9EC1A0)

98 Based on an interview with OMIE (conducted October 2018).

99 European Power Exchange, "15-minute intraday call auction." (http://static.epexspot.com/document/29113/15-Minute%20Intraday%20Call%20Auction)

■Recommendation 4-4:
Introduce a mechanism by which renewable power sources are involved in power supply-and-demand balancing

A mechanism should be established whereby renewable power sources can contribute to supply-and-demand balancing, rather than the approach in which output fluctuations from variable renewable power plants are covered by the supply-and-demand balancing function of existing thermal power plants alone. In addition, output prediction technologies for VRE should be improved, and the intraday market should be revised so that it can be used until immediately before, on the assumption that tertiary reserve type 2 will be abolished.

Conclusion

In these Recommendations, we have looked back on the past nine years of power system restructuring since the nuclear disaster at TEPCO's Fukushima Daiichi Nuclear Power Plant, assessed the current situation, and made recommendations on further accelerating reform. Compared to the system prior to 2011 with (de facto) regional monopolies and the vertically integrated system, there has been a major increase in new PPSs entering the market, and the liquidity of the day-ahead market has surpassed 30%, so the reforms are producing effects. At the same time, systems and rules that give preferential treatment to existing providers and existing power sources remain, and areas where reform has not made much progress still remain, with new market systems that maintain this same character are being introduced.

In particular, it must be pointed out that the speed and the government's disposition toward integrating renewables, whose deployment is progressing worldwide, into the electricity system is not adequate. This is reflected in the fact that the rule for use of transmission networks is "first-come, first served" basis, the dispatch order is not based on marginal costs, and there is an excess of caution with respect to building new transmission networks. To make variable renewables as main power sources, it will be necessary to rebuild the existing electricity system, which has emphasized nuclear and coal-fired power and been based on closed networks, and this should be the fundamental principle of power system restructuring.

By contrast, looking at Europe, power sector reform of unbundling and achieving competitive electricity market was completed 10 to 20 years ago, and in the 2010s, progress was made in integrating variable renewables into markets and systems. As a result of these thoroughgoing reforms, the renewable energy share is now over 30-50%. Furthermore, in recent years, as the next stage, Europe is quickly transitioning to energy system reform, including sector integration.

World is currently in the midst of responding to the novel coronavirus, but there is gradually starting to be discussions on reopening social life and reviving the economy. Around the world, many are calling for a green economic recovery under the slogan "Rebuild Better." The recovery from the corona crisis must be used as an opportunity not simply to restore the economy as it was before but to transition from the fossil fuel-based society that we have had thus far to a society driven by more sustainable, more resilient energy systems.

Accordingly, we would urge the Japanese government to quickly implement these recommendations based on the principles of power system restructuring. Among the reforms that are currently progressing, as verified by these Recommendations, there are some still in the initial stages, so their effects are still hard to gauge. REI intends to further verify the direction of reforms and continue to express its views, partly in light of the fact that the legal unbundling of the transmission business was carried out nationwide in April of this year.

May 2020

Renewable Energy Institute Power System Restructuring Research Team

List of Recommendations

Chapter 1
Completing the unbundling and strengthening the authority of the independent regulatory body

■1-1: Execute legal unbundling with the holding company style, in principle

When legal separation is used to unbundle generation and transmission, the holding company style should be the general rule, not the affiliated company style.

■1-2: Seek for ownership unbundling and merge transmission/distribution companies

The extent to which transmission networks have been opened should be strictly monitored and regulations on conduct rigorously enforced, and if networks are not opened adequately, ownership unbundling should be promptly adopted. At the same time, transmission companies (subsidiaries) should be integrated over time from the standpoint of expanding inter-regional operations.

■1-3:
Codify strict monitoring and conduct regulations for transmission/distribution companies

Regarding conduct regulations on transmission/distribution companies, transparency should be established through rigorous disclosure and strict surveillance conducted by the EGC. In addition, needed regulations should be codified centering on issues that currently only require voluntary action even though problems have been indicated, such as those related to personnel and compliance systems.

■1-4: Strengthen the authority and involvement of the EGC

To the extent possible under the National Government Organization Act, the EGC's authority should be strengthened, and this should include giving it the authority to make binding decisions from a standpoint independent of METI, as well as requiring METI to respect the EGC's recommendations. The EGC's involvement in areas related to new connections to transmission networks and network development planning and operations should also be strengthened, as should its oversight of OCCTO.

■1-5: Strengthen key personnel and enhance the support staff at EGC

Regarding the Chairperson and other members of the EGC, regulations should be stipulated on status guarantees, concurrent positions and post-appointment employment, the positions should be made full-time, and the dedicated support staff should be enhanced to strengthen the organization's independence and specialization.

Chapter 2
Promoting competition in the retail sector and the market to realize decarbonized society

■2-1: Strengthen surveillance of improper discounting by major power utilities

In order to promote fair competition in the retail market, the EGC and Fair Trade Commission should strengthen surveillance of improper discounting by major power utilities.

■2-2:
Revise the system of recovering general nuclear power costs through regulated grid tariffs

Regulated grid tariffs are originally intended to be charges for recovering costs related to transmission and distribution. The method of recovering nuclear power costs using grid tariffs should be revised.

■2-3:
Institute systems and mechanisms that make it easy for consumers to choose renewable power

To make it easy for consumers to choose renewable power, systems need to be instituted such as power source tracking, mandatory labeling of power sources and carbon dioxide emissions by retailers, and a mechanism that allows consumers to directly conclude power purchase agreements with generators.

■2-4: Monitor non-fossil fuel value transactions within major power utilities

When renewable power is bought or sold, non-fossil fuel value transactions from the generation division to the retail division of the former major power companies need to be monitored so that major power utilities do not have a unilateral advantage, and, in some cases, structural measures such as separating the generation and retail divisions of major power utilities need to be considered.

■2-5: Create a system with non-fossil fuel certificates that are valid internationally

A system equivalent to power source tracking should be established and power source information should be clearly indicated on non-fossil fuel certificates. At the same time, criteria need to be established for power source sustainability to make the system applicable internationally.

Chapter 3
Promoting competition and market system reform in the generation sector

■3-1: Further expand the day-ahead spot market

While the day-ahead market appears to be expanding in recent years, gross bidding is a voluntary initiative, so going forward uncertainty remains. The EGC should strengthen market surveillance and take steps such as making gross bidding mandatory in order to further expand the day-ahead market.

■3-2: Consider future structural measures

If competition is not promoted in the generation sector and adequate liquidity is not secured in the wholesale electricity market, structural measures should be considered, including selling off generation facilities, as has been done in the US and Europe, and separating the generation and retail divisions of the former major power companies.

■3-3: Reform the “Baseload market”

The “Baseload market” has just begun, but contract prices are high and volume is low. The EGC should strengthen market surveillance and if conditions do not subsequently improve, reforms should be considered in connection with bid prices and other areas.

■3-4: Design a capacity mechanism consistent with decarbonization policy

For ensuring consistency with decarbonization, the system should be designed to ensure flexibility in the market so that the regulations on carbon dioxide emissions can be incorporated into the capacity mechanism and that mass deployment of renewable energy can be accommodated.

Chapter 4
Realizing fair and rational grid operations

■4-1:
Expand full application of the Japanese version of “Connect and Manage” and apply it to existing power sources

The Japanese version of “Connect and Manage” should be fully applied as soon as possible by all grid operators to address the problem of shortages in available grid capacity. In addition, the system should be improved to create a more rational connection management method that includes existing power sources.

■4-2: Formulate a master plan based on sufficient consideration of a broad range of benefits

In formulating the master grid plan, opinions on benefits need to be broadly heard and discussions on them need to take place at the national level. The benefits brought about by deployment of renewable energy should be considered as a part of this.

■4-3: Create a cost-efficient, rational framework for grid enhancement cost sharing

The cost of enhancing inter-regional connectors should be shared nationwide and JEPX price difference revenue should be promptly utilized. The renewable energy surcharge approach is problematic, but even supposing it were adopted, strict analysis of the effects of renewable energy deployment needs to be conducted along with disclosure and close examination of cost information.

■4-4:
Introduce a mechanism by which renewable power sources are involved in supply-and-demand balancing

A mechanism should be established whereby renewable power sources can contribute to supply-and-demand balancing, rather than the approach in which output fluctuations from variable renewable power plants are covered by the supply-and-demand balancing function of existing thermal power plants alone. In addition, output prediction technologies for variable renewable energy should be improved, and the intraday market should be revised so that it can be used until immediately before, on the assumption that tertiary reserve type 2 will be abolished.

Recommendations for Power System Restructuring

Toward Further Deployment of Renewables

October 2020

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