Aggregation of Electricity Supply Plans
Fiscal Year 2020

June 2020

Organization for Cross-regional Coordination of
Transmission Operators, Japan

INTRODUCTION

The Organization for Cross-regional Coordination of Transmission Operators, Japan (hereafter, the Organization) has aggregated the electricity supply plans for fiscal year (FY) 2020 according to the provisions of Article 28 of the Operational Rules of the Organization and Article 29 of the Electricity Business Act(hereafter, the Act), which require the plans to be submitted by electric power companies (EPCOs), and publish their results.

The electricity supply plans are submitted by the EPCOs according to the Network Code of the Organization, aggregated by the Organization, and sent to the Ministry of Economy, Trade and Industry (METI) annually by the end of March.

In total, 1,484 electricity supply plans for FY 2020 were aggregated, including 1,483 plans submitted by companies that became EPCOs by the end of December 2019 and one plan submitted by a company that became an EPCO by February 28, 2020.

Number of Electric Power Companies Subject to the Aggregation in FY 2020

Business License	Number
Generation Companies	821
Retail Companies	620
Specified Transmission, Distribution and Retail Companies	26
Specified Transmission and Distribution Companies	4
Transmission Companies	3
General Transmission and Distribution Companies	10
Total	1,484

[Reference] Electricity supply plan

EPCOs shall develop a comprehensive plan for electricity supply, and development of generation or transmission facility for a 10-year period according to the provisions of Article 29 of the Act. METI shall recommend to EPCOs any alteration of the supply plan if the plan is recognized as being inadequate for the security of a stable supply by cross-regional operation or for other development of electricity business in a comprehensive and rational manner

Due Date of Submission of Supply Plans	
(1)Electric power company submission to the Organization	February 28 (draft: Feb. 10)
(2)General electric power company submission to the Organization	March 25 (draft: Mar. 10)
(3)The Organization submission to the METI	the End of March

[Reference] Items to be aggregated in the electricity supply plan

Items to be aggregated in the electricity supply plan are described in the covering letter of the aggregation of electricity supply plans according to the provisions of the Ordinance of METI. The Organization has aggregated the plans according to this description.

Items to be reported in the Aggregation (determined by the Ordinance of the METI)	Contents
I. Electricity Demand Forecast	
1. Actual and Preliminary Data for FY 2019, and Forecast for FY 2020 and 2021 (Short-Term)	Actual peak demand for the previous year, and forecast peak demand for the 1st and 2nd years of the projected period in both each regional area and nationwide
2. 10-Year Demand Forecast (Long-Term)	Forecast peak demand from the 3rd to 10th years of the projected period in both each regional area and nationwide
II. Electricity Supply and Demand	
1. Actual Data for FY 2019, and Projection for FY 2020 and 2021 (Short-Term)	Actual supply-demand for the previous year, and projected supply-demand for the 1st and 2nd years of the projected period in both each regional area and nationwide
2. Projection of Supply–Demand Balance for 10 years (Long-Term)	Projected supply-demand from the 3rd to 10th years of the projected period in both each regional area and nationwide
III. Analysis of the Transition of Power Generation Sources	Development and retirement plans of power generation sources which express the transition of power generation in nationwide
IV. Development Plans for Transmission and Distribution Facilities	Aggregated reinforcement plans of inter- and intra-regional transmission and distribution facilities
V. Cross-Regional Operation	Aggregated transaction plans between each area
VI. Analysis of Characteristics of Electric Power Companies	Aggregated situation for electric power companies by each business licenses
VII. Findings and Current Challenges	Opinion to the Minister of Economics, Trade & Industry

CONTENTS

I. Electricity Demand Forecast

1. Actual and Preliminary Data for FY 2019 and Forecast for FY 2020 and 2021 (Short-Term)

a. Peak Demand (average value of the three highest daily loads[1]) in August

Table 1-1 shows the actual data for the aggregated peak demand for each regional service area[2] submitted by the 10 general transmission and distribution (GT&D) companies for FY 2019 and the forecast[3] value for FY 2020 and 2021.

Peak demand (average value of the three highest daily loads) for FY 2020 was forecast at 158,960 MW, which represents a 0.1% increase over 158,740 MW, that is, the temperature-adjusted[4] value for FY 2019.

Peak demand for FY 2021 was forecast at 158,800 MW, which represents 60 MW or a 0.0% increase over the temperature-adjusted[4] value for FY 2019.

Table 1-1 Peak Demand (average value of the three highest daily loads) in August
(nationwide, 10^4 kW at the sending end)

FY 2019 Actual (temperature adjusted)	FY 2020 Forecast	FY 2021 Forecast
15,874	15,896 (+0.1%*)	15,880 (+0.0%*)

*% change compared with actual data for FY 2019 (temperature adjusted).

b. Forecast for FY 2019 and 2020

Tables 1-2 and 1-3 show the monthly peak demand in FY 2020 and 2021, respectively from the aggregated peak demand for each regional service area submitted by the 10 GT&D companies. The monthly peak demand in summer (August) is greater than that in winter (January) by about 9 GW; therefore, nationwide peak demand occurs in summer.

Table 1-2 Monthly Peak Demand (average value of the three highest daily loads) in FY 2020
(nationwide, 10^4 kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.
Peak Demand	11,607	11,467	12,683	15,856	15,896	13,931
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Peak Demand	11,926	12,467	14,341	14,980	14,956	13,480

1 Peak demand (average value of the three highest daily loads) corresponds to the average value of the three highest daily loads (hourly average) in each month.

2 Peak demand in the regional service areas refers to the average value of the three highest daily loads in public demand supplied by retail companies and GT&D companies through the transmission and distribution network of the GT&D companies. The Organization publishes these average values according to the provisions of paragraph 5, Article 23 of the Operational Rules.

3 Demand forecast beyond FY 2020 is based on normal weather. Thus, weather conditions for forecast assumption may vary in contrast to the actual data or estimated value in FY 2019.

4 Temperature adjustment is implemented to capture the current demand based on normal weather, which excludes demand fluctuations triggered by air-conditioner operation.

Table 1-3 Monthly Peak Demand (average value of the three highest daily loads) in FY 2021
(nationwide, 10^4 kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.
Peak Demand	11,599	11,458	12,671	15,840	15,880	13,918
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Peak Demand	11,917	12,454	14,325	14,958	14,935	13,466

c. Annual Electric Energy Requirements

Table 1-3 shows the preliminary data[5] for FY 2019 and the forecast value for FY 2020 from the aggregated electric energy requirements of each regional service area submitted by the 10 GT&D companies.

The electric energy requirements for FY 2020 are forecast at 881.8 TWh, a 0.2% increase over the 879.9 TWh in the preliminary data for FY 2019.

Table 1-4 Annual Electric Energy Requirements
(nationwide, TWh at the sending end)

FY 2019 Preliminary (temperature- and leap-year-adjusted)	FY 2020 Forecast
879.9	881.8 (+0.2%*)

* % changes over the preliminary value for the previous year.

[5] Preliminary data for annual electric energy requirements are an aggregation of the actual data from April to November 2019 with the preliminary data from December 2019 to March 2020.

2. 10-Year Demand Forecast (Long-Term)

Table 1-5 shows the major economic indicators developed and published on November 27, 2019 by the Organization, which are assumptions for the GT&D companies to forecast the peak demand in their regional service areas.

The real gross domestic product (GDP)[6] is estimated at ¥539.1 trillion in FY 2019 and ¥575.9 trillion in FY 2029 with an annual average growth rate (AAGR) of 0.7%. The index of industrial production (IIP)[7] is projected at 102.4 in FY 2019 and 109.8 in FY 2029 with an AAGR of 0.7%.

On the other hand, the population is estimated at 126.04 M. in FY 2019 and 120.10 M. in FY 2029 with an AAGR of -0.5%.

Table 1-5 Major Economic Indicators Assumed for Demand Forecast

	FY 2019	FY 2029
Gross Domestic Product(GDP)	¥539.1 trillion	¥575.9 trillion [+0.7%]*
Index of Industrial Product(IIP)	102.4	109.8 [+0.7%]*
Population	126.04 M.	120.10 M. [△0.5%]*

* Average annual growth rate for the forecast value of FY 2019

a. Peak Demand (average value of the three highest daily loads) in August

Table 1-6 shows the peak demand forecast for FY 2020, FY 2024, and FY 2029 as the aggregation of peak demand for each regional service area submitted by the 10 GT&D companies. In addition, Figure 1-1 shows the actual data and the forecast of peak demand from FY 2008 to 2029.

The peak demand nationwide is forecast at 157,870 MW in FY 2024 and 156,660 MW in FY 2029, with an AAGR of -0.1% from FY 2019 to FY 2029.

The peak demand forecast over 10 years shows a slightly decreasing trend, which is largely due to negative factors, such as efforts to reduce electricity use, wider utilization of energy-saving electric appliances, a shrinking population, and load-leveling measures, and despite positive factors such as the expansion of economic scale and greater dissemination of electric appliances.

Table 1-6 Peak Demand Forecast (average value of the three highest daily loads) for August (nationwide, 10^4 kW at the sending end)

FY 2020 [aforementioned]	FY 2024	FY 2029
15,896	15,787 [△0.1%]*	15,666 [△0.1%]*

* Average Annual Growth Rate for the forecast value of FY 2019

[6] GDP expressed as the chained price for CY 2011

[7] Index value in CY 2015 = 100

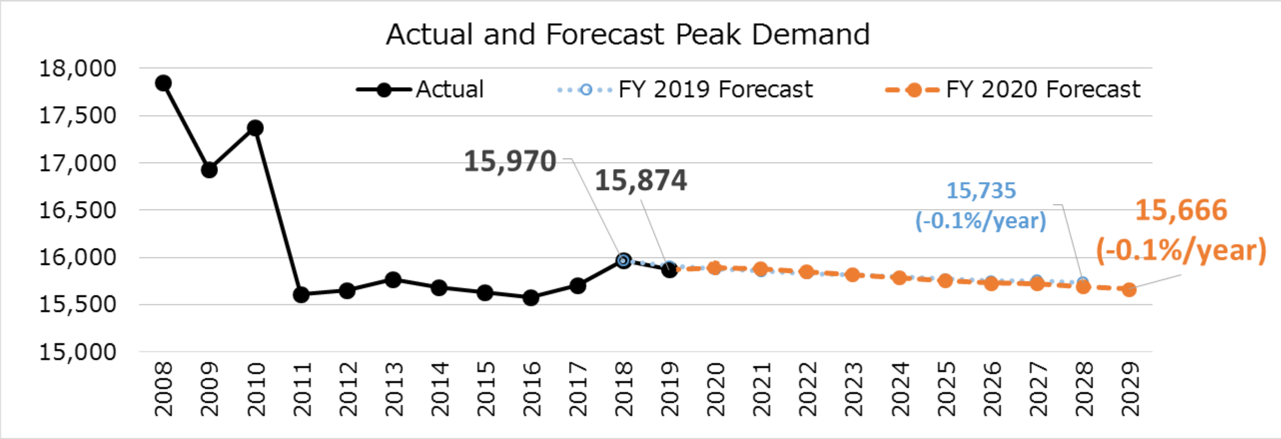

Figure 1-1 Actual and Forecast Peak Demand (August for Nationwide, 10^4 kW at the sending end)

b. Annual Electric Energy Requirement

Table 1-7 shows the forecast for annual electric energy requirements in FY 2020, FY 2024, and FY 2029 as the aggregation of the electric energy requirements for each regional service area submitted by the 10 GT&D companies.

The nationwide annual electric energy requirement is forecast at 876.9 TWh in FY 2024 and 872.1 TWh in FY 2029, with an AAGR of -0.1% from FY 2019 to FY 2029.

The annual electric energy requirement forecast over 10 years shows a slightly decreasing trend, which is largely due to negative factors, such as efforts to reduce electricity use, wider utilization of energy-saving electric appliances, and a shrinking population, and despite positive factors such as the expansion of economic scale and greater dissemination of electric appliances.

Table 1-7 Annual Electric Energy Requirement Forecast
(nationwide, TWh at the sending end)

FY 2020 [aforementioned]	FY 2024	FY 2029
881.8	876.9 [△0.1%]*	872.1 [△0.1%]*

* AAGR for the forecast value of FY 2019.

II. Electricity Supply and Demand

1. Supply–Demand Balance Evaluation Method

The Organization will evaluate the supply–demand balance for each regional service area as well as nationwide using the supply capacity[8] and peak demand data for the regional service areas.

The Organization will implement its evaluation using the criterion of whether the reserve margin (%)[9] for each regional service area is secured over 8% or not. In the Okinawa EPCO regional service area, the criterion is to secure power supply capacity over peak demand against an interruption of its largest generating unit and balancing capacity with frequency control function in its regional service area and the evaluation will be implemented at the time of the least reserve margin.

Figure 2-1 summarizes the supply–demand balance evaluation. Supply capacity includes the generating capacity requirements secured by retail and GT&D companies for their regional service areas and the production of surplus power[10] of generation companies. The supply capacity currently secured by retail companies includes power procured[11] from other regional service areas through cross-regional interconnection lines. Thus, the surplus power of generation companies or reserve capacity of retail companies might provide supply capacity for other regional service areas in the future.

Under the circumstances in which the operation of a nuclear power plant has become uncertain, the supply capacity of the corresponding unit or plant is recorded as zero where the corresponding supply capacity is reported as "uncertain" according to Procedures for Electricity Supply Plans of FY 2020 (published in December 2019 by the Agency for Natural Resources and Energy). In the electricity supply plans for FY 2020, supply capacity was reported as "uncertain" by all nuclear power plants except for those that had resumed operation by the time of the submission of the electricity supply plans (February 28, 2020).

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[8] Supply capacity is the maximum power that can be generated steadily during the peak demand period (average value of the three highest daily loads).

[9] Reserve margin (%) describes the difference between supply capacity and peak demand (average value of the three highest daily loads) divided by peak demand (average value of the three highest daily loads).

[10] Surplus power is the surplus power generation capacity of generation companies in a regional service area without sales destination.

[11] In case of congestion in cross-regional interconnection lines, the rebated figure to each area calculated by the Organization is added.

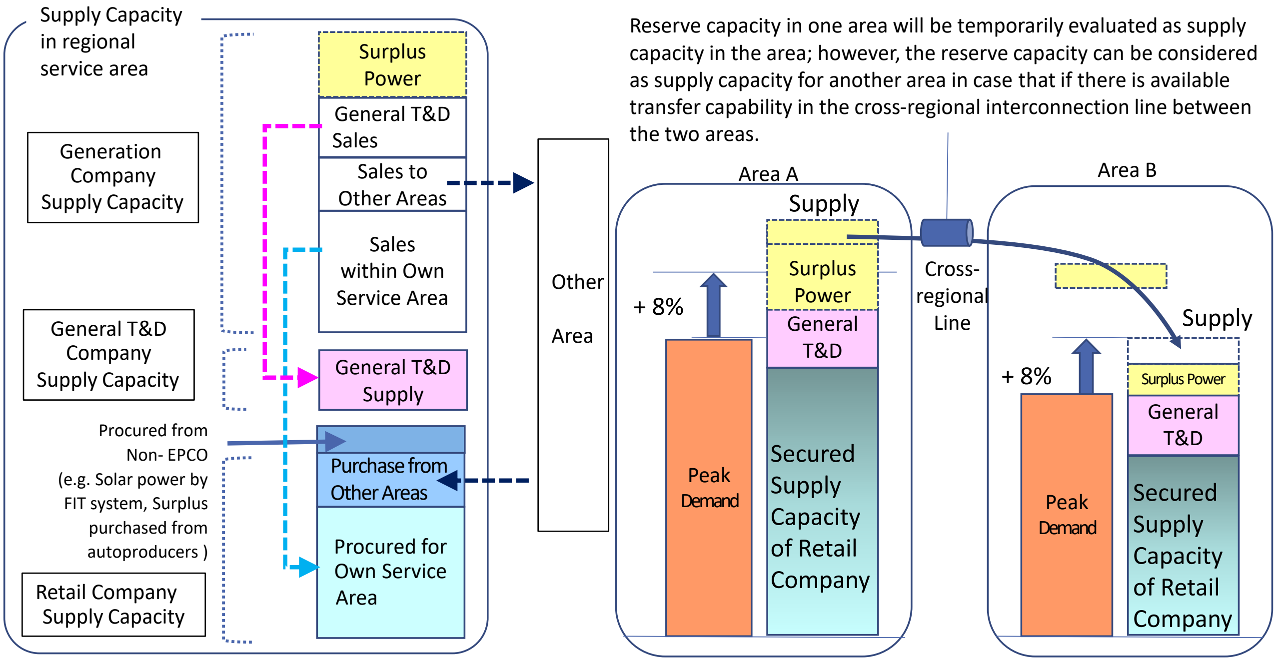

Figure 2-1 Summary of Supply–Demand Balance Evaluation

[Reference] Calculation Method of Supply Capacity

The calculation method of supply capacity or surplus power is based on the description in the "Guideline for the Calculation of Demand and Supply Capacity"[12] (Agency for Natural Resources and Energy: Dec. 2019) and "Procedures for Electricity Supply Plans of FY 2020"[13] (Agency for Natural Resources and Energy: Dec. 2019).

[12] Guideline for the Calculation of Demand and Supply Capacity(only in Japanese)
https://www.enecho.meti.go.jp/category/electricity_and_gas/electricity_measures/001/pdf/guideline.pdf

[13] Procedures for Electricity Supply Plans of FY 2020(only in Japanese)
https://www.enecho.meti.go.jp/category/electricity_and_gas/electricity_measures/001/pdf/kisai-youryo.pdf

[Reference]Evaluation Steps of Supply-Demand Balance

Evaluation steps of supply-demand balance is stated below.

STEP 1

Evaluate Supply-Demand Balance by aggregating supply capacity in **each regional service area**

（For Okinawa area, evaluation is implemented at the time of least reserve margin instead of the time of occurring peak demand）

STEP 2

Evaluate Supply-Demand Balance by adding supply capacity in other area through **utilization of cross-regional lines**

STEP 3

Evaluate Supply-Demand Balance by further adding **power generation facilities development not reported in the supply plans**

[Reference] Calculation Method of Available Transfer Capability(ATC)

The calculation method of available transfer capability of cross-regional interconnection lines is stated below.

ATC = Transfer Capability (1) – Transfer Margin (2) – Schedule Power Flow of cross-regional interconnection line at 15:00 in August (3)

Short-term

(1): Based on "Transfer Capability of Cross-regional Interconnection Lines FY 2020-2029" [annual and long-term plans] (Feb. 28, 2020: The Organization)[14]

(2): Based on "Transfer Margin of Cross-regional Interconnection Lines FY 2020 and 2021" [annual plan] (Feb. 28, 2020: The Organization)[15,16]

(3): Based on monthly scheduled power flows reported in the "Plan for Transaction of Electricity (Table 36)" of the electricity supply plan for FY 2020

Mid-to-Long-term

(1): For FY 2020 and 2021, the August value calculated from (1) above in Short-term, for FY 2022-2029, based on "Transfer Capability of Cross-regional Interconnection Lines FY 2020-2029" [annual and long-term plans] (Feb. 28, 2020: The Organization)[14]

(2): For FY 2020 and 2021, the August value calculated from (2) above in Short-term, for FY 2022-2029, based on "Transfer Margin of Cross-regional Interconnection Lines FY 2022-2029" [long-term plans] (Mar. 1, 2020: The Organization)

(3): Based on 15:00 in August scheduled power flows of the period reported in "Plan for Transaction of Electricity (Table 32-8)" of the electricity supply plan for FY 2020

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[14] Reference: material from the "5th Meeting of the Working Group on Cross-regional Transfer Capability" (in Japanese)
http://www.occto.or.jp/iinkai/unyouyouryou/2019/unyouyouryou_2019_5_haifu.html

[15] Reference: material from the "4th Meeting of the Working Group on Transmission Margin" (in Japanese)
http://www.occto.or.jp/iinkai/margin/2019/margin_kentoukai_2019_4.html

[16] The value of the transfer margin for FY 2021 is calculated based on the "Transfer Margin of Cross-regional Interconnection Lines FY 2020 and 2021" [annual plan] (Feb. 28, 2020: The Organization)

2. Actual Data for FY 2019 and Projection for FY 2020 and 2021 (Short-Term)

a. Actual Data for FY 2019

Table 2-1 shows the actual supply–demand balance in August 2019 based on the nationwide supply capacity and peak demand data.

A reserve margin of 8%, which is the criterion for stable supply, was secured in all regional service areas supplied by GT&D companies.

Table 2-1 Actual Supply–Demand Balance in August 2019
(nationwide, 10^4 kW at the sending end)

Peak Demand (temperature adjusted) [aforementioned]	Supply Capacity (nationwide)	Reserve Capacity	Reserve Margin
15,874	17,835	1,961	12.4%

Table 2-2 shows the actual supply–demand balance in each regional service area in August 2019. Although the reserve margin of Kansai area was below 3%, a reserve margin of 8% was secured utilizing cross-regional interconnection lines to share power from other areas with sufficient supply capacity within the ATC.

Table 2-2 Actual Supply–Demand Balance in August 2019
(each regional service area, 10^4 kW at the sending end)

	Hokkaido	Tohoku	Tokyo	Chubu	Hokuriku	Kansai	Chugoku	Shikoku	Kyushu	Okinawa
Peak Demand	423	1,303	5,289	2,454	497	2,691	1,042	488	1,538	150
Supply Capacity	468	1,500	5,858	2,771	591	2,769	1,229	587	1,841	222
Reserve Margin	10.6%	15.1%	10.7%	12.9%	18.9%	**2.9%**	18.0%	20.4%	19.7%	47.8%
Levelized Reserve Margin	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	11.5%	16.6%	47.8%

<Reference> Supply and Demand Balance of Actual Operation

Table 2-3 shows that a reserve margin of 3%, which is the criterion for stable daily operation, was secured at actual supply and demand.

Table 2-3 Supply–Demand Balance of Actual Operation in August 2019
(each regional service area, 10^4 kW at the sending end)

	Hokkaido	Tohoku	Tokyo	Chubu	Hokuriku	Kansai	Chugoku	Shikoku	Kyushu	Okinawa
Peak Demand	438	1,440	5,510	2,539	521	2,751	1,067	494	1,546	145
Supply Capacity	469	1,509	5,990	2,847	584	3,081	1,172	600	1,814	206
Reserve Margin	7.2%	4.8%	8.7%	12.1%	12.1%	12.0%	9.8%	21.6%	17.3%	42.4%

b. Projection of Supply–Demand Balance in FY 2020 and 2021

i) Projection for FY 2020

Table 2-4 and Figure 2-2 show the projection of a monthly supply–demand balance (at the time of the least reserve margin nationwide[17]) for FY 2020. A reserve margin of 8% is secured for each month nationwide, even in the lowest margin of 11.8% in December.

Table 2-4 Projection of the Monthly Supply–Demand Balance for FY 2019
(at the time of the least reserve margin; nationwide, [17] 10^4 kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.
Peak Demand	11,607	11,466	12,678	15,854	15,892	13,927
Supply Capacity	14,100	14,354	15,454	17,829	17,948	17,047
Reserve Margin	21.5%	25.2%	21.9%	12.5%	12.9%	22.4%
	Oct.	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**
Peak Demand	11,926	12,467	14,341	14,980	14,956	13,480
Supply Capacity	14,660	14,485	16,036	16,819	16,911	16,226
Reserve Margin	22.9%	16.2%	11.8%	12.3%	13.1%	20.4%

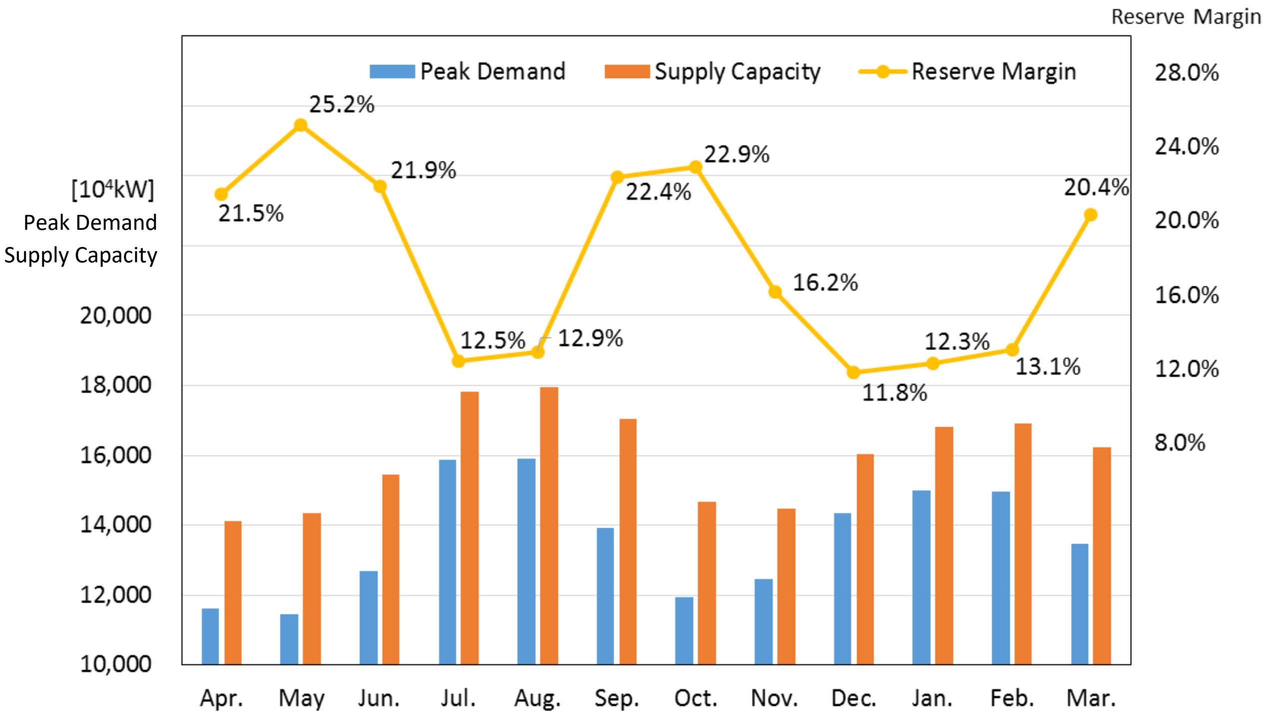


Figure 2-2 Projection of the Monthly Supply–Demand Balance for FY 2020
(at the time of the least reserve margin;[17] nationwide, at the sending end)

[17] Addition of the peak demand and the supply capacity at the time of the least reserve margin.

Table 2-5 shows the monthly projection of the least reserve margin for each regional service area. In addition, Table 2-6 shows the monthly projection of the least reserve margin for each regional service area recalculated to levelize using power exchanges to areas below the 8% reserve margin from areas of over the 8% reserve margin based on the ATC.[18]

The least reserve margin for each regional service area almost secures the criterion of a stable supply, with a reserve margin of 8%, except for some areas and months such as Hokuriku area in December, Kansai area from December to February, and Kyushu area in December and January. However, reserve margins of 8% (the criterion of stable supply) are secured by using cross-regional interconnection lines to share power from other areas with sufficient supply capacity.

Table 2-5 Monthly Projection of the Least Reserve Margins Nationwide and for Each Regional Service Area (resources within own service area only, at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	48.9%	69.9%	61.3%	28.7%	31.9%	43.6%	23.8%	38.6%	16.9%	13.9%	13.8%	26.9%
Tohoku	23.0%	33.0%	23.1%	14.6%	16.2%	17.9%	17.6%	16.0%	16.2%	16.5%	16.2%	22.5%
Tokyo	11.1%	18.1%	20.3%	9.2%	10.0%	20.0%	20.1%	11.6%	12.7%	12.3%	13.3%	16.1%
50 Hz areas Total	16.3%	24.7%	23.5%	11.3%	12.5%	21.1%	19.9%	14.7%	13.7%	13.3%	13.9%	18.2%
Chubu	17.0%	21.4%	22.5%	9.1%	10.6%	21.4%	27.1%	23.3%	20.4%	15.9%	15.7%	23.4%
Hokuriku	42.6%	41.3%	24.7%	26.6%	20.9%	22.4%	12.8%	9.9%	**5.7%**	9.6%	11.2%	20.6%
Kansai	21.5%	15.3%	8.8%	8.6%	8.9%	20.6%	13.7%	8.5%	**2.2%**	**5.2%**	**6.7%**	13.5%
Chugoku	29.0%	32.9%	38.2%	24.1%	23.2%	33.7%	41.9%	25.6%	13.0%	14.5%	13.1%	27.1%
Shikoku	34.9%	29.3%	28.1%	22.4%	23.4%	28.1%	53.4%	25.5%	17.4%	20.8%	18.1%	25.8%
Kyushu	32.9%	36.0%	21.2%	12.5%	11.5%	22.5%	23.2%	14.1%	**2.4%**	**7.6%**	10.9%	26.0%
60 Hz areas Total	25.0%	25.0%	20.4%	13.1%	13.1%	23.2%	24.9%	16.9%	9.7%	10.9%	11.7%	21.3%
Interconnected	21.0%	24.9%	21.8%	12.3%	12.8%	22.3%	22.7%	15.9%	11.5%	12.0%	12.7%	19.9%
Okinawa	74.0%	55.8%	31.9%	28.8%	27.9%	31.5%	44.8%	49.4%	63.6%	57.8%	68.2%	85.6%
Nationwide	21.5%	25.2%	21.9%	12.5%	12.9%	22.4%	22.9%	16.2%	11.8%	12.3%	13.1%	20.4%

Below 8% criteria

Table 2-6 Monthly Projection of the Least Reserve Margins Nationwide and for Each Regional Service Area (with power exchanges through cross-regional interconnection lines, at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	41.9%	61.2%	61.3%	18.0%	25.8%	35.0%	19.9%	23.1%	13.6%	12.9%	12.9%	18.2%
Tohoku	14.2%	21.9%	20.6%	10.9%	11.6%	20.2%	19.9%	13.9%	13.6%	12.9%	12.9%	18.2%
Tokyo	14.2%	21.9%	20.6%	10.9%	11.6%	20.2%	19.9%	13.9%	13.6%	12.9%	12.9%	18.2%
Chubu	25.0%	24.6%	20.6%	13.1%	13.1%	23.2%	24.9%	17.4%	13.6%	11.2%	12.6%	21.3%
Hokuriku	25.0%	24.6%	20.6%	13.1%	13.1%	23.2%	24.9%	16.7%	8.3%	11.2%	12.6%	21.3%
Kansai	25.0%	24.6%	20.6%	13.1%	13.1%	23.2%	24.9%	16.7%	8.3%	11.2%	12.6%	21.3%
Chugoku	25.0%	24.6%	20.6%	13.1%	13.1%	23.2%	24.9%	16.7%	8.3%	11.2%	12.6%	21.3%
Shikoku	25.0%	24.6%	20.6%	13.1%	13.1%	23.2%	24.9%	16.7%	8.3%	11.2%	12.6%	21.3%
Kyushu	25.0%	27.0%	20.6%	13.1%	13.1%	23.2%	24.9%	16.7%	8.3%	11.2%	12.6%	21.3%
Interconnected	21.0%	24.9%	21.8%	12.3%	12.8%	22.3%	22.7%	15.9%	11.5%	12.0%	12.7%	19.9%
Okinawa	74.0%	55.8%	31.9%	28.8%	27.9%	31.5%	44.8%	49.4%	63.6%	57.8%	68.2%	85.6%
Nationwide	21.5%	25.2%	21.9%	12.5%	12.9%	22.4%	22.9%	16.2%	11.8%	12.3%	13.1%	20.4%

Improve to over 8%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection lines.

[18] This evaluation is implemented based on the following. The evaluation of timing of utilization of interconnection lines varies in the regional service areas; power exchange availability is calculated based on the least reserve margin, and the calculated results are lower than those based on the reserve margin at a given time. Therefore, this evaluation covers a more severe condition, which is better for a stable supply.

Further, information on environmental assessment of thermal power plants[19] probably includes some generating facilities which EPCO confirm their business judgment and proceed to their construction. Therefore, the Organization has investigated generating facilities that are not included in the electricity supply plans, although they have already made application for generator connection to GT&D companies and submitted construction plans according to the provisions of Article 48 of the Act in cooperation with the Government.

As a result, there are 250 MW of such generating facilities nationwide; thus, the Organization includes those facilities to supply capacity and recalculates reserve margins as outlined in Table 2-7.

Table 2-7 Monthly Projection of the Least Reserve Margins Nationwide and for Each Regional Service Area (with power exchanges through cross-regional interconnection lines and generating facilities not included in the electricity supply plans, at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	41.9%	61.2%	61.3%	18.0%	25.8%	35.0%	20.0%	26.9%	13.8%	13.2%	13.1%	18.5%
Tohoku	14.2%	21.9%	20.6%	10.9%	11.6%	20.2%	20.0%	13.9%	13.8%	13.2%	13.1%	18.5%
Tokyo	14.2%	21.9%	20.6%	10.9%	11.6%	20.2%	20.0%	13.9%	13.8%	13.1%	13.1%	18.5%
Chubu	25.0%	24.6%	20.6%	13.2%	13.2%	23.3%	25.0%	17.4%	13.8%	11.3%	12.6%	21.4%
Hokuriku	25.0%	24.6%	20.6%	13.2%	13.2%	23.3%	25.0%	16.9%	8.5%	11.3%	12.6%	21.4%
Kansai	25.0%	24.6%	20.6%	13.2%	13.2%	23.3%	25.0%	16.9%	8.5%	11.3%	12.6%	21.4%
Chugoku	25.0%	24.6%	20.6%	13.2%	13.2%	23.3%	25.0%	16.9%	8.5%	11.3%	12.6%	21.4%
Shikoku	25.0%	24.6%	20.6%	13.2%	13.2%	23.3%	25.0%	16.9%	8.5%	11.3%	12.6%	21.4%
Kyushu	25.0%	27.0%	20.6%	13.2%	13.2%	23.3%	25.0%	16.9%	8.5%	11.3%	12.6%	21.4%
Interconnected	21.0%	24.9%	21.8%	12.4%	12.8%	22.4%	22.8%	16.1%	11.6%	12.1%	12.9%	20.1%
Okinawa	74.0%	55.8%	31.9%	28.8%	27.9%	31.5%	44.8%	49.4%	63.6%	57.8%	68.2%	85.6%
Nationwide	21.5%	25.2%	21.9%	12.5%	13.0%	22.5%	23.0%	16.4%	12.0%	12.4%	13.2%	20.6%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection line.

In the Okinawa EPCO regional service area,[20] which is a small and isolated island system unable to receive power through interconnection lines, the criterion of stable supply is to secure supply capacity over peak demand by deducting the capacity of the largest generating unit and balancing capacity with frequency control ('Generator I', total of 301 MW), without applying the criteria of other interconnected areas.[21]

Table 2-8 shows the monthly reserve margin against the deduction of the capacity of Generator I, which indicates the stable supply was secured in each month.

Table 2-8 Monthly Reserve Margin against the Deduction of the Capacity of Generator I (at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Okinawa	44.8%	30.8%	10.0%	8.1%	7.3%	10.4%	21.7%	22.4%	33.1%	28.4%	38.5%	54.0%

[19] Reference: Information on environmental assessment of thermal power plants (METI website, only in Japanese) http://www.meti.go.jp/policy/safety_security/industrial_safety/sangyo/electric/detail/thermal.html

[20] In the Okinawa EPCO regional service area, the evaluation excludes the reserve margins of several isolated islands.

[21] The evaluation is implemented at the time of the least reserve margin instead of the peak demand occurrence.

ii) Projection for FY 2021[22]

Table 2-9 and Figure 2-3 show the projection of a monthly supply–demand balance (at the time of the least reserve margin nationwide[17]) for FY 2021. A reserve margin of 8% is secured for each month nationwide, even in the lowest margin of 9.9% in February.

Table 2-9 Projection of the Monthly Supply–Demand Balance for FY 2021
(at the time of the least reserve margin; nationwide[17], 10^4 kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.
Peak Demand	11,599	11,457	12,668	15,838	15,876	13,914
Supply Capacity	14,522	14,667	15,403	17,777	17,885	16,814
Reserve Margin	25.2%	28.0%	21.6%	12.2%	12.7%	20.8%
	Oct.	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**
Peak Demand	11,917	12,454	14,325	14,958	14,935	13,466
Supply Capacity	14,668	14,360	16,018	16,651	16,420	15,355
Reserve Margin	23.1%	15.3%	11.8%	11.3%	9.9%	14.0%

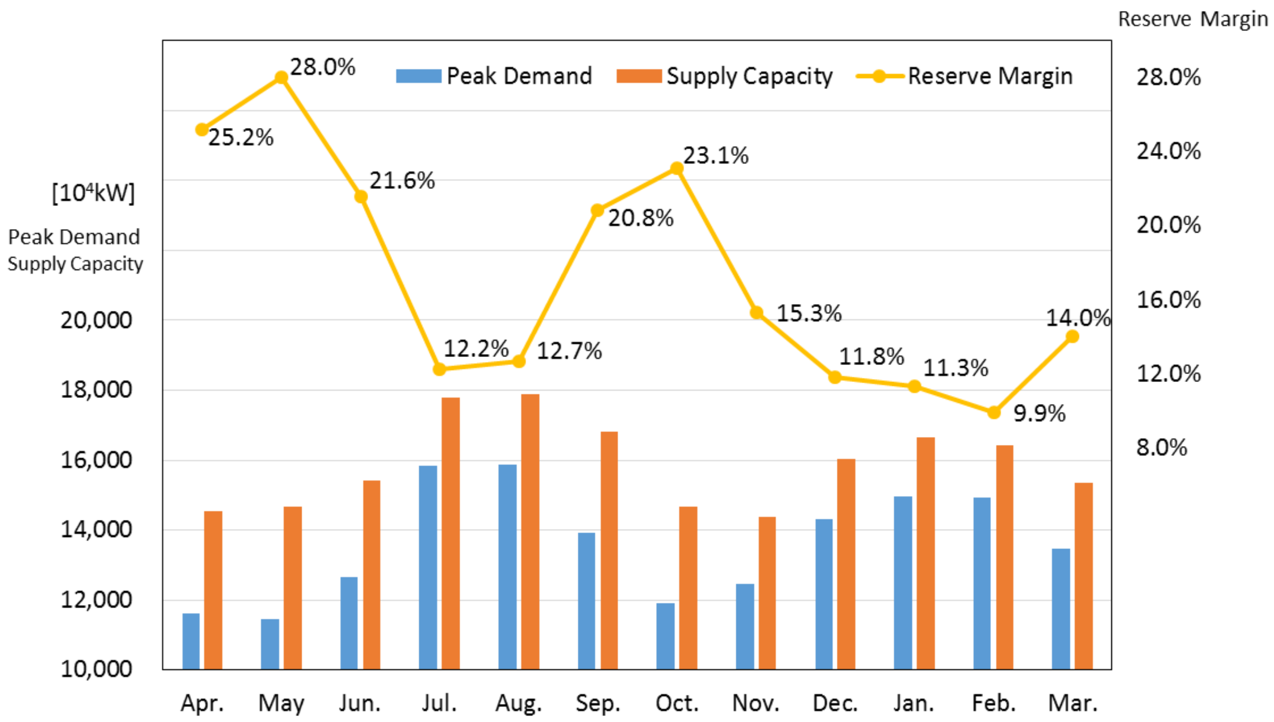


Figure 2-3 Projection of the Monthly Supply–Demand Balance for FY 2021
(at the time of the least reserve margin;[17] nationwide, at the sending end)

[22] The Organization has structured "special generator procurement", which is the scheme for soliciting and utilizing suspended or retiring generation facility as supply capacity in case supply capacity shortage is projected. Accordingly, METI has amended the Ordinance for Enhancement of the Electricity Business; changes include the submission of an enlarged monthly supply–demand balance to the second projected year of the electricity supply plan.

Table 2-10 shows the monthly projection of the least reserve margin for each regional service area. In addition, Table 2-11 shows the monthly projection of the least reserve margin for each regional service area recalculated to levelize using power exchanges to areas below the 8% reserve margin from areas of over the 8% reserve margin based on the ATC.[18]

The least reserve margin for each regional service area almost secures the criterion of a stable supply, with a reserve margin of 8%, except for some areas and months such as Tokyo area in July, August, November, and from January to March, Chubu area in July, August, and from December to February, and Kansai and Chugoku areas, both in December. However, reserve margins of 8% (the criterion of stable supply) are secured by using cross-regional interconnection lines to share power from other areas with sufficient supply capacity.

Table 2-10 Monthly Projection of the Least Reserve Margins Nationwide and for Each Regional Service Area (resources within own service area only, at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	43.5%	54.4%	56.9%	32.3%	27.6%	39.1%	22.7%	34.1%	32.5%	28.3%	29.6%	22.8%
Tohoku	25.6%	37.8%	28.0%	25.4%	24.7%	20.6%	23.9%	18.4%	19.1%	21.3%	21.6%	22.5%
Tokyo	16.8%	22.3%	13.4%	**4.5%**	**5.2%**	16.3%	16.8%	**7.9%**	10.5%	**6.7%**	**4.8%**	**6.9%**
50 Hz areas Total	20.6%	27.6%	19.0%	9.9%	10.1%	18.6%	18.7%	12.2%	14.0%	11.3%	10.1%	11.3%
Chubu	20.6%	20.0%	19.5%	**6.4%**	**6.6%**	11.8%	17.0%	14.2%	**7.7%**	**6.4%**	**4.0%**	10.2%
Hokuriku	23.5%	33.5%	23.4%	14.8%	9.4%	16.1%	29.2%	15.8%	15.0%	9.1%	9.4%	16.3%
Kansai	28.4%	22.0%	17.6%	8.5%	8.9%	17.5%	21.8%	14.6%	**5.7%**	8.3%	10.0%	12.3%
Chugoku	26.5%	35.2%	30.7%	26.2%	27.0%	32.6%	33.6%	16.0%	**6.1%**	12.4%	13.8%	21.4%
Shikoku	37.1%	47.0%	33.4%	24.5%	23.4%	34.5%	48.9%	20.8%	15.9%	19.4%	17.3%	21.2%
Kyushu	43.9%	38.6%	30.1%	21.6%	25.1%	39.3%	35.5%	27.2%	16.3%	17.9%	10.4%	23.5%
60 Hz areas Total	28.6%	27.8%	23.1%	13.6%	14.1%	22.2%	26.0%	17.2%	9.4%	10.7%	9.2%	15.5%
Interconnected	24.9%	27.7%	21.3%	12.0%	12.3%	20.6%	22.8%	14.9%	11.4%	11.0%	9.6%	13.6%
Okinawa	60.1%	55.7%	48.3%	42.9%	44.9%	40.7%	49.7%	55.9%	68.8%	60.9%	59.3%	72.1%
Nationwide	25.2%	28.0%	21.6%	12.2%	12.7%	20.8%	23.1%	15.3%	11.8%	11.3%	9.9%	14.0%

Below 8% criteria

Table 2-11 Monthly Projection of the Least Reserve Margins Nationwide and for Each Regional Service Area (with power exchanges through cross-regional interconnection lines, at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	26.6%	41.2%	49.8%	22.9%	20.0%	36.9%	19.1%	19.5%	17.9%	14.1%	15.3%	13.5%
Tohoku	21.8%	26.5%	17.6%	9.5%	9.7%	16.1%	19.1%	12.1%	11.3%	12.9%	15.3%	13.5%
Tokyo	20.6%	26.5%	17.6%	9.5%	9.7%	16.1%	19.1%	12.1%	11.2%	10.7%	8.0%	10.5%
Chubu	24.3%	26.5%	22.5%	9.9%	10.3%	16.1%	19.9%	16.0%	11.2%	10.7%	8.6%	14.7%
Hokuriku	24.3%	28.4%	22.5%	14.7%	13.9%	16.1%	19.9%	16.0%	11.2%	10.7%	9.5%	15.6%
Kansai	26.0%	28.4%	22.5%	14.7%	13.9%	24.7%	29.0%	17.1%	11.2%	10.7%	9.5%	15.6%
Chugoku	26.0%	28.4%	22.5%	14.7%	13.9%	24.7%	29.0%	17.1%	11.2%	10.7%	9.5%	15.6%
Shikoku	26.0%	28.4%	22.5%	14.7%	13.9%	24.7%	29.0%	17.1%	11.2%	10.7%	9.5%	15.6%
Kyushu	41.3%	28.6%	22.5%	14.7%	20.2%	33.4%	29.5%	17.8%	11.2%	10.7%	9.5%	16.1%
Interconnected	24.9%	27.7%	21.3%	12.0%	12.3%	20.6%	22.8%	14.9%	11.4%	11.0%	9.6%	13.6%
Okinawa	60.1%	55.7%	48.3%	42.9%	44.9%	40.7%	49.7%	55.9%	68.8%	60.9%	59.3%	72.1%
Nationwide	25.2%	28.0%	21.6%	12.2%	12.7%	20.8%	23.1%	15.3%	11.8%	11.3%	9.9%	14.0%

Improve to over 8%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection lines.

Further, information on environmental assessment of thermal power plants[19] probably includes some generating facilities which EPCO confirm their business judgment and proceed to their construction. Therefore, the Organization has investigated generating facilities that are not included in the electricity supply plans, although they have already made application for generator connection to GT&D companies and submitted construction plans according to the provisions of Article 48 of the Act in cooperation with the Government.

As a result, there are 320 MW of such generating facilities nationwide; thus, the Organization includes those facilities to supply capacity and recalculates reserve margins as outlined in Table 2-12.

Table 2-12 Monthly Projection of the Least Reserve Margins Nationwide and for Each Regional Service Area
(with power exchanges through cross-regional interconnection lines and generating facilities not included in the electricity supply plans, at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	31.0%	46.1%	54.6%	27.2%	24.2%	41.4%	19.4%	23.4%	21.5%	17.6%	18.8%	14.6%
Tohoku	21.8%	26.5%	17.6%	9.5%	9.7%	16.1%	19.4%	12.1%	11.3%	12.9%	15.3%	14.6%
Tokyo	20.6%	26.5%	17.6%	9.5%	9.7%	16.1%	19.4%	12.1%	11.3%	10.8%	8.0%	10.5%
Chubu	24.3%	26.5%	22.6%	9.9%	10.3%	16.1%	19.9%	16.0%	11.3%	10.8%	8.6%	14.7%
Hokuriku	24.3%	28.4%	22.6%	14.8%	13.9%	16.1%	19.9%	16.0%	11.3%	10.8%	9.7%	15.6%
Kansai	26.0%	28.4%	22.6%	14.8%	13.9%	24.7%	29.0%	17.1%	11.3%	10.8%	9.7%	15.6%
Chugoku	26.0%	28.4%	22.6%	14.8%	13.9%	24.7%	29.0%	17.1%	11.3%	10.8%	9.7%	15.6%
Shikoku	26.0%	28.4%	22.6%	14.8%	13.9%	24.7%	29.0%	17.1%	11.3%	10.8%	9.7%	15.6%
Kyushu	42.0%	29.3%	22.6%	14.8%	20.7%	34.0%	30.8%	19.0%	11.3%	10.8%	9.7%	17.2%
Interconnected	25.1%	27.9%	21.5%	12.1%	12.5%	20.8%	23.1%	15.2%	11.6%	11.2%	9.8%	13.8%
Okinawa	60.1%	55.7%	48.3%	42.9%	44.9%	40.7%	49.7%	55.9%	68.8%	60.9%	59.3%	72.1%
Nationwide	25.4%	28.2%	21.8%	12.4%	12.8%	21.0%	23.3%	15.6%	12.0%	11.5%	10.2%	14.3%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection line.

In the Okinawa EPCO regional service area, [20] which is a small and isolated island system unable to receive power through interconnection lines, the criterion of stable supply is to secure supply capacity over peak demand by deducting the capacity of the largest generating unit and balancing capacity with frequency control ('Generator I', total of 301 MW), without applying the criteria of other interconnected areas.[21]

Table 2-13 shows the monthly reserve margin against the deduction of the capacity of Generator I, which indicates the stable supply was secured in each month.

Table 2-13 Monthly Reserve Margin against the Deduction of the Capacity of Generator I (at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Okinawa	31.1%	30.9%	27.0%	22.3%	24.5%	19.7%	26.7%	29.0%	38.4%	31.7%	29.8%	40.7%

3. Projection of Supply–Demand Balance for 10 years (Long-Term)

a. Supply–Demand Balance

Table 2-14 and Figure 2-4 show the annual supply–demand balance projection(at 15:00 in August[23]) for a 10-year period.

A reserve margin of 8% is secured each year nationwide, even in the lowest margin of 12.7% in FY 2021.

Table 2-14 Annual Supply–Demand Balance Projection from FY 2020 to 2029
(nationwide at 15:00 in August,[23] 10^4 kW at the sending end)

	2020	2021	2022	2023	2024
Peak Demand	15,892	15,876	15,845	15,814	15,783
Supply Capacity	17,948	17,885	17,891	18,215	18,275
Reserve Margin	12.9%	12.7%	12.9%	15.2%	15.8%
	2025	2026	2027	2028	2029
Peak Demand	15,755	15,725	15,722	15,692	15,662
Supply Capacity	18,383	18,329	18,399	18,411	18,440
Reserve Margin	16.7%	16.6%	17.0%	17.3%	17.7%

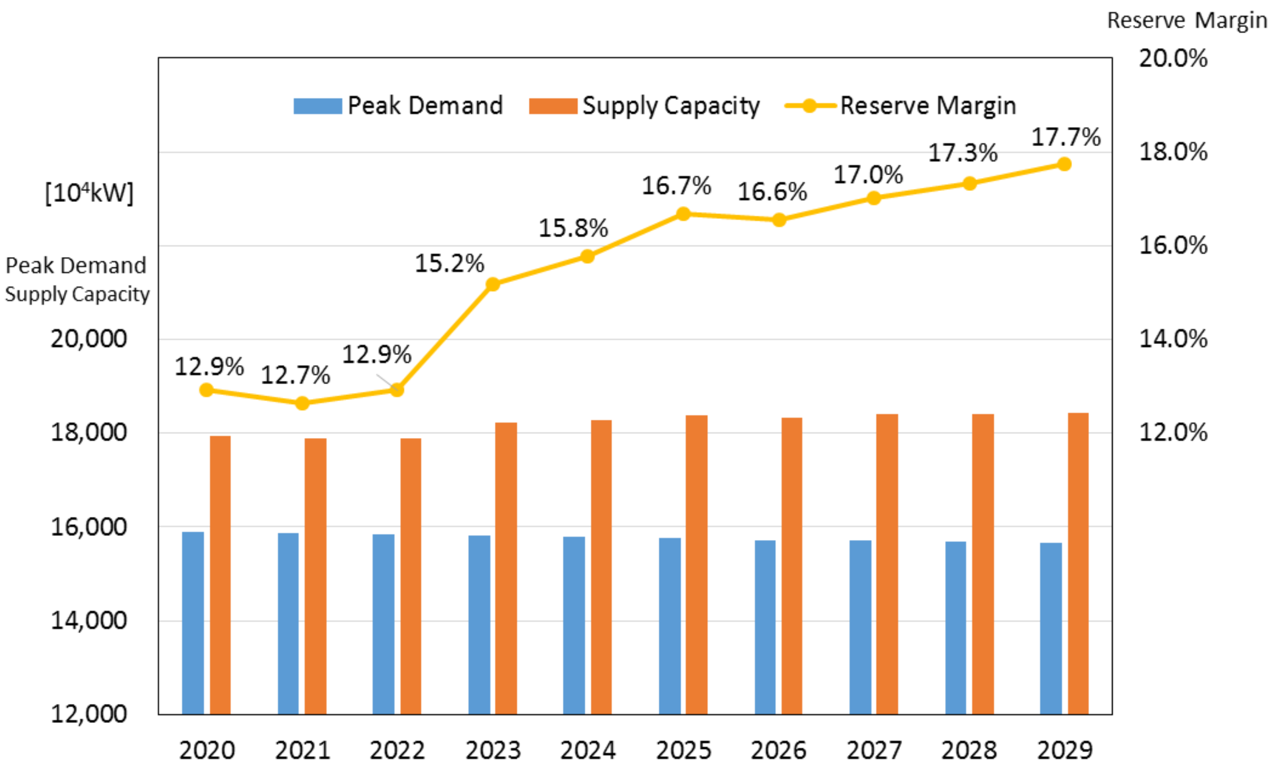


Figure 2-4 Mid-to-Long-Term Annual Supply–Demand Balance Projection
(nationwide at 15:00 in August,[23] at the sending end)

[23] In Okinawa, at 20:00 in August.

Table 2-15 shows the monthly projection of the least reserve margin for each regional service area. In addition, Table 2-16 shows the monthly projection of the least reserve margin for each regional service area recalculated to levelize using power exchanges to areas below the 8% reserve margin from areas over the 8% reserve margin based on the ATC.[18]

Reserve margins at each time calculation include some areas and years that cannot achieve the criterion of a stable supply such as Tokyo in FY 2021 and 2022, Chubu in FY 2021, and Kansai from FY 2025 to 2029. However, the criterion of a stable supply is projected to be secured in all areas and years by sharing power from other areas with sufficient supply capacity through cross-regional interconnection lines

Table 2-15 Annual Projection of Reserve Margins for Each Regional Service Area
(at 15:00 in August[23], resources within own service area only, at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	31.9%	27.6%	27.4%	50.2%	50.0%	50.9%	49.7%	61.1%	61.0%	61.1%
Tohoku	16.2%	24.7%	27.8%	30.5%	32.5%	33.9%	37.6%	38.9%	40.3%	41.7%
Tokyo	10.0%	5.2%	5.5%	9.1%	9.6%	13.7%	13.4%	13.2%	14.1%	14.3%
50 Hz areas Total	12.5%	10.1%	10.9%	15.5%	16.2%	19.6%	19.9%	20.7%	21.6%	22.0%
Chubu	10.6%	6.6%	11.0%	11.8%	15.7%	15.9%	16.4%	16.5%	17.0%	17.6%
Hokuriku	20.9%	9.4%	11.9%	14.8%	15.1%	13.9%	14.6%	15.0%	14.7%	15.0%
Kansai	8.9%	8.9%	9.4%	8.7%	9.0%	5.0%	5.7%	6.2%	6.0%	6.4%
Chugoku	23.2%	27.0%	28.7%	24.4%	25.1%	25.8%	26.0%	25.9%	25.4%	25.8%
Shikoku	23.4%	23.4%	13.0%	23.0%	24.5%	24.7%	26.0%	26.7%	26.1%	27.0%
Kyushu	11.5%	25.1%	18.7%	19.2%	14.0%	14.6%	9.0%	8.7%	8.0%	8.2%
60 Hz areas Total	13.1%	14.1%	14.2%	14.5%	15.0%	13.9%	13.4%	13.6%	13.5%	13.9%
Interconnected	12.8%	12.3%	12.7%	14.9%	15.5%	16.4%	16.3%	16.8%	17.1%	17.5%
Okinawa	27.9%	44.9%	34.4%	43.2%	45.3%	40.9%	40.0%	39.4%	38.7%	38.0%
Nationwide	12.9%	12.7%	12.9%	15.2%	15.8%	16.7%	16.6%	17.0%	17.3%	17.7%

Below 8% criteria

Table 2-16 Annual Projection of Reserve Margins for Each Regional Service Area
(at 15:00 in August[23], with power exchanges through cross-regional interconnection lines, at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	25.8%	20.0%	17.4%	40.2%	40.0%	40.8%	40.4%	51.8%	51.7%	51.8%
Tohoku	11.6%	9.7%	16.9%	20.1%	21.8%	23.1%	24.2%	25.6%	16.2%	16.6%
Tokyo	11.6%	9.7%	8.9%	12.4%	12.9%	15.1%	14.9%	15.0%	16.2%	16.6%
Chubu	13.1%	10.3%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Hokuriku	13.1%	13.9%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Kansai	13.1%	13.9%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Chugoku	13.1%	13.9%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Shikoku	13.1%	13.9%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Kyushu	13.1%	20.2%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Interconnected	12.8%	12.3%	12.7%	14.9%	15.5%	16.4%	16.3%	16.8%	17.1%	17.5%
Okinawa	27.9%	44.9%	34.4%	43.2%	45.3%	40.9%	40.0%	39.4%	38.7%	38.0%
Nationwide	12.9%	12.7%	12.9%	15.2%	15.8%	16.7%	16.6%	17.0%	17.3%	17.7%

Improve to over 8%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection line.

Further, information on environmental assessment of thermal power plants[19] probably includes some generating facilities which EPCO confirm their business judgment and proceed to their construction. Therefore, the Organization has investigated generating facilities that are not included in the electricity supply plans, although they have already made application for generator connection to GT&D companies and submitted construction plans according to the provisions of Article 48 of the Act in cooperation with the Government.

As a result, there are 390 MW of such generating facilities nationwide at the end of FY 2029; thus, the Organization includes those facilities to supply capacity and recalculates reserve margins as outlined in Table 2-17.

Table 2-17 Annual Projection of Reserve Margins for Each Regional Service Area

(at 15:00 in August [23], with power exchanges through cross-regional interconnection lines and generating facilities not included in the electricity supply plans, at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	25.8%	24.2%	21.6%	44.4%	44.2%	45.0%	44.6%	56.0%	55.9%	56.0%
Tohoku	11.6%	9.7%	16.9%	20.1%	21.8%	23.1%	24.2%	25.6%	16.3%	16.7%
Tokyo	11.6%	9.7%	9.1%	12.5%	13.1%	15.3%	15.0%	15.1%	16.3%	16.7%
Chubu	13.2%	10.3%	14.3%	14.6%	15.1%	15.3%	15.0%	15.1%	16.3%	16.7%
Hokuriku	13.2%	13.9%	14.3%	14.6%	15.1%	15.3%	15.0%	15.1%	16.3%	16.7%
Kansai	13.2%	13.9%	14.3%	14.6%	15.1%	15.3%	15.0%	15.1%	16.3%	16.7%
Chugoku	13.2%	13.9%	14.3%	14.6%	15.1%	15.3%	15.0%	15.1%	16.3%	16.7%
Shikoku	13.2%	13.9%	14.3%	14.6%	15.1%	15.3%	15.0%	15.1%	16.3%	16.7%
Kyushu	13.2%	20.7%	14.3%	14.6%	15.1%	15.3%	15.0%	15.1%	16.3%	16.7%
Interconnected	12.8%	12.5%	13.0%	15.2%	15.8%	16.7%	16.6%	17.1%	17.4%	17.8%
Okinawa	27.9%	44.9%	34.4%	43.2%	45.3%	40.9%	40.0%	39.4%	38.7%	38.0%
Nationwide	13.0%	12.8%	13.2%	15.4%	16.0%	16.9%	16.8%	17.3%	17.6%	18.0%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection line.

In the Okinawa EPCO regional service area [20], which is a small and isolated island system unable to receive power through interconnection lines, the criterion of stable supply is to secure supply capacity over peak demand by deducting the capacity of the largest generating unit and balancing capacity with frequency control ('Generator I', total of 301 MW), without applying the criteria of other interconnected areas.[21]

Table 2-18 shows the monthly reserve margin against the deduction of the capacity of Generator I, which indicates the stable supply was secured in the projected period.

Table 2-18 Annual Projection of a Reserve Margin with the Capacity Equivalent to Generator I in Okinawa Deducted (at 20:00 in August, at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Okinawa	7.3%	24.5%	14.1%	23.0%	25.3%	21.0%	20.2%	19.6%	19.1%	18.5%

Table 2-19 shows the annual projection of reserve margins in January for winter peak demand in the Hokkaido and Tohoku EPCO areas. A stable supply is secured throughout the period. In addition, Table 2-20 shows the projection of the least reserve margin for each regional service area recalculated to levelize using power exchanges to areas below the 8% reserve margin from areas over the 8% reserve margin based on the ATC.

Table 2-19 Annual Projection of Reserve Margins for Winter Peak Demand in the Hokkaido and Tohoku Areas (at 18:00 in January, at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	13.9%	28.3%	33.3%	28.3%	28.8%	29.1%	38.6%	38.5%	38.5%	38.4%
Tohoku	16.5%	21.3%	21.8%	24.2%	25.6%	27.3%	30.7%	32.0%	34.1%	35.8%

Table 2-20 Annual Projection of Reserve Margins for Winter Peak Demand in the Hokkaido and Tohoku Areas (at 18:00 in January, with power exchanges through cross-regional interconnection lines, at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	15.3%	23.2%	24.9%	25.3%	26.5%	27.8%	32.9%	33.7%	35.3%	36.5%
Tohoku	16.0%	23.2%	24.9%	25.3%	26.5%	27.8%	32.9%	33.7%	35.3%	36.5%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection lines.

There are 390 MW of generating facilities that are not included in the electricity supply plans, although they have already made application for generator connection to GT&D companies and submitted construction plans according to the provisions of Article 48 of the Act. Table 2-21 shows the recalculated reserve margins including those facilities to supply capacity.

Table 2-21 Annual Projection of Reserve Margins for Winter Peak Demand in the Hokkaido and Tohoku Areas (at 18:00 in January, with power exchanges through cross-regional interconnection lines and generating facilities not included in the electricity supply plans, at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	16.8%	24.1%	27.8%	26.2%	27.4%	28.7%	33.8%	34.7%	36.3%	37.4%
Tohoku	16.8%	24.1%	25.1%	26.2%	27.4%	28.7%	33.8%	34.7%	36.3%	37.4%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection lines.

b. Supply Capacity Secured by GT&D Companies

GT&D companies secure their supply capacity for the demand of isolated island areas throughout the projected period, and also secure a balancing capacity equivalent to 7%[24] over their peak demand in their regional service areas for FY 2020 by public solicitation. Table 2-22 shows the secured balancing capacity procured by GT&D companies.[25]

Table 2-22 Secured Balancing Capacity[25] Procured by GT&D Companies (%, 10^4 kW in Okinawa)

	Hokkaido	Tohoku	Tokyo	Chubu	Hokuriku	Kansai	Chugoku	Shikoku	Kyushu	Okinawa
Balancing Capacity	7.0%	7.0%	7.0%	7.1%	7.0%	7.0%	7.1%	7.3%	7.1%	30.1

c. Conclusions Concerning Supply–Demand Balance Evaluation

i) Supply–Demand Balance Evaluation for FY 2020 and 2021 (short-term)

The criterion of stable supply (i.e., 8% of reserve margin) is secured throughout the areas and for the short-term period.

On the other hand, there are some months and areas that have scarce reserve margin in the peak demand period, especially in winter. Careful watch shall be kept for abrupt outages or suspension and retirement of generating facilities.

ii) Supply–Demand Balance Evaluation for FY 2020–2029 (mid-to-long-term)

The criterion of stable supply is also secured throughout the areas and for the mid-to-long-term period.

However, the supply-demand balance in the three years from FY 2020 to 2022 is projected to be tight. The Organization continuously and carefully evaluates the supply–demand balance, monitoring the submission of changing supply plans and the accompanying supply–demand balance.

[24] Public solicitation of balancing capacity is implemented so as to secure a balancing capacity equivalent to 7% over their peak demand in their regional service areas, and its procurement is based on the peak demand of the second projected year of the previous electric supply plan. Therefore, the procured balancing capacity may be lower than the capacity equivalent to 7% over their peak demand of the current year.

[25] The capacity is the ratio of the balancing capacity to the peak demand in the regional service areas of GT&D companies. The ratios for the Hokkaido and Tohoku EPCO areas are in January, and in August for the other areas.

[Reference] Detailed Analysis of the Aggregation

a. Transition of supply capacity by generation sources

Table 2-5 shows the supply capacity (at 15:00 in August,[26] nationwide) by power generation source in the projected period.

Supply capacity of renewables[27] is projected to increase. Thermal power is projected to temporarily decrease through replacement according to future power development and reach its bottom in FY 2021 and 2022, after which it increases due to replacement or new installations.

As a whole, supply capacity is projected to decrease slightly in the coming years, but thereafter increases.

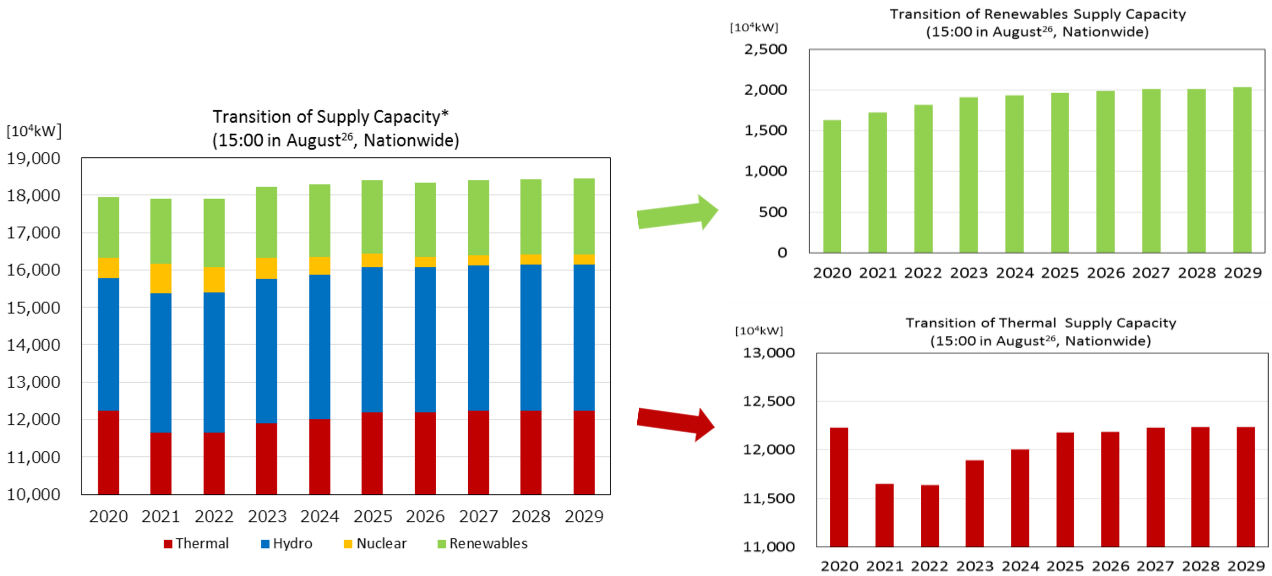


Figure 2-5 Transition of Supply Capacity by Generation Sources

(* Each generation source is added up figure of submission from EPCOs.)

[26] In Okinawa, at 12:00.

[27] In Okinawa, supply capacity of solar and wind power is calculated for the L5 value.

b. Transition of suspended thermal power plants

Figure 2-6 shows mid-to-long-term projections of suspended thermal power plants (19 - 23 GW), which are not counted as supply capacity due to long-term planned outage. The Organization has implemented hearings from EPCOs regarding whether the suspended plants are available for postponement of suspension or rapid power generation around one year with judgment and preparation in the proper timing. As a result, it is possible that suspended thermal power plants of 6 - 13 GW will be counted on as additional supply capacity.

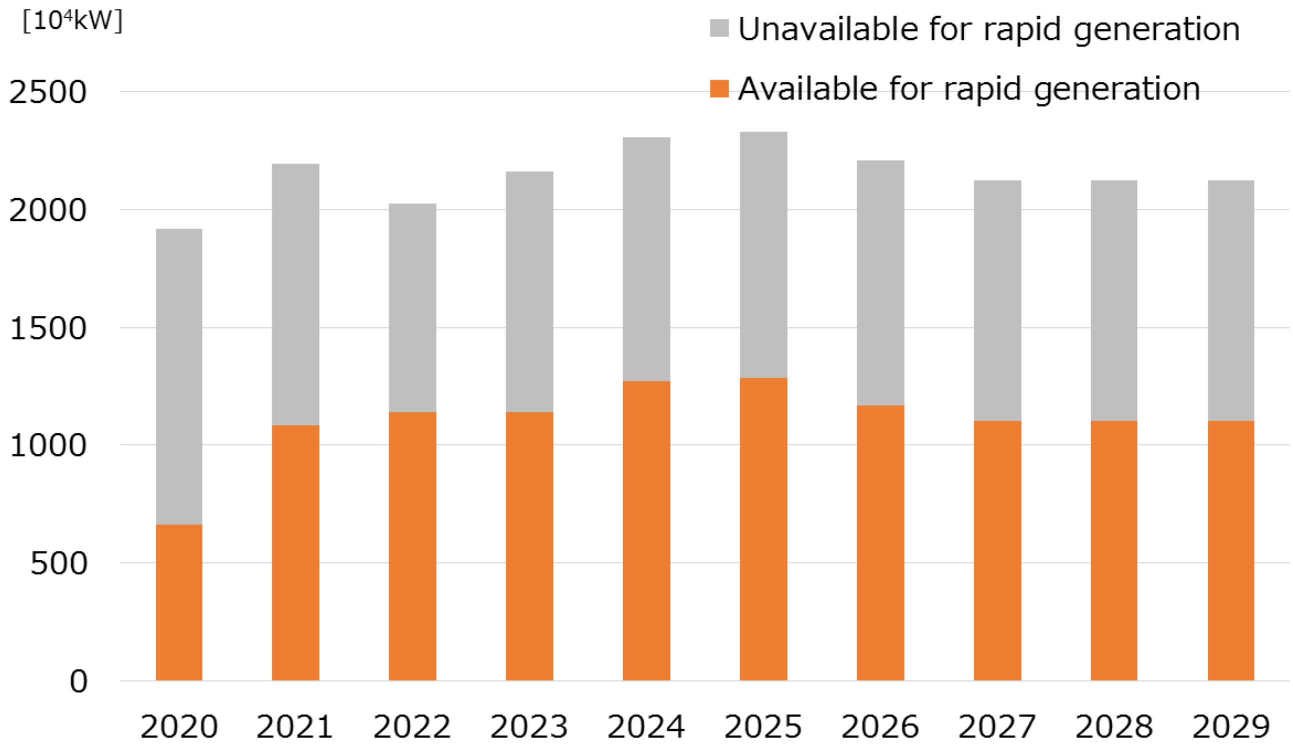


Figure 2-6 Projections of Suspended Thermal Power Plants

III. Analysis of the Transition of Power Generation Sources

Analysis in this chapter is based on the automatic aggregation of values submitted from EPCOs. It is noted that these values will not necessarily be realized in the future due to operating conditions of power plants or actions due to political measures.

1. Transition of Power Generation Sources (Capacity)

The installed power generation capacity is the automatic aggregation of the capacity of electric power plants owned by EPCOs and those as feed-in-tariff (FIT) generators owned by companies other than EPCOs that are registered as the procured supply capacity of retail and GT&D companies in the projected period. For the development plans of EPCOs, only generating facilities that have a given probability of development are included in the calculation; however, not all development plans will necessarily be realized, and inefficient facilities will proceed to be retired resulting from actions due to political measures in the future.

The installed generation capacity by power generation source submitted from EPCOs is calculated from the concepts below.

*1 Hydro and Thermal

For existing facilities, the generation company aggregates the generating facility that it owns. For newly installing facility, generating facility such as in the course of proceeding its environmental assessment or publishing its commercial operation, is included in the aggregation. The same concept is applied to geothermal, biomass and wastes power generation sources.

*2 Nuclear

The generation company aggregates the generating facility in actual operation that it owns, in addition to 33 units for which the date for resuming operation is uncertain, and excluding any operation-terminated facility.

*3 Solar and Wind

The GT&D company aggregates the projected value of integrating the generation facility according to application of preliminary consultation and the available connecting capacity of its transmission lines or the actual growth trend of integration.

Table 3-1 and Figure 3-1 show the transition of installed power generation capacity by power generation source which are automatically aggregated values of EPCOs submission based on the concepts above.

Table 3-1 Composition of the Transition of Installed Power Generation Capacities by Power Generation Source (nationwide, 10^4 kW)

Power Generation Sources		2019	2020	2024	2029
Hydro*1		4,915	4,913	4,930	4,940
	Conventional	2,168	2,166	2,183	2,192
	Pumped Storage	2,747	2,747	2,747	2,747
Thermal*1		15,950	16,062	16,293	16,378
	Coal	4,595	4,752	5,286	5,282
	LNG	8,365	8,414	8,205	8,291
	Oil and others[28]	2,990	2,897	2,802	2,805
Nuclear*2		3,308	3,308	3,308	3,308
Renewables		6,456	6,951	8,537	9,545
	Wind*3	433	486	865	1,272
	Solar*3	5,535	5,970	7,048	7,652
	Geothermal*1	53	54	53	55
	Biomass*1	331	359	500	497
	Waste*1	106	83	71	71
Miscellaneous		40	24	23	23
Total		30,671	31,259	33,092	34,194

Note) The totals are not necessarily equal due to independent rounding.

*1 The Organization automatically aggregates the value of the genererating facility that the generation company owns; however, not all development plans will necessarily be realized, and inefficient facilities will proceed to be retired resulting from actions due to political measures in the future. For newly installing facility, generating facility such as in the course of proceeding its environmental assessment or publishing its commercial operation, is included in the aggregation.

*2 Included are the facilities in actual operation, in addition to 33 units for which the date for resuming operation is uncertain; operation-terminated facilities are excluded.

*3 The GT&D company aggregates the projected value of integrating the generation facility according to application of preliminary consultation and the available connecting capacity of its transmission lines or the actual growth trend of integration.

[28] The category 'Oil and others' includes the total installed capacities from oil, LPG, and other gas and bituminous mixture fired capacities.

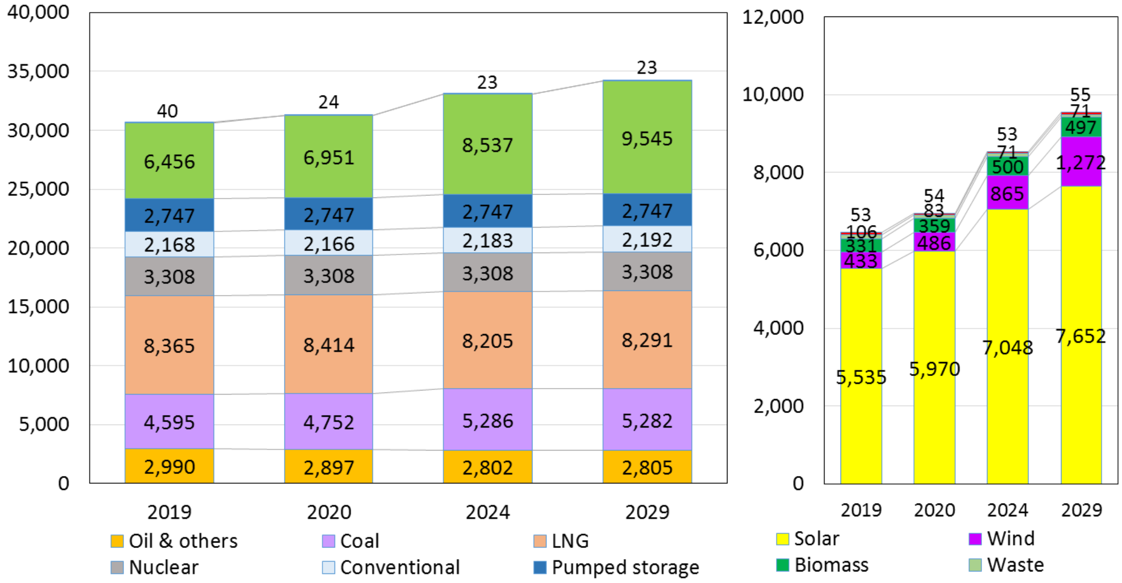


Figure 3-1 Transition of Installed Power Generation Capacities by Power Generation Sources (Nationwide)

* The sum of the installed power generation capacity by each power generation source is the aggregation of the values submitted by EPCOs.

2. Installed Power Generation Capacity for Each Regional Service Area

Figure 3-2 shows the installed power generation capacity for each regional service area at the end of FY 2019.

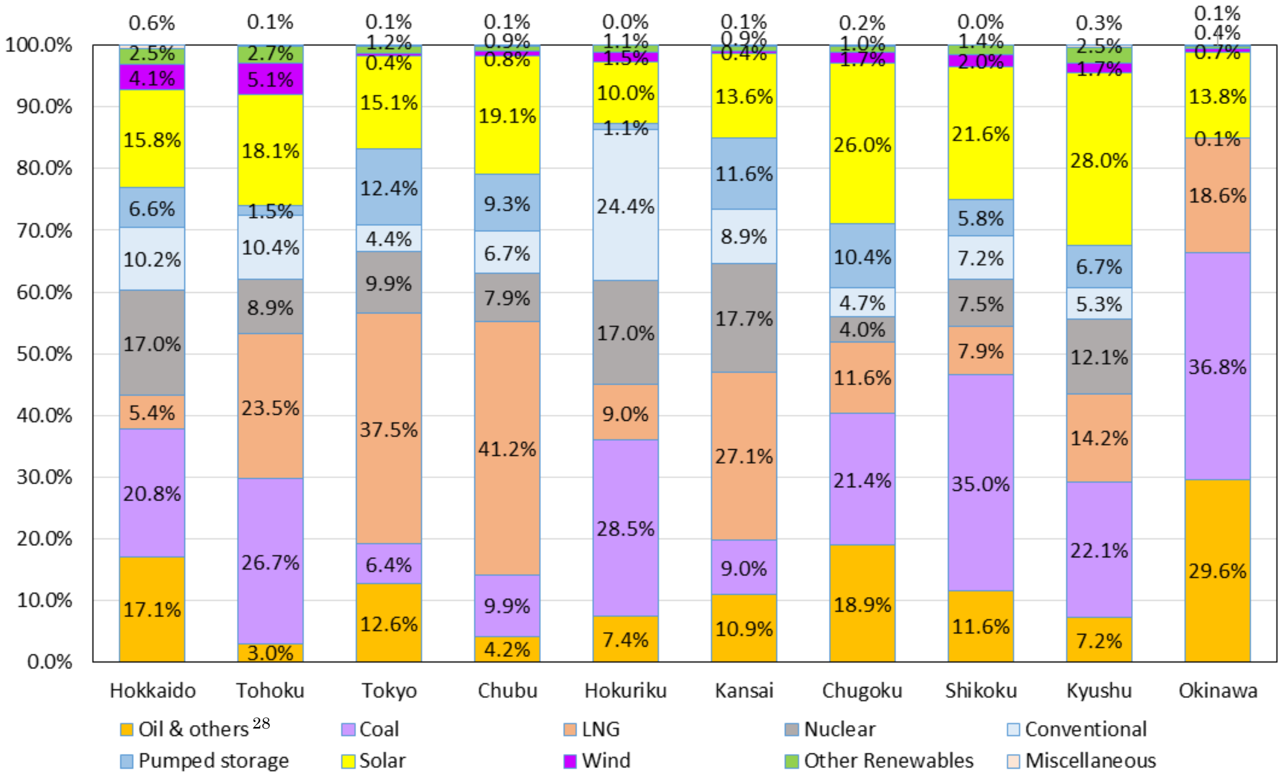


Figure 3-2 Composition of Installed Power Generation Capacity (kW) for Each Regional Service Area

* The ratio of the installed power generation capacity by each power generation source is calculated from automatic aggregation of the values.

3. Transition of Solar and Wind Generation Capacities

Figure 3-3 shows the projection of integrated solar and wind generation capacities by each regional service area (at the end of the indicated fiscal year).[29]

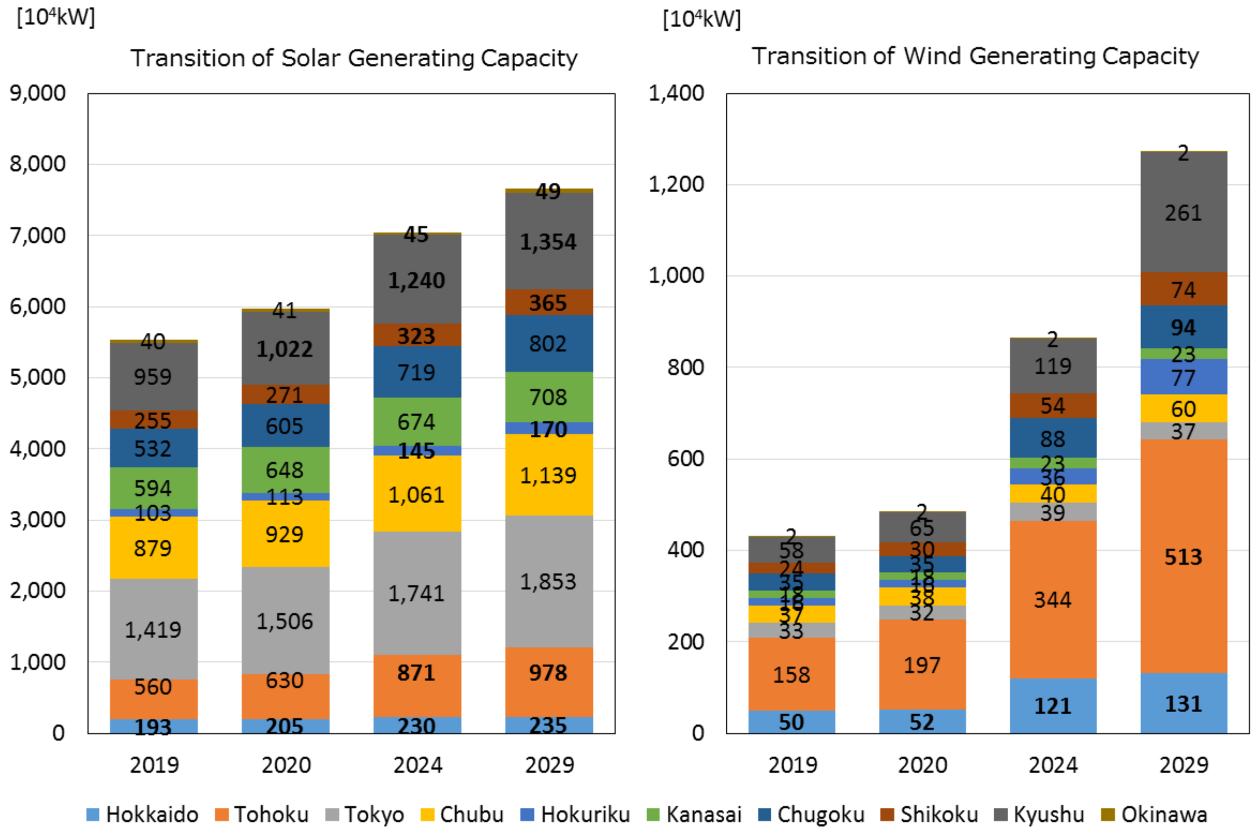


Figure 3-3 Transition of Solar and Wind Generating Capacity for Each Regional Service Area

[29] The GT&D company of each regional area aggregates the projected value of integrating the generation facility according to application of preliminary consultation for generator interconnection, and the available connecting capacity of its transmission lines or the actual growth trend of integration.

4. Development Plans by Power Generation Source

Table 3-2 shows the development plans[30] up to FY 2029 submitted by generation companies, according to their new developments, uprated or derated installed facilities, and planned retirement of facilities in the projected period.

Table 3-2 Generation Development Plans up to FY 2029 by Stages[30] (nationwide, 10^4 kW)

Power Generation Sources		New Installation		Uprating/Derating		Retirement	
		Capacity	Sites	Capacity	Sites	Capacity	Sites
Hydro		**37.9**	**51**	**6.8**	**46**	**△ 22.2**	**32**
	Conventional	37.9	51	6.8	46	△ 22.2	32
	Pumped Storage	-	-	-	-	-	-
Thermal		**1,447.6**	**34**	**5.2**	**1**	**△ 958.6**	**42**
	Coal	685.1	10	-	-	△ 51.8	3
	LNG	757.4	15	5.2	1	△ 763.5	16
	Oil	5.1	9	-	-	△ 143.3	23
	LPG	-	-	-	-	-	-
	Bituminous	-	-	-	-	-	-
	Other Gas	-	-	-	-	-	-
Nuclear		**1,018.0**	**7**	**15.2**	**1**	**-**	**-**
Renewables		**735.3**	**345**	**0.8**	**3**	**△ 31.1**	**49**
	Wind	179.2	54	-	-	△ 14.7	36
	Solar	404.0	253	-	-	△ 0.2	1
	Geothermal	4.4	3	0.6	2	△ 2.4	1
	Biomass	140.5	30	-	-	△ 8.4	6
	Waste	7.2	5	0.2	1	△ 5.6	5
Total		**3,238.7**	**437**	**28.0**	**51**	**△ 1,012.0**	**123**

Note) The totals are not necessarily equal due to independent rounding to two decimal places.

30 These are aggregated including facilities for which the date of commercial operation is "uncertain."

[Reference] Net Electric Energy Generation (at the sending end)

Net electric energy generation (at the sending end) is an estimation* comprised of calculated values by power generation source in a given premise by each generation company or GT&D company for the projected period. Note that this is not necessarily the same as actual net electric energy generation.

Each generation company has submitted the value of electric energy generation, which is the sum of the energy generation of available generation facilities in the projected period. This is automatically summed in merit order of operation cost. In addition, the value is based on future energy sales led by actual sales and future sales contracts, without considering the effect of regulating measures.

This estimation of net electric energy generation may change according to the operating conditions of nuclear power plants, change in generation sources—specified as "miscellaneous" in future trends—and energy output shedding of inefficient coal-fired thermal power generation according to the regulating measures of generation efficiency under the Energy Conservation Act. Thus, note that the estimation is not necessarily the same as electric energy generation in the future, and is likely to approximate the target value of the energy mix of the nation.

The calculation method and the result of net electric energy generation by power generation source are stated below.

* This estimation includes electric energy generated from generation facilities owned by generationcompanies as well as that of generation facilities such as FIT generators, which retail companies or GT&D companies procure from sources other than generation companies.

(1) Renewables (Table 3-3)

For solar and wind power, the GT&D company calculates their energy generation, based on the aggregation of the projected value of integrating generation facility according to application of preliminary consultation and the available connecting capacity of its transmission lines or the actual growth trend of integration. For geothermal, biomass and waste power generation sources, the generation company calculates their energy generation based on the generation plan that the company develops.

Table 3-3 Composition of the Transition of Electric Energy Generated by Renewable Generation Sources (nationwide, at the sending end; 10^8 kWh)

Generation Source		2019	2020	2024	2029
Renewables		937	1,023	1,362	1,504
	Wind	82	93	166	237
	Solar	634	684	842	912
	Geothermal	25	25	28	29
	Biomass	167	197	305	305
	Waste	28	23	22	21

(2) Hydro and Thermal (Table 3-4)

The generation company calculates their energy generation based on the generation plan that the company develops. For thermal power generation, the energy generated from coal-fired thermal power, which has a relatively low operation cost, has a large share due to its merit-order ranking (by operation cost) without considering the effect of regulating measures.

Table 3-4 Composition of the Transition of Electric Energy Generated by Hydro and Thermal Generation Sources (nationwide, at the sending end; 10^8 kWh)

Generation Source		2019	2020	2024	2029
Hydro		822	819	839	875
	Conventional	757	769	780	802
	Pumped Storage	65	49	60	73
Thermal		6,553	6,539	5,890	5,782
	Coal	2,681	2,884	3,070	3,128
	LNG	3,594	3,370	2,563	2,403
	Oil and others[28]	278	284	256	251

(3) Nuclear (Table 3-5)

The generation company calculates their energy generation based on the generation plan that the company develops for units resuming operation at the end of February 2020. However, units with over 40 years of actual operation require permission from the Nuclear Regulation Authority to resume operation; the energy generation of such units is calculated as zero. In addition, projections concerning resumption of operation are not included in the estimation.

Table 3-5 Composition of the Transition of Electric Energy Generated by Nuclear Generation Sources (nationwide, at the sending end; 10^8 kWh)

Generation Source	2019	2020	2024	2029
Nuclear	604	419	475	303

Table 3-6 shows the sum of (1), (2) and (3) with the energy generation categorized as “miscellaneous”.

Table 3-6 Composition of the Transition of Electric Energy Generated by All Generation Sources (nationwide, at the sending end; 10^8 kWh)

	2019	2020	2024	2029
Total	9,030	8,853	8,597	8,491

[Reference] Net Electric Energy Generation for Each Regional Service Area

Figure 3-4 shows the net electric energy generation for each regional service area in FY 2019.

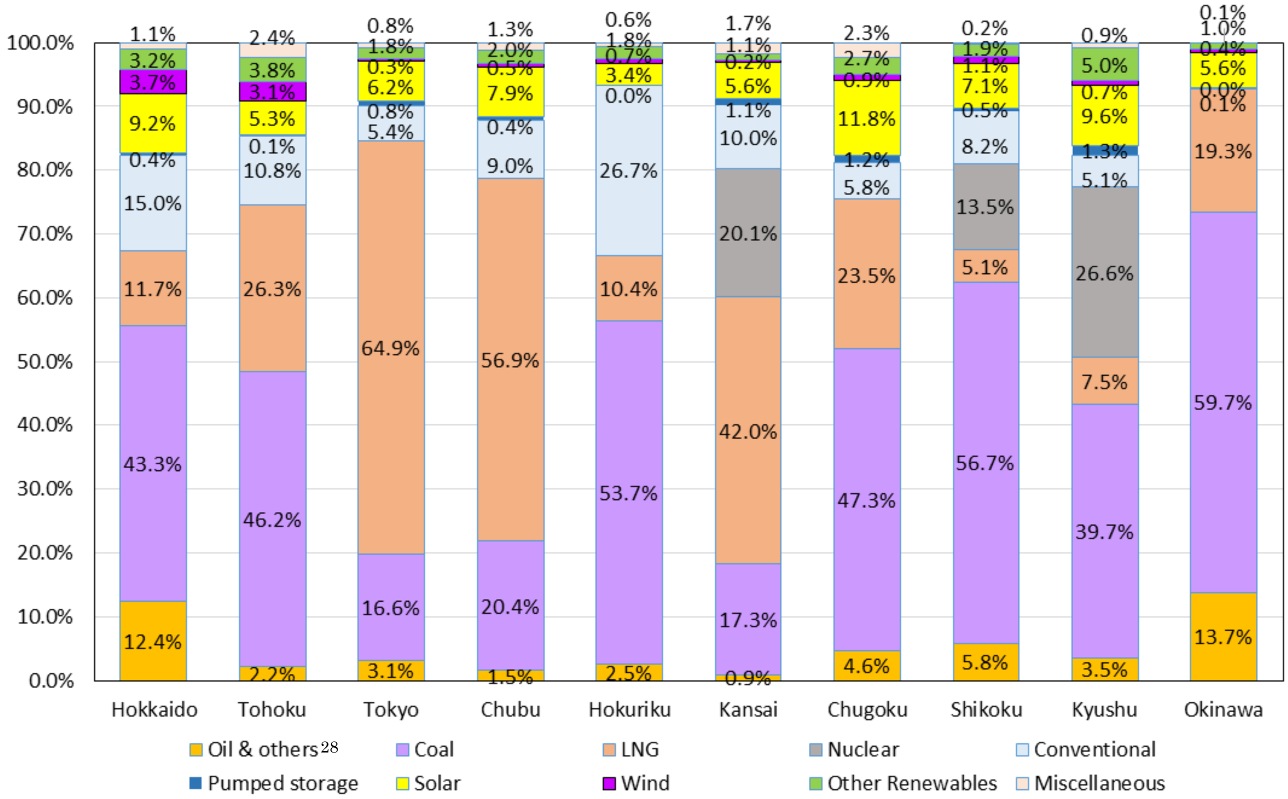


Figure 3-4 Composition of Net Electric Energy Generation (kWh) for Each Regional Service Area

[Reference] Transition of Capacity Factors by Power Generation Source

Table 3-7 and Figure 3-5 show the capacity factors by power generation source. Projection of the capacity factors is automatically calculated using the aforementioned power generation sources and the net electric energy generation data provided by the Organization.

As noted, these values are calculated from a given projection; the capacity factors in this chapter will differ from those in actual operation.

Table 3-3 Capacity Factors by Power Generation Source (nationwide)

Power Generation Sources		FY 2019	FY 2020	FY 2024	FY 2029
Hydro		19.0%	19.0%	19.4%	20.2%
	Conventional	39.8%	40.6%	40.8%	41.8%
	Pumped Storage	2.7%	2.0%	2.5%	3.0%
Thermal		46.8%	46.5%	41.3%	40.3%
	Coal	66.4%	69.3%	66.3%	67.6%
	LNG	48.9%	45.7%	35.7%	33.1%
	Oil and others[28]	10.6%	11.2%	10.4%	10.2%
Nuclear		20.8%	14.5%	16.4%	10.5%
Renewables		16.5%	16.8%	18.2%	18.0%
	Wind[31]	21.6%	21.9%	21.9%	21.3%
	Solar[31]	13.0%	13.1%	13.6%	13.6%
	Geothermal	53.6%	54.1%	60.3%	61.2%
	Biomass	57.4%	62.6%	69.5%	70.0%
	Waste	30.7%	32.1%	34.8%	34.3%

* These values are calculated from a given projection; note that the capacity factors in this chapter will differ from those in actual operation.

[31] There is no consideration for low capacity factors of solar and wind power generation due to output shedding.

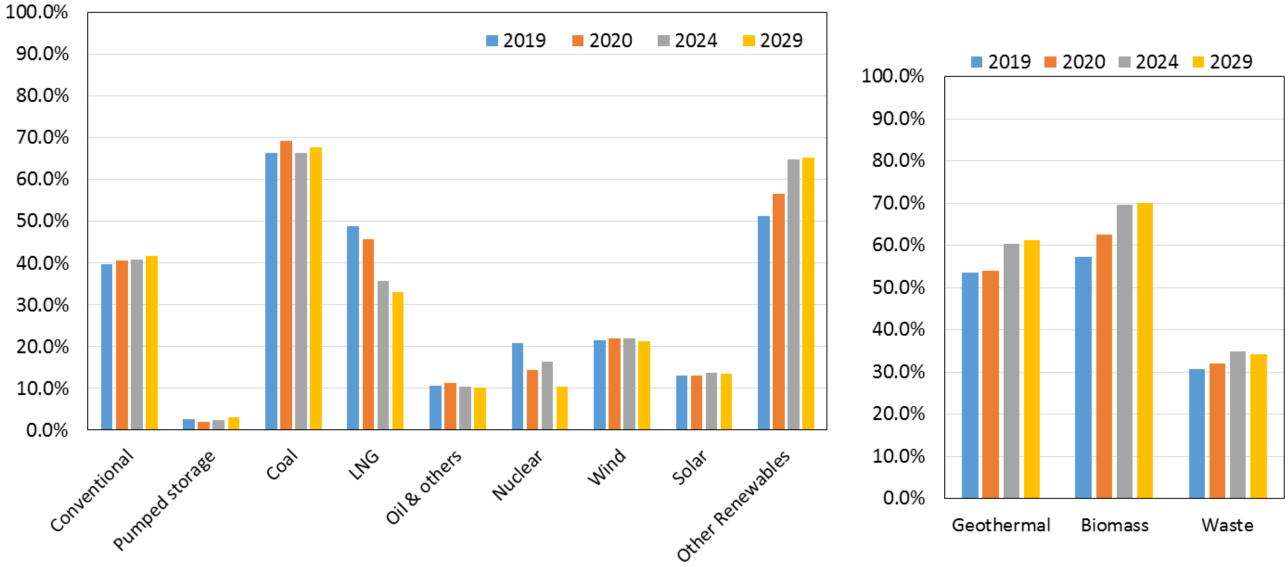


Figure 3-5 Capacity Factors by Power Generation Source (Nationwide)

* These values are calculated from a given projection; note that the capacity factors in this chapter will differ from those in actual operation.

IV. Development Plans for Transmission and Distribution Facilities

The Organization has aggregated the development plans[32] for cross-regional transmission lines and substations (transformers and AC/DC converters) up to FY 2029 submitted by GT&D and transmission companies. Table 4-1 shows the development plans for cross-regional transmission lines and substations. Figure 4-1 shows the outlook for electric systems nationwide. (1), (2), and (3) below list the development plans according to cross-regional transmission lines, major substations, and summaries, respectively.

Newly installing generation facilities, mostly renewables generators, are likely to be sited in remote areas distant from the load center. Thus, new long distance transmission network development plans are under review.

For cross-regional interconnection lines, the necessary enhancement is planned for cross-regional operation.

Table 4-1 Development Plans for Cross-regional Transmission Lines and Substations[33]

Increased Length of Transmission Lines [34][35]*		726km (549km)
	Overhead Lines*	687km (542km)
	Underground Lines	39km (6km)
Uprated Capacities of Transformers		28,290MVA (17,400MVA)
Uprated Capacities of AC/DC Converters[36]		1,800MW (1,800MW)
Decreased Length of Transmission Lines (Retirement)		△ 61km (△108km)
Derated Capacities of Transformers (Retirement)		△ 2,700MVA (△2,700MVA)

Enhancement plans for cross-regional transmission lines are summarized below.

[32] Development plans for transmission lines and substations are required to be submitted for voltages of more than 250 kV, or within two classes of the highest voltage available in the regional service areas. (For the Okinawa EPCO, only 132 kV or more is required.) The totals are not necessarily equal due to independent rounding.
[33] Figures in parenthesis are those in the previous year.
[34] Development plans corresponding to changes in line category or circuit numbers that were not included in measuring the increased length of transmission lines were treated as 'no change in the length of transmission lines'.
[35] Increased length does not include the item with * because of an undetermined in-service date.
[36] Installed capacity for the converter station on one side is included in the DC transmission system.

Interconnection Facility Enhancement Plan between Tohoku and Tokyo
(in service: November 2027)

500kV Transmission Lines	・(prov.)Cross-regional North Bulk Line: 81 km ・(prov.)Cross-regional South Bulk Line: 62 km ・Soma-Futaba Bulk Line/ Connecting Point Change: 15 km ・(prov.)Shinchi Access Line/ Cross-regional Switching Station lead-in: 1km ・(prov.)Joban Bulk Line/ Cross-regional Switching Station Dπ lead-in: 1 km
Switching Stations	(prov.)Cross-regional Switching Station: 10 circuits

Interconnection Facility Enhancement Plan between Tokyo and Chubu
(120 MW→210 MW; in service: March 2021)

AC/DC Converter Stations	・Shin Shinano AC/DC Converter Station： 900 MW ・Hida AC/DC Converter Station： 900 MW
DC Bulk Line 500kV Transmission Lines	・Hida-Shinano DC Bulk Line: 89 km ・Hida Branch Line: 0.4 km

Interconnection Facility Enhancement Plan between Tokyo and Chubu
(210 MW→300 MW; in service: FY 2027)

Frequency Converter Stations	・(prov.)Shin Sakuma FC station: 300 MW ・Higashi Shimizu FC station: 300 MW→900 MW
275 kV Transmission Lines	・Higashi Shimizu Line: 20 km ・(prov.)Sakuma Higashi Bulk Line/ Shin Sakuma FC Branch Line: 3 km ・(prov.)Sakuma Nishi Bulk Line/ Shin Sakuma FC Branch Line: 1 km ・Shin Toyone-Toei Line: 1 km ・Sakuma Nishi Bulk Line: 11 km , 2km ・Sakuma Higashi Bulk Line: 123 km
500 kV Transformers	・Shin Fuji Substation: 750MVA×1 ・Shizuoka Substation: 1,000MVA×1 ・Toei Substation: 800MVA×1 →1,500MVA×2

Interconnection Facility Enhancement Plan between Chubu and Kansai
(in service: undetermined)*under review in the master plan[37]

500 kV Transmission Lines	・Sekigahara Kita Oomi Line: 2 km ・Sangi Bulk Line/ Sekigahara Switching Station π lead-in: 1 km ・Kita Oomi Line/ Kita Oomi Switching Station π lead-in: 1 km
Switching Stations	・Sekigahara Switching Station: 6 circuits ・Kita Oomi Switching Station: 6 circuits

[37] The master plan is the facility formation policy that targets the long-term future electricity system.

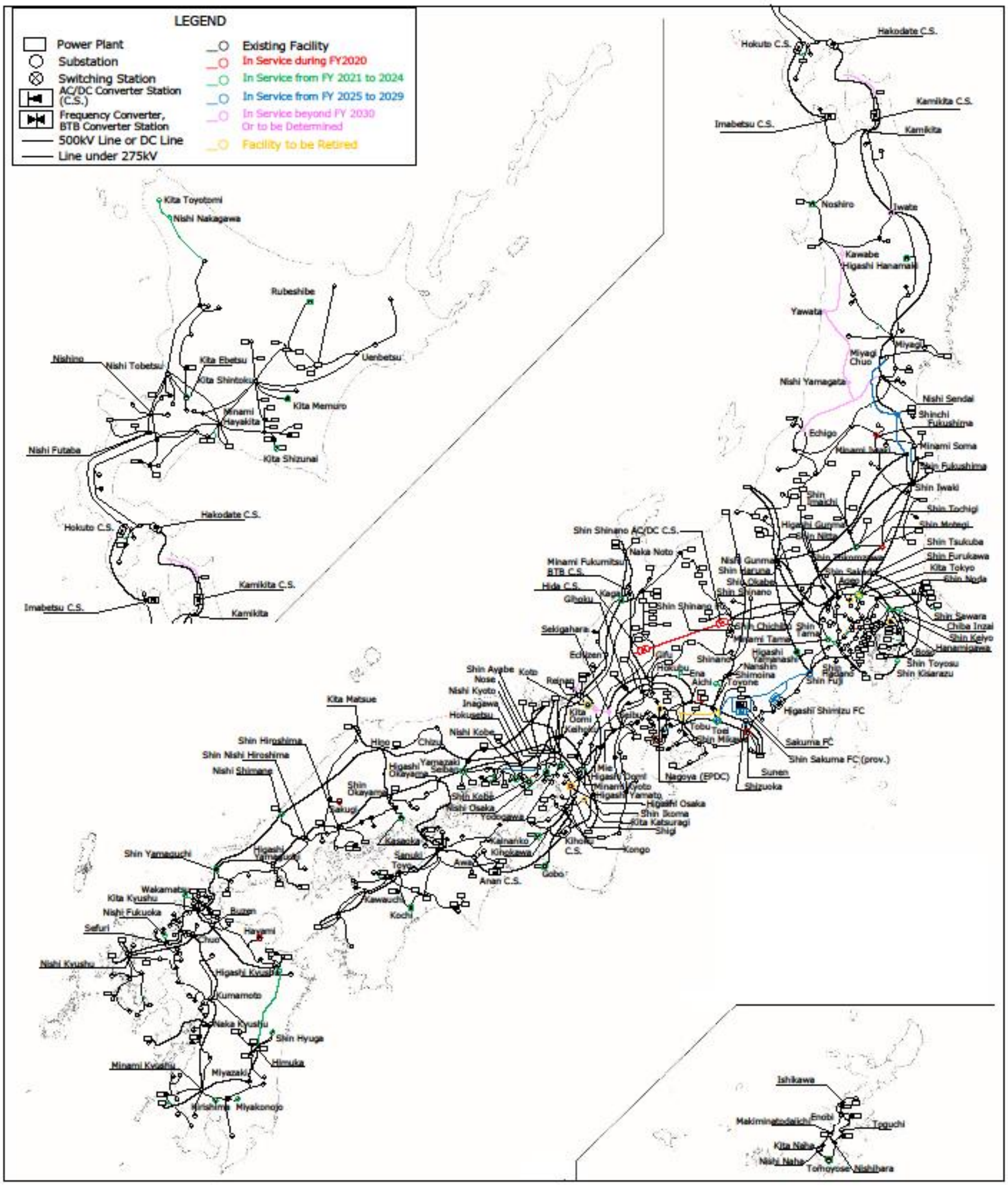


Figure 4-1 Power Grid Configuration in Japan

1. Development Plans for Major Transmission Lines

Table 4-2 Development Plans under Construction

Company	Line[38]	Voltage	Length[39, 40]	Circuit	Under construction	In service	Purpose[41]
TEPCO Power Grid	Shinano-Hida DC Bulk Line	DC± 200kV	89km	BP 1	Jul. 2017	Mar. 2021	Reliability upgrade*4
	Shinjuku-Jonan Line replacement	275kV	16.4km *2,*3	3	Nov. 2017	Jul. 2018(No.1) Apr. 2020(No.2) Apr. 2019(No.3)	Aging management
	Higashi Shinjuku Line replacement	275kV	23.4→5.0km (No.2) *2, *3 23.4→5.3km (No. 3) *2, *3	2	Jan. 2019	Nov. 2032(No.2) Nov. 2025(No.3)	Aging management
	Shinjuku Line replacement	275kV	22.1→ 21.1km (No.1) *2, *3 19.9→ 21.1km (No.2,3) *2, *3	3	Sep. 2019	Aug. 2028(No.1) Nov. 2032(No.2) Nov. 2025(No.3)	Aging management
Chubu EPCO	Hida Branch Line	500kV	0.4km	2	Jun. 2018	Sep. 2020	Reliability upgrade*4
	Yahagi daiichi Branch Line	275kV	5km	1	Jul. 2019	Mar. 2021	Aging management Economic upgrade
	Higashi Nagoya - Tobu Line	275kV	8km*2	2	Apr. 2019	Jun. 2025	Aging management Economic upgrade
Kansai EPCO	Kobelco Power Kobe daini Access Line*1	275kV	4.4km*2	3	Apr. 2017	Feb. 2021(No.1) May 2021(No.2) Feb. 2022(No.3)	Generator connection
	Shin Kobe Line	275kV	20.2km→ 21.5km*2	2	May 2019	Jul. 2020	Generator connection Aging management
Shikoku EPCO	Saijo Access Line*1	187kV	7km*3	2	Nov. 2019	May 2021	Generator connection
Kyushu EPCO	Hyuga Bulk Line	500kV	124km	2	Nov. 2014	Jun. 2022	Reliability upgrade Economic upgrade
	JR Shin Isahaya Branch Line	220kV	1km	2	May 2019	Apr. 2021	Demand coverage
Electric Power Development Company (EPDC)	Ooma Bulk Line	500kV	61.2km	2	May 2006	Uncertain	Generator connection
Northern Hokkaido Wind Energy Transmission Company (NHWETC)	NHWETC Toyotomi-Nakagawa Bulk Line	187kV	51km	2	Sep. 2018	Sep. 2022	Generator connection

38 Line with *1 denotes the line renamed not to be identified the fuel of the connecting power plant.
39 Length with *2 denotes "Underground," otherwise "Overhead."
40 Length with *3 denotes the change of line category or circuit numbers, not included in Table 4-1.
41 Purpose is stated below: *4 indicates enforcement related to cross-regional interconnection lines.
*5 indicates the case is under review in the master plan of the cross-regional development plan.

Demand coverage	Related to increase/decrease of demand
Generator connection	Related to generator connection or retirement
Aging management	Related to aging management of facilities (including proper update of facilities with evaluation of obsolescence
Reliability upgrade	Related to improvement in the reliability or security of stable supply
Economic upgrade	Related to improvement in economies, such as reducing transmission loss, facility downsizing, or upgrading the stability of the system

Table 4-3 Development Plans in the Planning Stages

Company	Line[38]	Voltage	Length[39, 40]	Circuit	Under construction	In service	Purpose[41]
Hokkaido EPCO	(prov.) Tomakomai Access Line*1	187kV	0.2km	1	May 2021	Jun. 2022	Generator connection
	(prov.) Kaminokuni daini Access Line*1	187kV	0.1km	1	Jan. 2021	Jul. 2021	Generator connection
	Kita Horonobe Line partly uprating	187kV	69km	2	May 2021	Jul. 2022	Generator connection
Tohoku EPCO	Plant A Access Line*1	275kV	3km	1	May 2021	FY 2022	Generator connection
	Plant B Access Line*1	275kV	0.2km	1	May 2021	FY 2022	Generator connection
	(prov.)Cross-regional North Bulk Line	500kV	81km	2	Sep. 2022	Nov. 2027	Generator connection
	(prov.)Cross-regional South Bulk Line	500kV	62km	2	Sep. 2024	Nov. 2027	Generator connection
	Soma-Futaba Bulk Line/connecting point change	500kV	15km	2	Apr. 2022	Nov. 2025	Generator connection
	(prov.)Shinchi Access Line/ Cross-regional Switching Station lead-in*1	500kV	1km	2	Jul. 2024	Jun. 2026	Generator connection Reliability upgrade*4
	(prov.)Joban Bulk Line/ Cross-regional Switching Station Dπ lead-in	500kV	1km	2	May 2025	Jul. 2026	Generator connection Reliability upgrade*4
	(prov.)Cross-regional Switching Station	500kV	-	10	May 2023	Nov. 2027 (Jun. 2026)	Generator connection
	Akita Bulk Line/ Kawabe Substation DT lead-in	275kV	5km	2	Beyond FY 2022	Beyond FY 2029	Generator connection
	Akimori Bulk Line/ Kawabe Substation DT lead-in	275kV	0.2km	2	Beyond FY 2025	Beyond FY 2029	Generator connection
	Asahi Bulk Line uprating	275kV→ 500kV	139km→ 138km	2	Beyond FY 2026	Beyond FY 2030	Generator connection
	Minami Yamagata Bulk Line uprating	275kV→ 500kV	23km→ 23km	2	Beyond FY 2029	Beyond FY 2030	Generator connection
	Dewa Bulk Line	500kV	97km	2	Beyond FY 2021	Beyond FY 2031	Generator connection
	Yamagata Bulk Line uprating/ extension	275kV→ 500kV	53km→ 99km	2	Beyond FY 2025	Beyond FY 2031	Generator connection
TEPCO Power Grid	(prov.)G7060005 Access Line	275kV	1km*2	1	Jul. 2021	Feb. 2022	Generator connection
	MS18GHZ051500 Access Line (prov.)	275kV	0.1km	2	Jul. 2021	Jun. 2022	Generator connection
	Keihin Line No.1&2 /connecting point change	275kV	22.7km→ 23.1km*3	2	Oct. 2021	Apr. 2022	Generator connection
	Higashi Shimizu Line	275kV	13km 7km (diversion)	2	Mar. 2022	Mar. 2027	Reliability upgrade*4
	Nishi Gunma Bulk Line /Higashi Yamanashi Substation T lead-in	500kV	0.1km(No.1) 0.1km(No.2) *3	2→3	May 2022	Nov. 2022	Demand coverage

Company	Line[38]	Voltage	Length[39, 40]	Circuit	Under construction	In service	Purpose[41]
TEPCO Power Grid	Goi Access Line*1	275kV	11km	2	Aug. 2021	Feb. 2024	Generator connection
	(prov.)Chiba Inzai Substation lead-in	275kV	11km*2	2	Feb. 2023	Apr. 2024	Demand coverage
Chubu EPCO	Ena Branch Line	500kV	1km	2	May 2020	Oct. 2024	Demand coverage
	Shimo Ina Branch Line	500kV	0.3km	2	Mar. 2022	Oct. 2024	Demand coverage
	Sekigahara-Kita Oomi Line	500kV	2km	2	Uncertain	Uncertain	Generator connection *4*5
	Sekigahara Switching Station	500kV	—	6	Uncertain	Uncertain	Generator connection *4*5
	Sangi Bulk Line/ Sekigahara Switching Station π lead-in	500kV	1km	2	Uncertain	Uncertain	Generator connection *4*5
Kansai EPCO	Kita Yamato Line/ Minami Kyoto Substation	500kV	0.1km→ 0.2km	2	Jun. 2021	Dec. 2021	Economic upgrade
	Kita Oomi Switching Station	500kV	—	6	Uncertain	Uncertain	Generator connection *4*5
	Kita Oomi Line/ Kita Oomi Switching	500kV	0.5km	2	Uncertain	Uncertain	Generator connection *4*5
	Tsuruga Line/ North side improvement	275kV	9.8km→ 9.3km*3	2	Uncertain	Uncertain	Aging management
	(prov.) Himeji Access Line*1	275kV	0.9km*2	2	Mar. 2021	Jan. 2025	Generator connection
	Shin Kakogawa Line	275kV	25.3km→ 25.3km*3	2	Jul. 2021	Jun. 2025	Generator connection Aging management
	(prov.) Himeji Access West Branch Line*1	275kV	1.2km→ 1.2km*3	2	Nov. 2022	Mar. 2023	Aging management
Kyushu EPCO	Saibu Gas/ Hibiki Access Line*1	220kV	4km	2	Mar. 2022	Jul. 2024	Generator connection
	Shin Kagoshima Line/ Sendai Plant π lead-in*1	220kV	2km→ 4km*3	1→2	Aug. 2020	Jul. 2023	Economic upgrade
EPDC	(prov.)Sakuma Higashi Bulk Line/ Shin Sakuma FC Branch Line	275kV	3km	2	FY 2022	FY 2026	Reliability upgrade*4
	(prov.)Sakuma Nishi Bulk Line/ Shin Sakuma FC Branch Line	275kV	1km	2	FY 2022	FY 2026	Reliability upgrade*4
	Shin Toyone-Toei Line	275kV	1km	1	FY 2022	FY 2026	Reliability upgrade*4
	Sakuma Nishi Bulk Line	275kV	10.6km→ 11km*3	2	FY 2022	FY 2027	Reliability upgrade*4
	Sakuma Nishi Bulk Line	275kV	2km	2	FY 2022	FY 2026	Reliability upgrade*4
	Sakuma Higashi Bulk Line	275kV	123.7km→ 123km*3	2	FY 2022	FY 2027	Reliability upgrade*4
Fukushima souden	Abukumananbu Line	154kV	22km*2	1	Apr. 2020	Jun. 2023	Generator connection

Table 4-4 Retirement Plans

Company	Line	Voltage	Length	Circuit	Retirement	Purpose [41]
EPDC	Shin Toyone-Toei Line	275kV	△2.6km	1	FY 2026	Reliability upgrade*4
	Sakuma Nishi Bulk Line	275kV	△58km	2	FY 2026	Economic upgrade

2. Development Plans for Major Substations

Table 4-5 Development Plans under Construction

Company	Substation[38, 42]	Voltage	Capacity	unit	Under construction	In service	Purpose[41]
Tohoku EPCO	Noshiro	275/66kV	100MVA	1	Oct. 2019	Jun. 2021	Generator connection
TEPCO Power Grid	Shin Keiyo	275/154kV	300MVA×2→ 450MVA×2	2→2	Jul. 2018	Sep. 2019(5B) Apr. 2021(6B)	Aging management
	Shin Shinano AC/DC Converter Station*6	—	—	-	Mar. 2016	Mar. 2021	Reliability upgrade*4
	Shin Motegi	500/275kV	1,500MVA	1	May 2019	Mar. 2021	Generator connection
	Higashi Yamanashi	500/154kV	750MVA	1	Apr. 2019	Dec. 2022	Demand coverage
Chubu EPCO	Shunen	275/154kV	450MVA×1→ 300MVA×1	1→1	Feb. 2019	Nov. 2020	Aging management
	Hida Converter Station*6	—	—	-	Aug. 2017	Mar. 2021	Reliability upgrade*4
	Chita Plant*1	275/154kV	300MVA×1→ 450MVA×1	1→1	Jul. 2019	Apr. 2021	Aging management
	Chita Plant*1	275/154kV	450MVA×2	2	Jul. 2019	Nov. 2020(N1B) Aug. 2021(N2B)	Generator connection
Kansai EPCO	Higashi Osaka	275/77kV	300MVA→ 200MVA	1→1	Nov. 2019	Jul. 2020	Aging management
Chugoku EPCO	Sakugi	220/110kV	200MVA	1	Jun. 2019	Nov. 2020	Generator connection
	Shin Yamaguchi	220/110kV	400MVA×2	2	Apr. 2019	Jun. 2021	Economic upgrade
Kyushu EPCO	Hayami	220/66kV	250MVA	1	May 2019	Jun. 2020	Generator connection
	Kirishima	220/66kV	300MVA	1	Jan. 2020	Dec. 2021	Generator connection
Okinawa EPCO	Tomoyose	132/66kV	125MVA×2→ 200MVA×2	2→2	Oct. 2017	Jan. 2021(1B) May 2024(2B)	Aging management
NHWETC	Kita Toyotomi*6	187/66kV	165MVA×3	3	Apr. 2019	Sep. 2022	Generator connection

Table 4-6 Development Plans in the Planning Stages

Company	Substation[38, 42]	Voltage	Capacity	unit	Under construction	In service	Purpose[41]
Hokkaido EPCO	Rubeshibe	187/66kV	60MVA×2→ 100MVA	2→1	Mar. 2021	Oct. 2021	Aging management

[42] Substation with *6 denotes a substation or a converter station newly installed, including an uprated electric facility.

Company	Substation[38, 42]	Voltage	Capacity	unit	Under construction	In service	Purpose[41]
Hokkaido EPCO	Nishi Nakagawa*6	187/100kV	100MVA×2	2	May 2020	Jul. 2022	Generator connection
	Kita Ebetsu	187/66kV	100MVA→ 150MVA	1→1	Mar. 2021	Jul. 2022	Aging management
	Kita Shizunai	187/66kV /11kV	45MVA→ 60MVA	1→1	Dec. 2021	Feb. 2023	Aging management
	Kita Memuro	187/66kV	60MVA→ 150MVA	1→1	Feb. 2023	Nov. 2023	Aging management
Tohoku EPCO	Fukushima	275/66kV	100MVA	1	Apr. 2020	Jan. 2021	Generator connection
	Higashi Hanamaki	275/154kV	300MVA	1	Jul. 2022	Dec. 2024	Demand coverage
	Iwate	500/275kV	1,000MVA	1	Beyond FY 2024	Beyond FY 2028	Generator connection
	Echigo	500/275kV	1,500MVA×3	3	Beyond FY 2024	Beyond FY 2030	Generator connection
	Yawata	500/154kV	750MVA	1	Beyond FY 2027	Beyond FY 2031	Generator connection
	Kawabe	500/275kV	1,500MVA×3	3	Beyond FY 2025	Beyond FY 2031 (Beyond FY 2029)	Generator connection
	Nishi Yamagata	275/154kV→ 500/154kV	300MVA×2 →450MVA×2	2→2	Beyond FY 2024	Beyond FY 2031	Generator connection
TEPCO Power Grid	Shin Kisarazu	275/154kV	450MVA×2	2	Sep. 2020	Apr. 2022	Generator connection
	Shin Tochigi	500/154kV	750MVA	1	May 2021	Nov. 2022	Generator connection
	Shin Fuji	500/154kV	750MVA	1	FY 2023	FY 2026	Reliability upgrade*4
	Kita Tokyo	275/66kV	300MVA	1	Dec. 2021	Jun. 2023	Economic upgrade
	Shin Keiyo	275/154kV	450MVA	1	Oct. 2021	Feb. 2023	Demand coverage
	(prov.)Chiba Inzai*6	275/66kV	300MVA×2	2	Jul. 2021	Apr. 2024	Demand coverage
	Minami Tama	275/66kV	200MVA→ 300MVA	1→1	Jan. 2021	Jun. 2022	Demand coverage
Chubu EPCO	Ena*6	500/154kV	200MVA×2	2	Jun. 2022	Oct. 2024	Demand coverage
	Shimo Ina*6	500/154kV	300MVA×2	2	Jun. 2021	Oct. 2024	Demand coverage
	Toei	500/275kV	800MVA×1→ 1,500MVA×2	1→2	Apr. 2022	FY 2024(N2B) FY 2026 (1B)	Reliability upgrade*4
	Shizuoka	500/275kV	1,000MVA	1	FY 2024	FY 2026	Reliability upgrade*4
	Higashi Shimizu	—	300MW→ 900MW	—	Oct. 2020	FY 2027	Reliability upgrade*4
Hokuriku EPCO	Kaga	275/154kV	400MVA	1	Jun. 2020	Sep. 2023	Reliability upgrade
Kansai EPCO	Gobo	500/154kV	750MVA×2	2	Jul. 2021	Jul. 2024	Generator connection
	Nishi Kobe	275/77kV	200MVA×2→ 300MVA	2→1	Aug. 2020	Jun. 2021	Aging management

Company	Substation[38, 42]	Voltage	Capacity	unit	Under construction	In service	Purpose[41]
Kansai EPCO	Koto	275/77kV	200MVA→ 300MVA	1→1	Jan. 2022	Oct. 2022	Aging management
	Yodogawa	275/77kV	300MVA×2→ 300MVA	2→1	Dec. 2020	Oct. 2021	Aging management
	Kainanko	275/77kV	300MVA×1, 200MVA×2→ 300MVA×2	3→2	Aug. 2022	Jun. 2024	Aging management
	Nishi Osaka	275/77kV	300MVA	1	Feb. 2021	May 2023	Demand coverage
	Seiban	275/77kV	300MVA×2→ 200MVA×2	2→2	Jan. 2022	Jun. 2024	Aging management
	Shin Kobe	275/77kV	300MVA×1, 200MVA×1→ 200MVA×1	2→1	Aug. 2022	Jan. 2024	Aging management
Chugoku EPCO	Kasaoka	220/110kV	250MVA→ 300MVA	1→1	Aug. 2020	Jun. 2021	Aging management
	Nishi Shimane	500/220kV	1,000MVA	1	Apr. 2020	Mar. 2022	Generator connection
Shikoku EPCO	Kochi	187/66kV	200MVA→ 300MVA	1→1	Nov. 2021	Apr. 2022	Aging management Demand coverage
Kyushu EPCO	Miyakonojo	220/110kV	150MVA	1	Dec. 2021	Mar. 2024	Generator connection
	Shin Hyuga	220/110 /66kV	250/150 /200MVA	1	Jun. 2021	Apr. 2023	Generator connection
	Wakamatsu	220/66kV	250MVA	1	May 2022	Apr. 2024	Generator connection
	Nishi Fukuoka	220/66kV	180MVA×2→ 300MVA	2→1	Sep. 2020	Apr. 2022	Aging management
EPDC	(prov.)Shin Sakuma FC*6	—	—	—	FY 2024	FY 2027	Reliability upgrade*4
Fukushima souden	Abukumaminami *6	154/66 /33kV	170MVA	1	Apr. 2020	Jun. 2023	Generator connection

Table 4-7 Retirement Plans

Company	Substation	Voltage	Capacity	unit	Retirement	Purpose[41]
TEPCO Power Grid	Hanamigawa	275/66kV	300MVA	1	Mar. 2024	Demand coverage
	Kita Tokyo	275/154kV	300MVA	1	Oct. 2021	Economic upgrade
	Ageo	275/66kV	300MVA	1	Jul. 2023	Economic upgrade
Kansai EPCO	Higashi Osaka	275/154kV	300MVA	1	Jan. 2021	Aging management
	Koto	275/77kV	100MVA×2	2	Oct. 2023	Aging management
	Kita Katsuragi	275/77kV	200MVA×2	2	May 2022(3B) May 2023(4B)	Aging management
EPDC	Nagoya	275/154kV	300MVA×3	3	FY 2024	Economic upgrade

3. Summary of Development Plans for Transmission Lines and Substations

Tables 4-8 to 4-11 show the summarized development or extension plans of major transmission lines and substations (transformers and converter stations) up to FY 2029 submitted by GT&D and transmission companies.

Table 4-8 Development Plans for Major Transmission Lines

Category	Voltage	Lines	Length[43]	Extended Length[44]	Total Length	Total Extended Length
Newly Installed or Extended	500kV	Overhead	643 km*	1,286 km*	643 km*	1,286 km*
		Underground	0 km	0 km		
	275kV	Overhead	△171 km	△350 km	△153 km	△312 km
		Underground	17 km	38 km		
	220kV	Overhead	5 km	10 km	5 km	10 km
		Underground	0 km	0 km		
	187kV	Overhead	120 km	240 km	120 km	240 km
		Underground	0 km	0 km		
	154kV	Overhead	0 km	0 km	22 km	22 km
		Underground	22 km	22 km		
	DC	Overhead	89 km	89 km	89 km	89 km
		Underground	0 km	0 km		
	Total	Overhead	687 km	1,275 km	726 km	1,335 km
		Underground	39 km	60 km		
To be Retired	275kV	Overhead	△61 km	△119 km	△61 km	△119 km
		Underground	0 km	0 km		
	Total	Overhead	△61 km	△119 km	△61 km	△119 km
		Underground	0 km	0 km		

Table 4-9 Revised Plans for Line Category and the Numbers of Circuits[45]

Voltage	Length Extended	Total Extended Length
500kV	0 km	1 km
275kV	254 km	535 km
220kV	4 km	8 km
187kV	7 km	14 km
Total	265 km	557 km

43 Length denotes both the increased length due to newly installed or extended plans, and the decreased length due to retirement. Development plans corresponding to the change of line category or the number of circuits were not included in the increased length of transmission lines shown in Table 4-8 and are treated as 'no change in the length'. The totals of lengths are not necessarily equal due to independent rounding. In addition, the overall total length is not necessarily equal due to independent rounding.

44 Total length denotes the aggregation of length multiplied by the number of circuits. Development plans corresponding to the change of line category or the number of circuits were not included in the increased length of transmission lines in Table 4-8 and are treated as 'no change in the length'.

45 Table 4-9 aggregates the extended and total extended lengths corresponding to the revised plans for the line category and the number of circuits.

Table 4-10 Development Plans for Major Substations

Category [46]	Voltage[47]	Increased Numbers	Increased Capacity
Newly Installed or Extended	500kV	23 [4]	22,100MVA [1,000MVA]
	275kV	7 [2]	3,150MVA [600MVA]
	220kV	7 [0]	1,790MVA [0MVA]
	187kV	4 [5]	930MVA [695MVA]
	154kV	1 [1]	170MVA [170MVA]
	132kV	0 [0]	150MVA [0MVA]
	Total	42 [12]	28,290MVA [2,465MVA]
To be Retired	275kV	△11	△2,700 MVA
	Total	△11	△2,700 MVA

[ ] : The aforementioned increase in the number of transformers resulted from new substation installations.

Table 4-11 Development Plans for AC/DC Converter Stations

Category	Company and Number of Sites		Capacity[48]
Newly Installed or Extended	TEPCO Power Grid	1	900MW
	Chubu EPCO	2	900MW 600MW
	Electric Power Development Company	1	300MW

46 Retirement plans with transformer installations are included in Newly Installed or Extended, and negative values are included in the increased numbers or the increased capacity.

47 Voltage class by upstream voltage.

48 Installed capacity of the converter stations on both sides of the DC lines is included.

4. Aging Management of Existing Transmission and Distribution Facility

Existing transmission and distribution facilities that were installed after the period of economic expansion (the 1960s to the 1970s) are approaching their time for replacement. The facilities to be replaced are on the increase, and significant facilities will be remained unreplaced in pace of the recent replacement work. To secure stable electricity supply in the future, appropriate decisions concerning the replacement schedule are vital. Figures 4-2 to 4-5 show the actual installation years of existing transmission and distribution facilities.

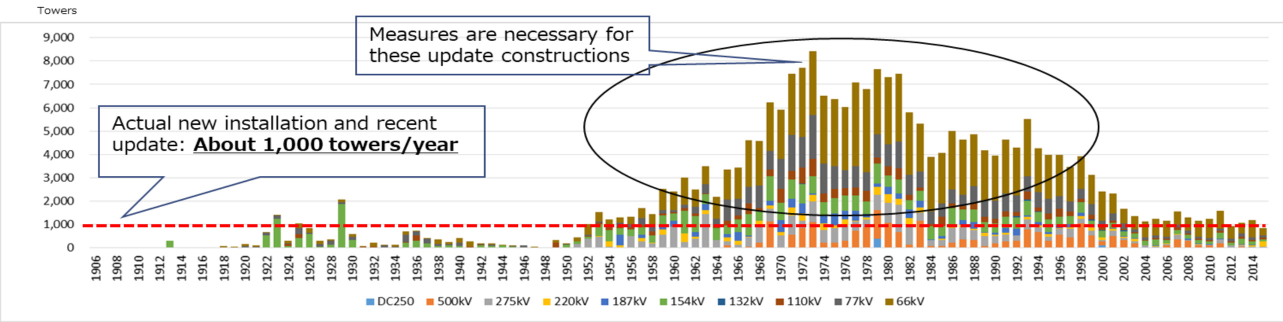


Figure 4-2 Actual Installation Year of Existing Transmission Towers (66kV-500kV)

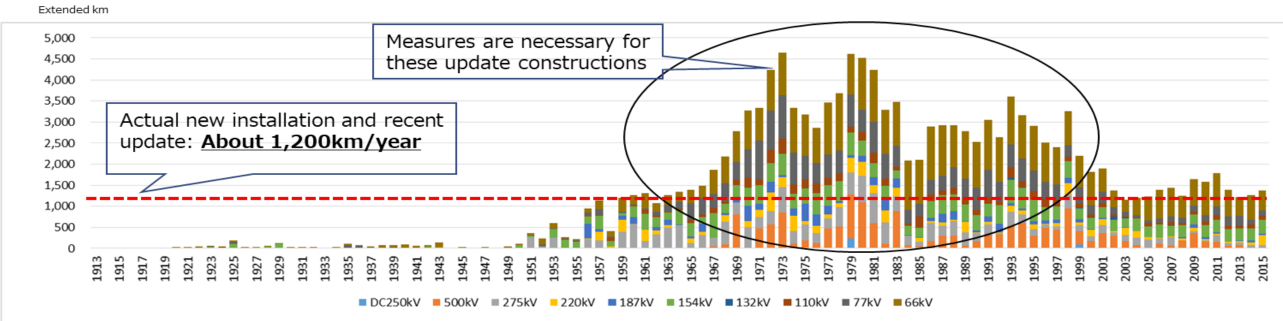


Figure 4-3 Actual Installation Year of Existing Overhead Lines (66kV-500kV)

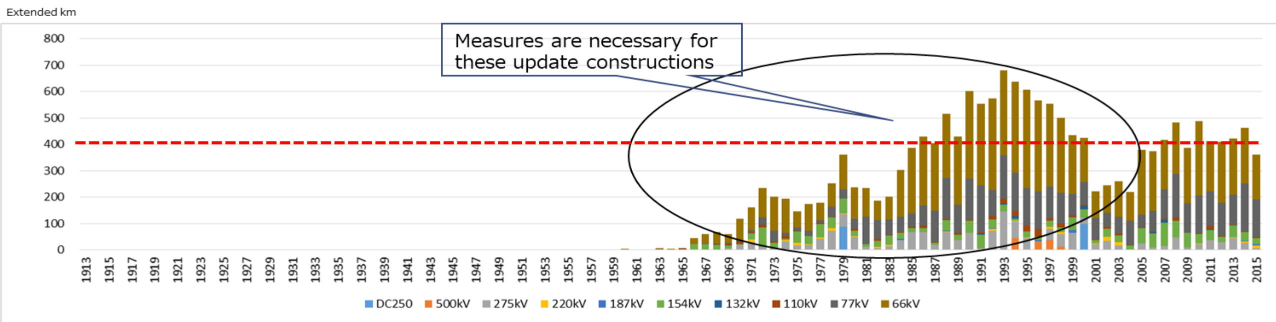


Figure 4-4 Actual Installation Year of Existing Underground Cables (66kV-500kV)

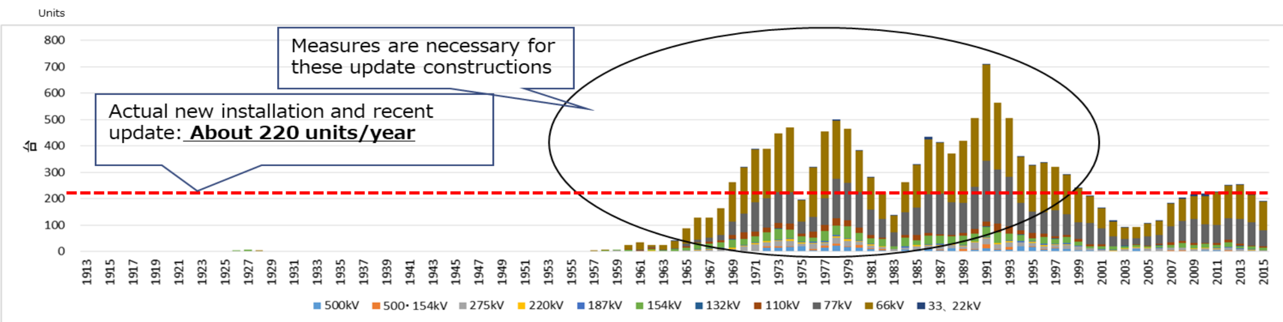


Figure 4-5 Actual Installation Year of Existing Transformers (66kV-500kV; one that is partly 22kV is included)

Furthermore, the number of transmission workers is on the decrease, and a skilled workforce has been in short supply in recent years. Figure 4-6 shows the transition of numbers of tower-climbing workers in transmission construction.[49]

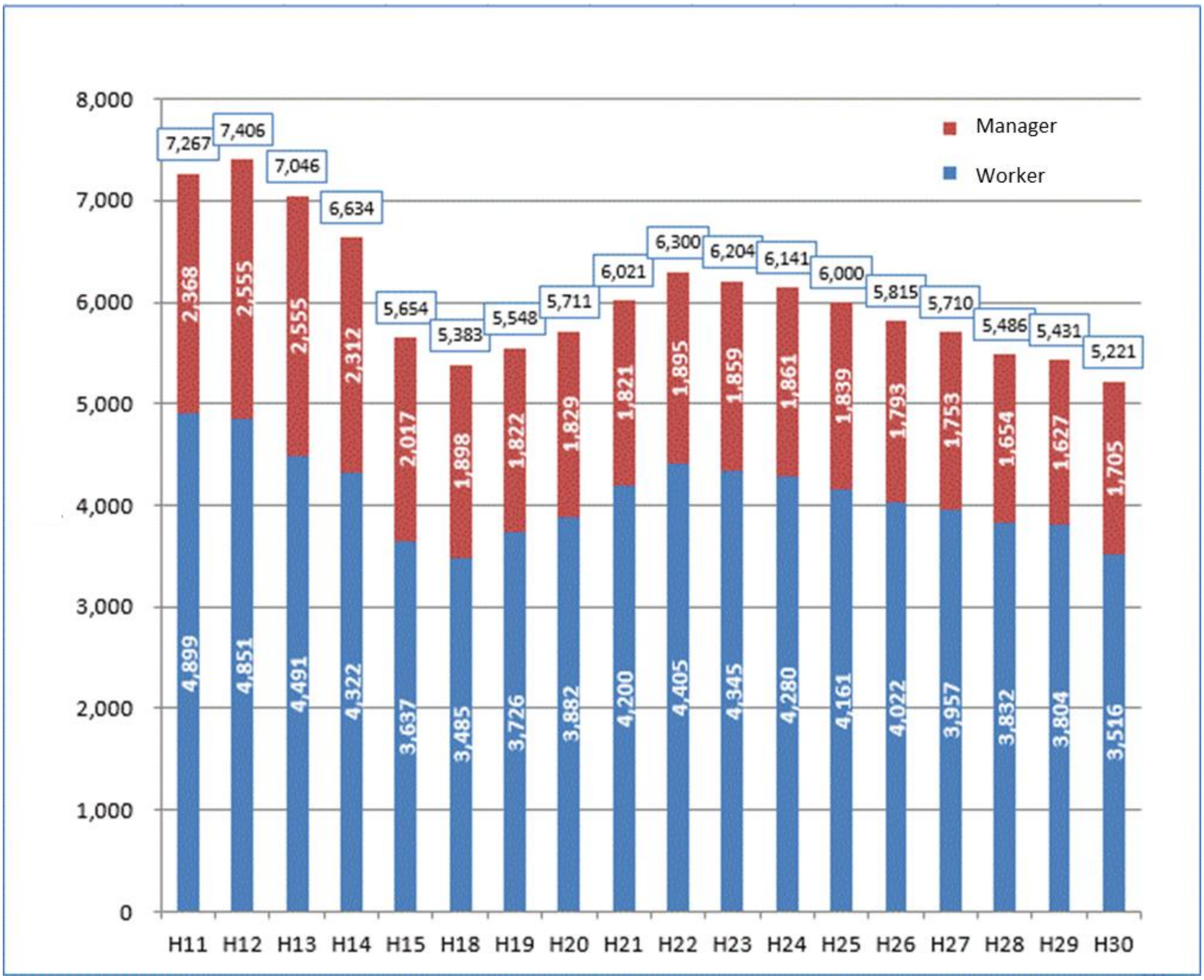


Figure 4-6 Transition of Numbers of Tower-climbing Transmission Workers [49]

[49] Source: Transmission Line Construction Engineering Society of Japan. http://www.sou-ken.or.jp/01souken/souken_toukei.php (only in Japanese)

V. Cross-regional Operation

Retail companies will procure the supply capacity for their customers in their regional service areas. The scheduled procurement from external service areas at 15:00 in August 2020 is illustrated in four figures. Figures 5-1 and 5-2 show the supply capacity and the ratio of the supply capacity, respectively, at 15:00 in August. Figures 5-3 and 5-4 show the energy supply and the ratio of the energy supply, respectively, in FY 2020.

Higher ratios for procurement from external regional service areas are observed in the Tokyo, Kansai, and Chugoku EPCO areas; those to external regional service areas are observed in the Tohoku, Shikoku, and Kyushu EPCO areas.

Results of analysis show the same tendency as in past years due to no changes in major bilateral contracts of transmission line use.

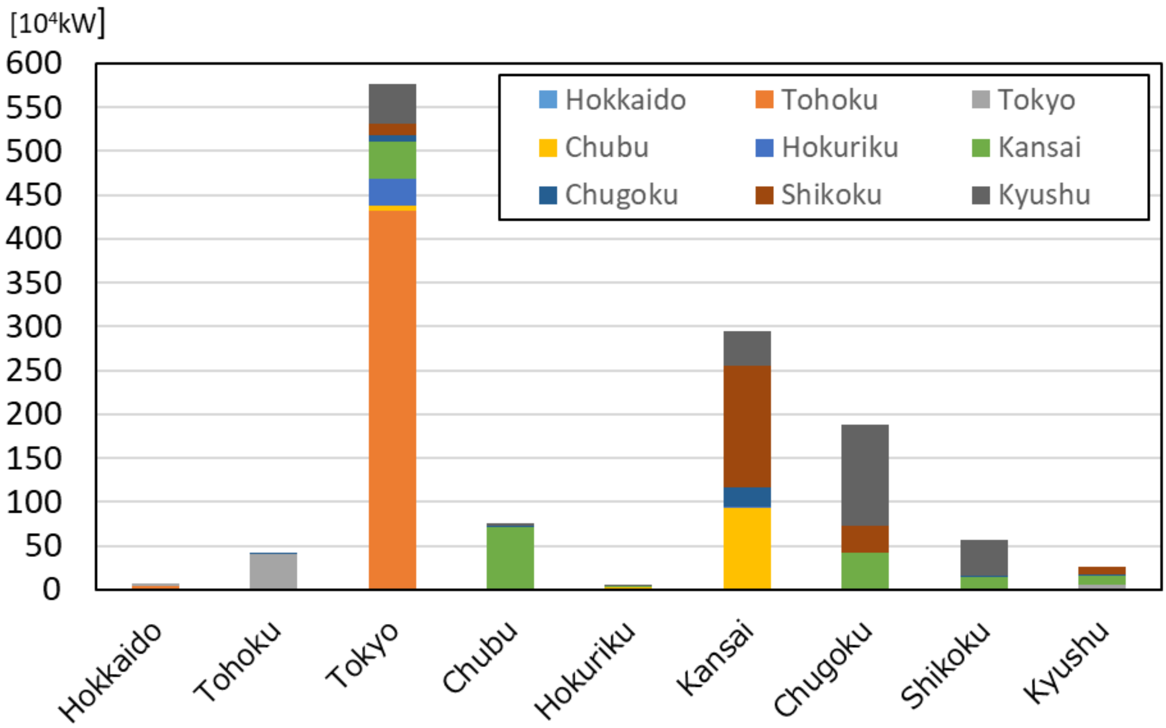


Figure 5-1 Scheduled Procurement of Supply Capacity from External Regional Service Areas

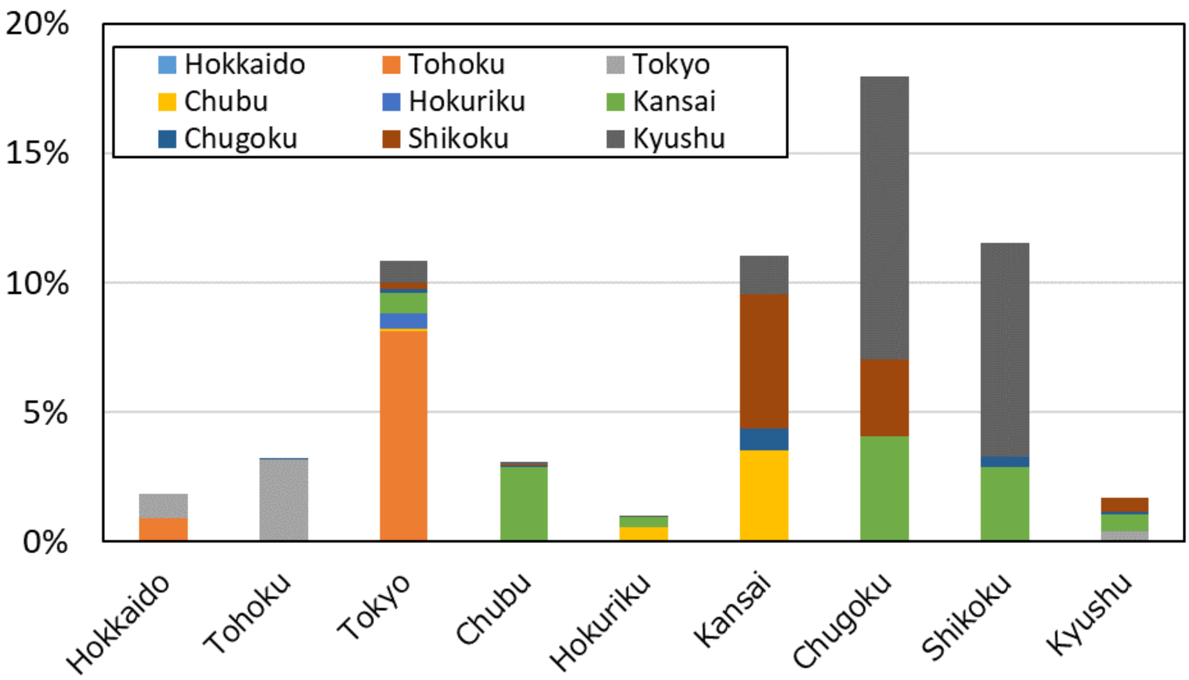


Figure 5-2 Ratio of Scheduled Procurement of Supply Capacity from External Regional Service Areas

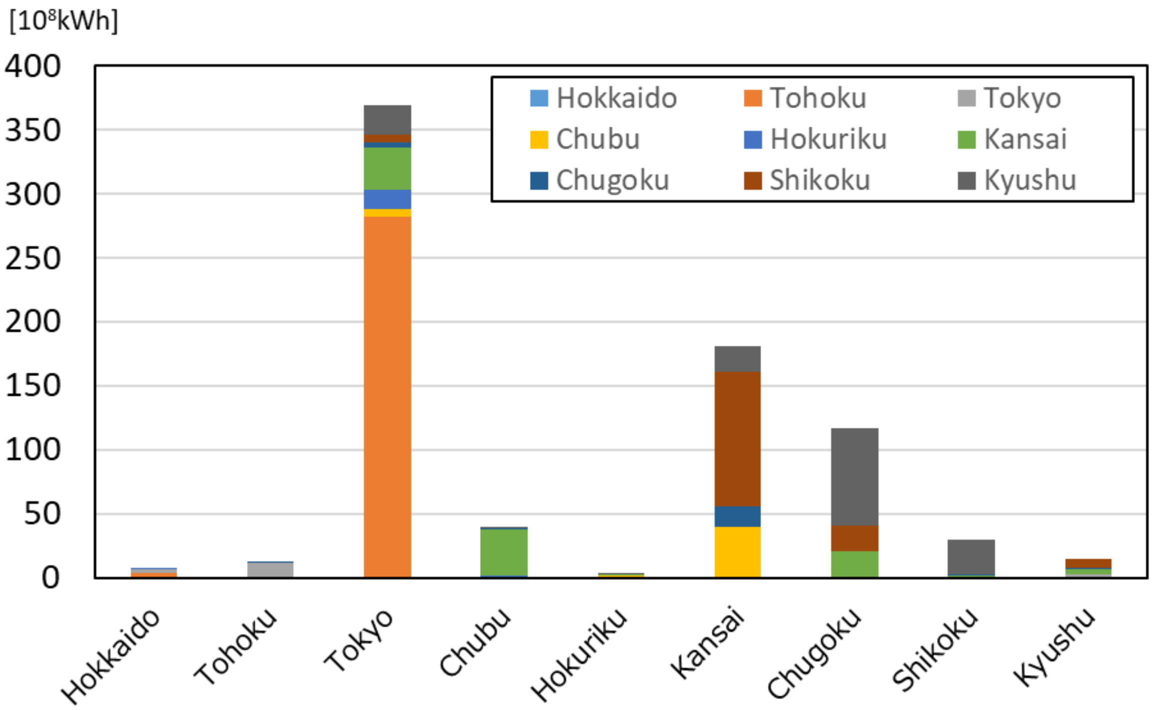


Figure 5-3 Scheduled Procurement of Energy Supply from External Regional Service Areas

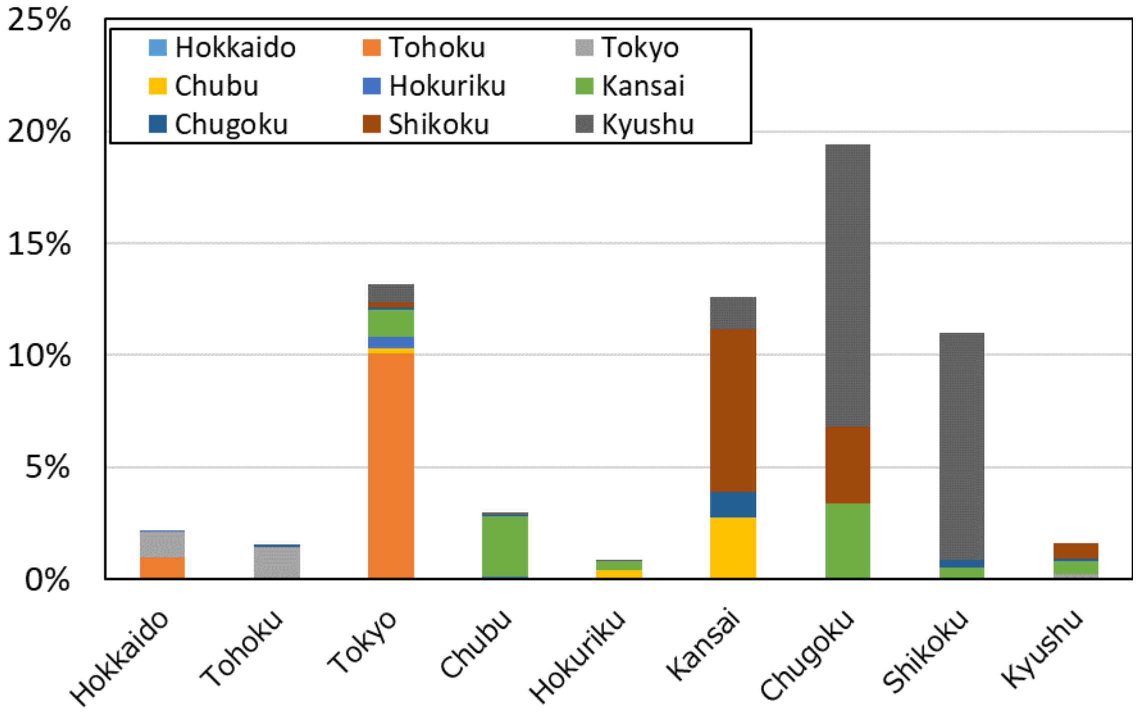


Figure 5-4 Ratio of Scheduled Procurement of Energy Supply from External Regional Service Areas

VI. Analysis of Characteristics of Electric Power Companies

1. Distribution of Retail Companies by Business Scale (Retail Demand)

In total, 620 retail companies submitted their electricity supply plans, and these are classified by the business scale of the retail demand forecast by the corresponding companies. Figures 6-1 and 6-2 show the distributions of the business scale of retail demand and the accumulated retail demand forecast by the corresponding companies, respectively. Notably, small and medium-sized retail companies (business scale of under 1 GW) plan to expand business.

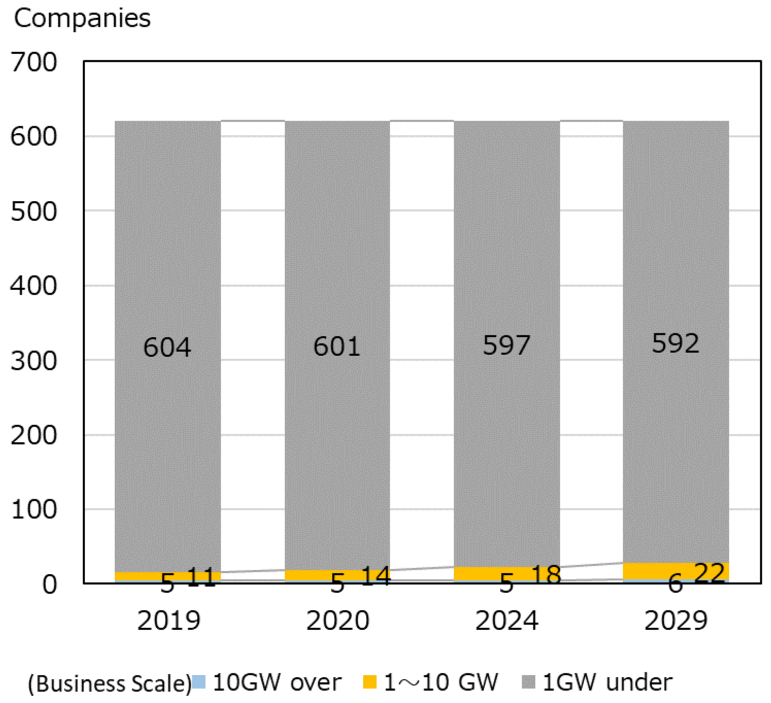


Figure 6-1 Distribution by Business Scale of the Retail Demand by Retail Companies

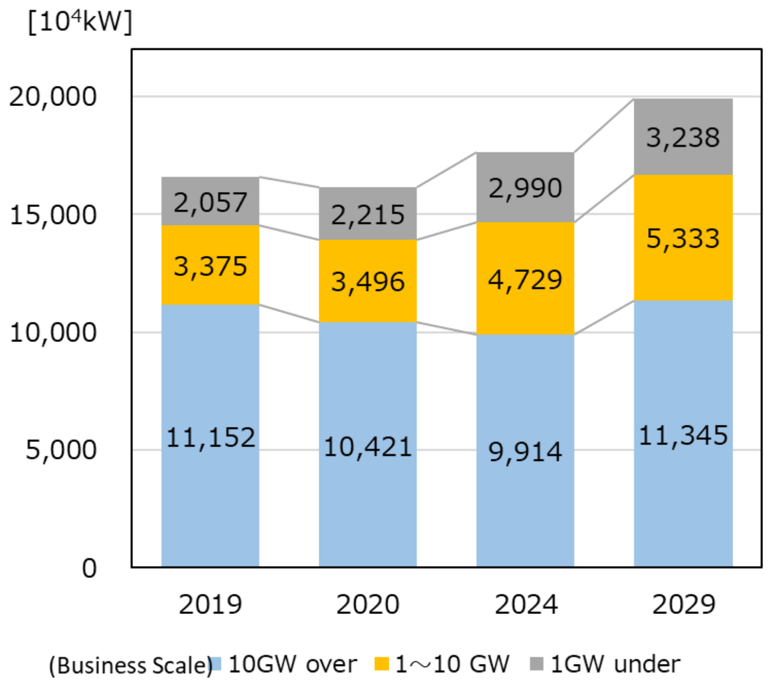


Figure 6-2 Distribution by Accumulated Retail Demand by Retail Companies

Again, retail companies are classified by the business scale of the retail energy sales forecast by the corresponding companies. Figures 6-3 and 6-4 show the distributions of the business scale of retail company energy sales and their accumulated energy sales forecast, respectively. Similarly, small and medium-sized retail companies (business scale of under 1 GW) plan to expand business.

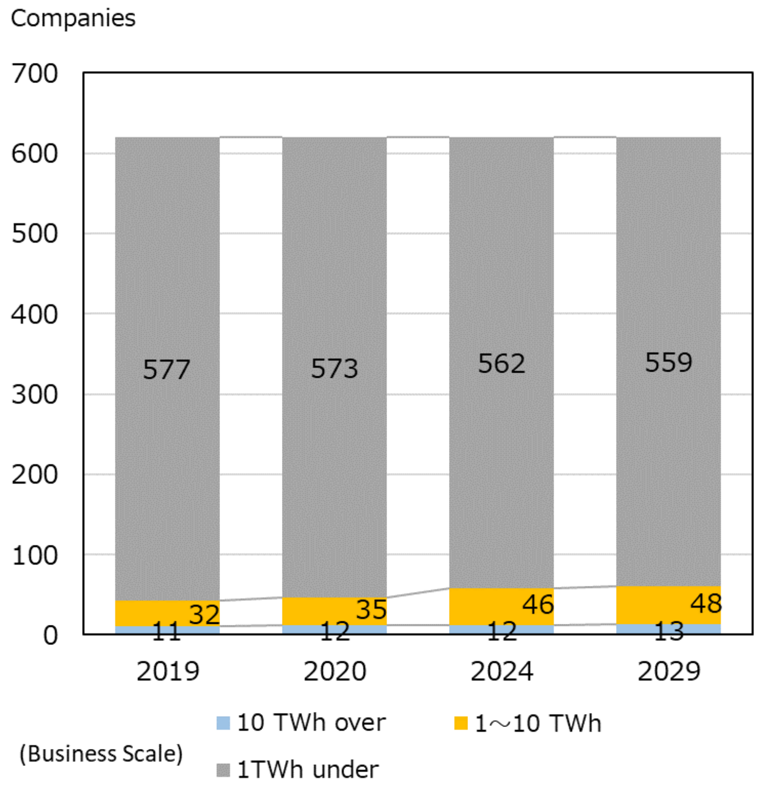


Figure 6-3 Distribution by Business Scale of Retail Company Energy Sales

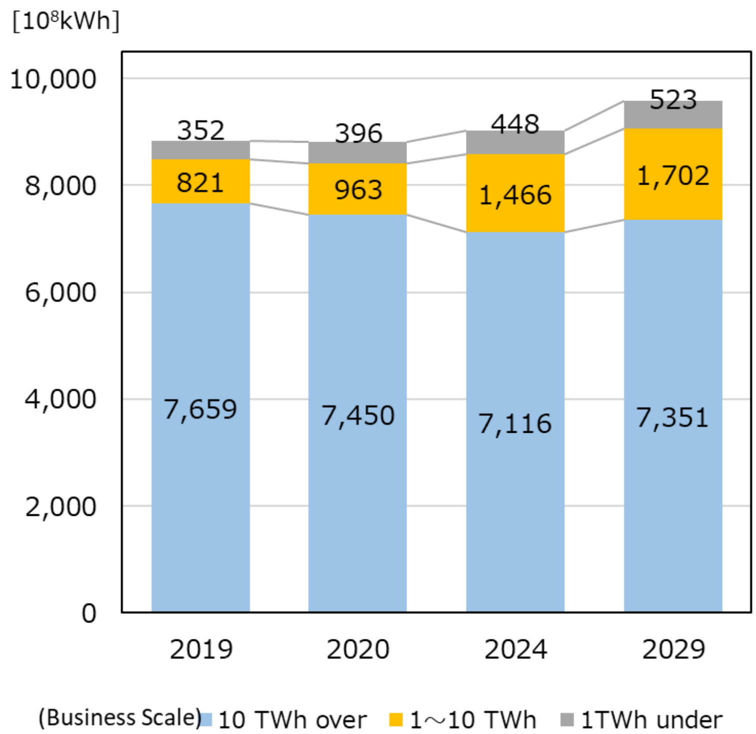


Figure 6-4 Distribution by Retail Company of Accumulated Energy Sales

2. Retail Company Business Areas

Figure 6-5 shows the ratio of retail companies by the number of areas where they plan to conduct their business. Figure 6-6 shows the number of retail companies by their business planning areas in FY 2020. The figures exclude 96 retail companies that had not yet developed their retail business plans. Half of the retail companies plan their business in a single area.

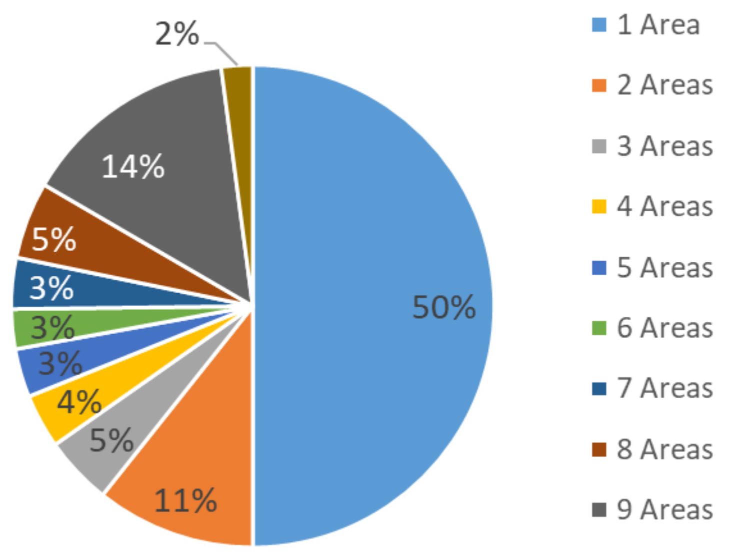


Figure 6-5 Ratio of Retail Companies by the Number of Planned Business Areas in FY 2020

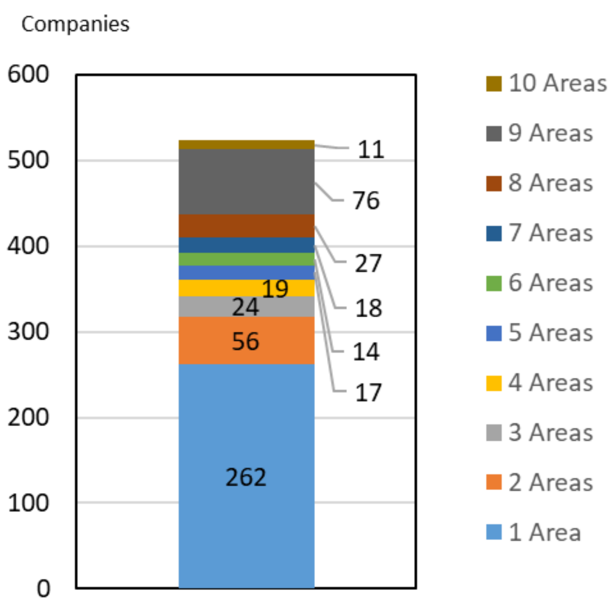
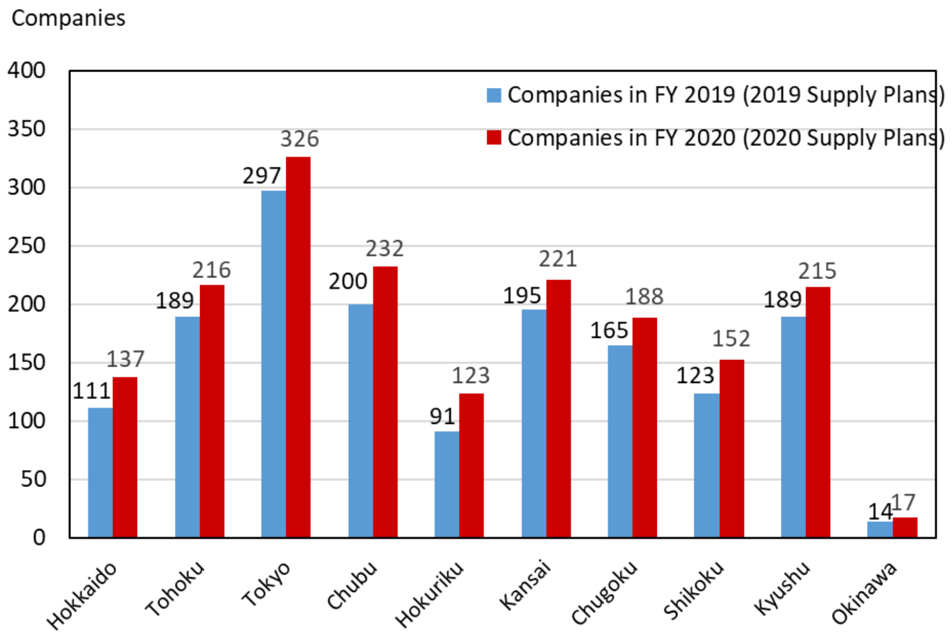


Figure 6-6 Number of Retail Companies by their Business Planning Areas in FY 2020

Figure 6-7 shows the number and the retail demand of retail companies in each regional service areas for GT&D companies in FY 2020. As retail companies increase their numbers in every regional service area, the choice of retail company for electricity customers is expanding.



Projected Peak Demand in FY 2020 (10^4 kW)

Hokkaido	Tohoku	Tokyo	Chubu	Hokuriku	Kansai	Chugoku	Shikoku	Kyushu	Okinawa
419	1,295	5,319	2,464	497	2,672	1,043	498	1,539	150

Figure 6-7 Number and Retail Demand of Retail Companies in Each Regional Service Area

3. Supply Capacity Procurement by Retail Companies

Figure 6-8 shows the retail demand forecast in the regional service area by the retail department of the former general electric utilities and their procured supply capacity to the retail demand. The retail and generation departments of the former general electric utilities secure sufficient supply capacity procured for the retail demand of their own area.

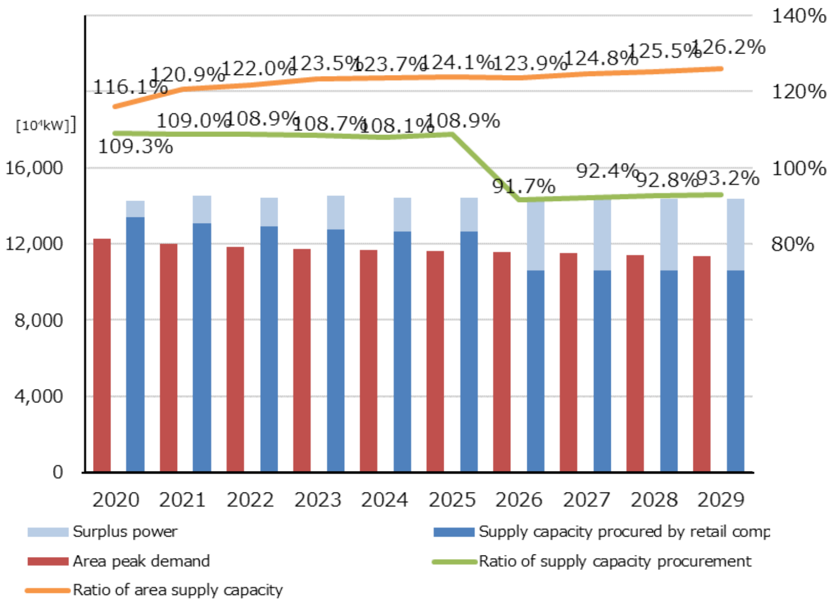


Figure 6-8 Ratio of Secured Supply Capacity to Forecast Retail Demand of Their Own Area for Former General Electric Utilities[50](at 15:00 in August[26], at the sending end)

[50] Includes surplus power of group companies deducting balancing capacity to the secured supply capacity by retail companies.

The competition between retail departments of former general electric utilities has become fierce; the supply capacity procured for the retail demand of external areas that such companies forecast, and the retail demand that power producers and suppliers (PPSs) forecast as their retail demand, indicate a declining trend as shown in Figure 6-9.

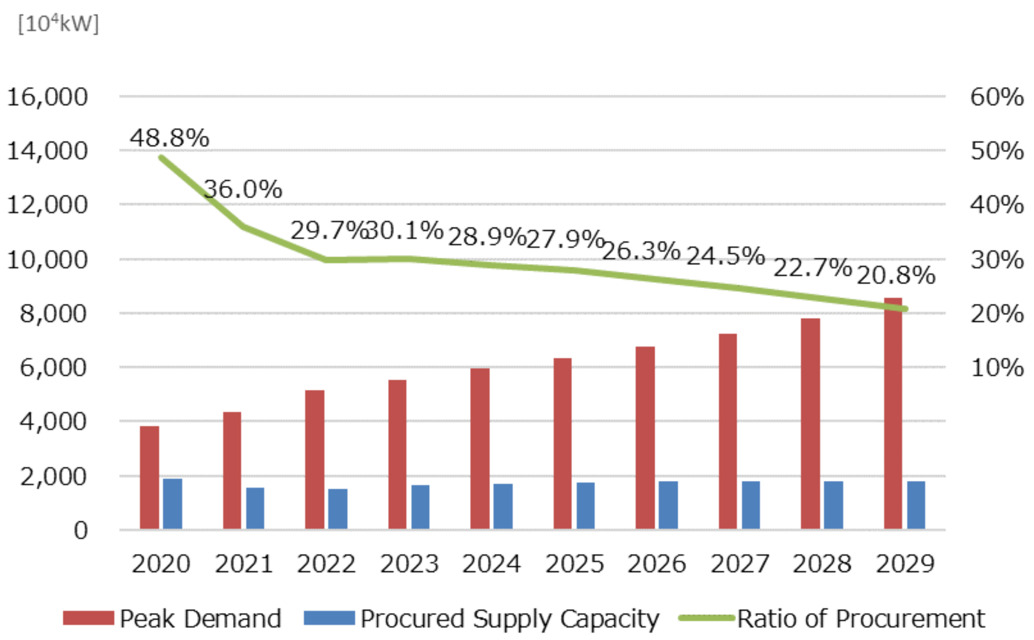


Figure 6-9 Ratio of Procured Supply Capacity to Forecast Retail Demand by Retail Companies [Former General Electric Utilities in External Areas and by PPSs] (at 15:00 in August[26], at the sending end)

4. Distribution of Generation Companies by Business Scale (Installed Capacity)

In total, 821 generation companies submitted their electricity supply plans, and these are classified by the business scale of the installed capacity operated by the corresponding companies. Figure 6-10 shows the distribution by business scale and Figure 6-11 shows the installed capacity operated by the corresponding companies.

Generation companies with an installed capacity of under 10 GW are planning to enlarge the scale of their business.

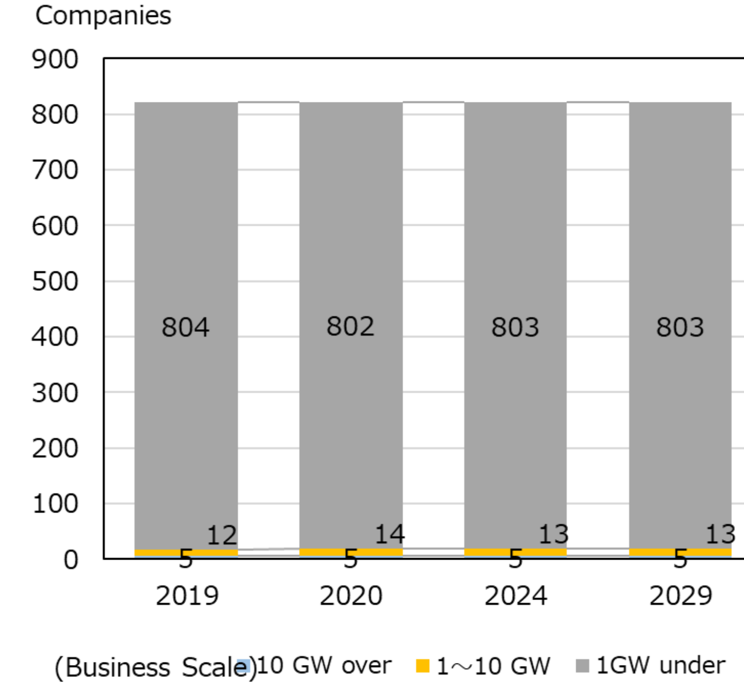


Figure 6-10 Distribution by Business Scale of Generation Company Installed Capacity

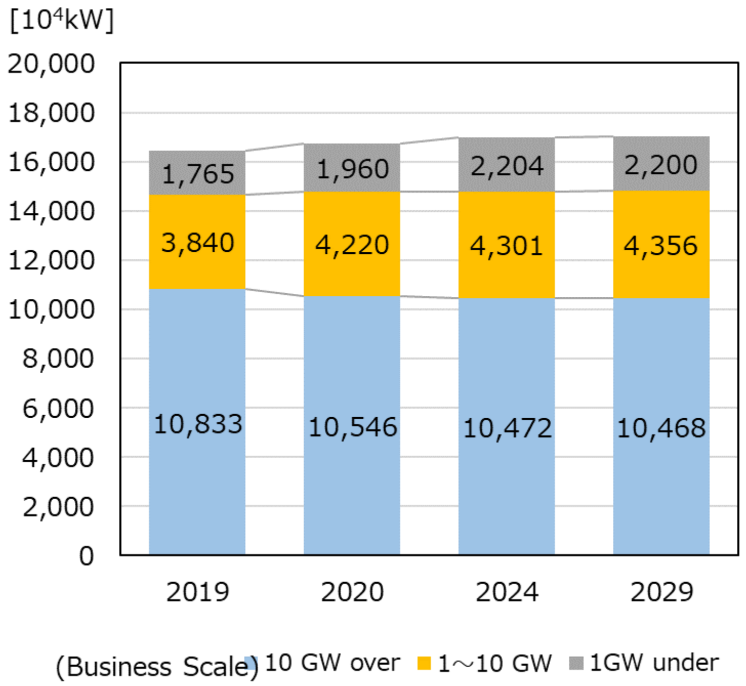


Figure 6-11 Distribution by Generation Company Accumulated Installed Capacity

Similarly, generation companies are classified by the business scale of the corresponding company energy supply forecast. Figure 6-12 shows the distribution by the business scale of the energy supply and Figure 6-13 shows the distribution by the corresponding company accumulated energy supply forecast.
Generation companies with an energy supply of under 10 TWh are planning to decrease their energy generation.

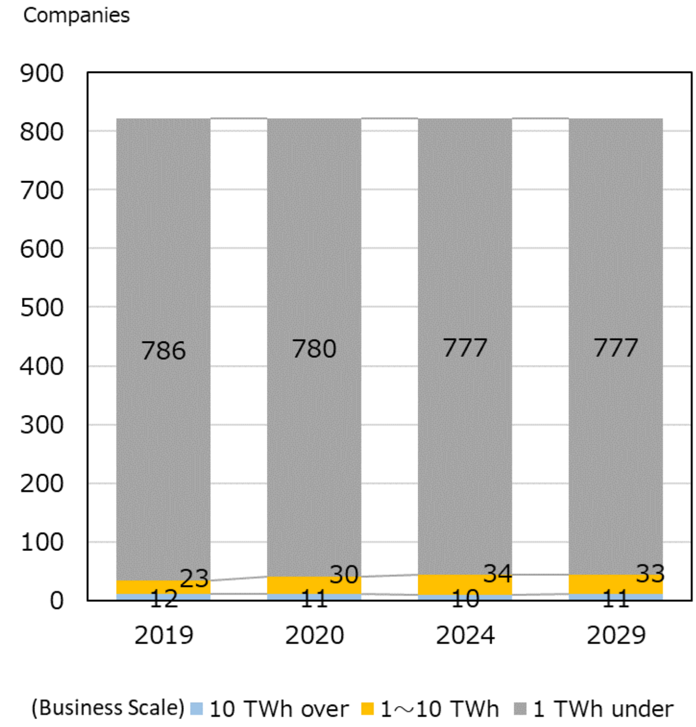


Figure 6-12 Distribution by Business Scale of Generation Company Energy Supply

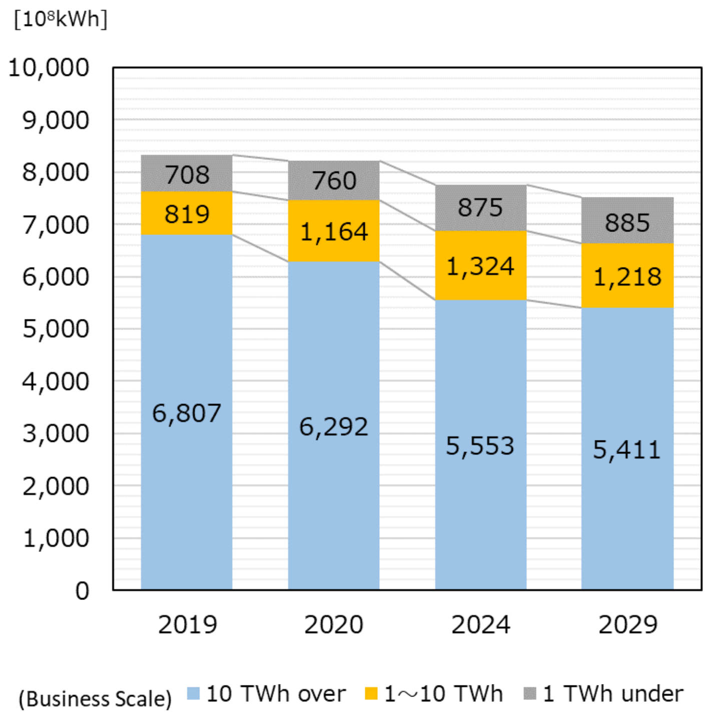


Figure 6-13 Distribution by Generation Company Accumulated Energy Supply

Figure 6-14 shows the number of generation companies by the power generation sources of their own generators at the end of FY 2020. The figures exclude 107 generation companies that do not own their generation plants. Approximately half of all generation companies solely own renewable energy generation facilities.

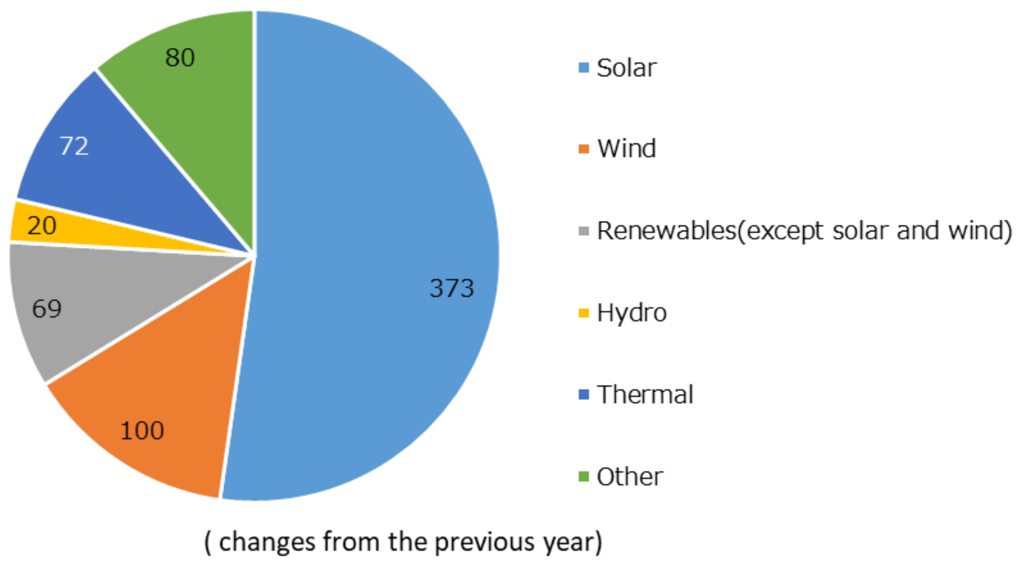


Figure 6-14 Number of Generation Companies by Power Generation Sources

5. Generation Company Business Areas

Figure 6-15 shows the ratio of generation companies to the number of areas where they plan to conduct their business. Figure 6-16 shows the number of generation companies by their business planning areas in FY 2020. The figures exclude 134 generation companies that do not own their generation plants.

Eighty percent of all generation companies plan their business in a single area.

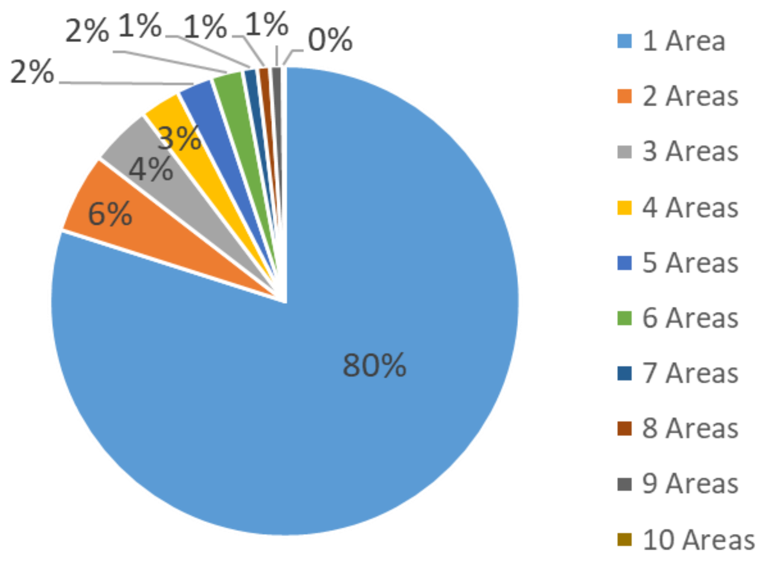


Figure 6-15 Ratio of Generation Companies by the Number of Planned Business Areas in FY 2020

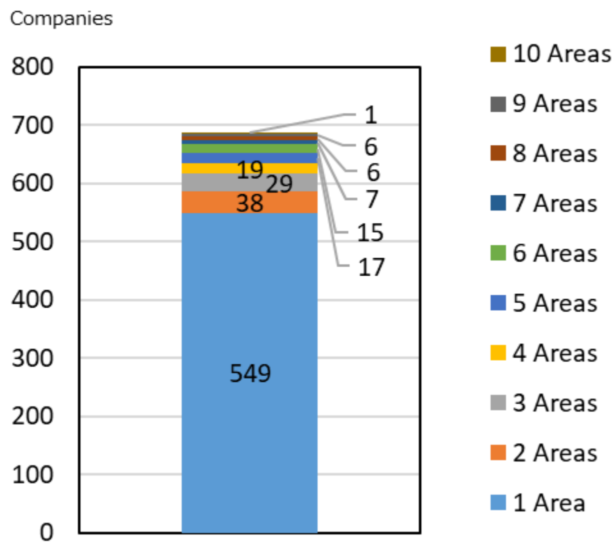
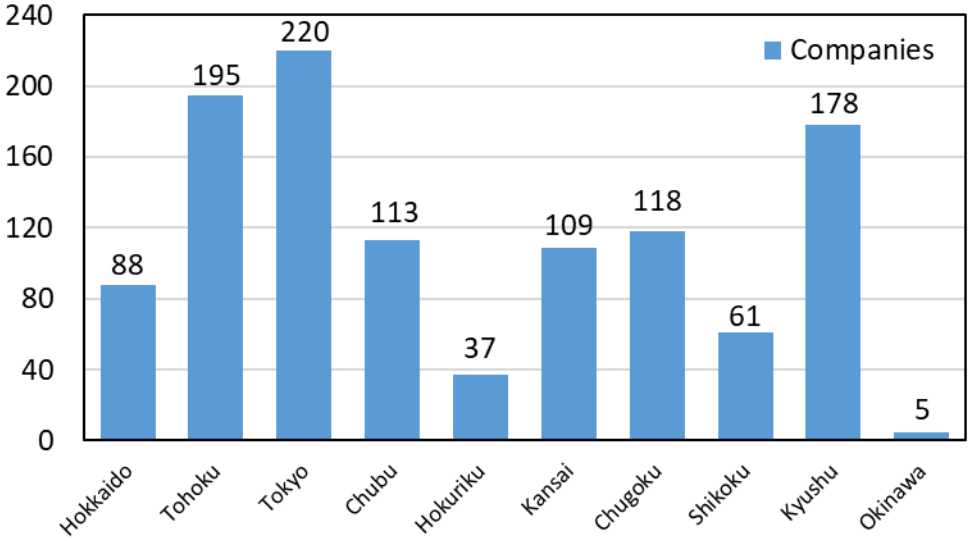


Figure 6-16 Number of Generation Companies by Their Business Planning Areas in FY 2020

Figure 6-17 shows the number and installed capacity of generation companies in each regional service area for GT&D companies in August 2020. In the Hokkaido, Tohoku, Chugoku, and Kyushu regional service areas, the scale of generation companies is rather small and their supply capacity is comparatively small despite the number of generation companies in these regional service areas.



Projected Supply Capacity in FY 2020 (10^4 kW)

Hokkaido	Tohoku	Tokyo	Chubu	Hokuriku	Kansai	Chugoku	Shikoku	Kyushu	Okinawa
531	1,796	5,068	2,516	595	2,604	985	680	1,759	192

Figure 6-17 Number and Installed Capacity of Generation Companies in Each Regional Service Area

VII. Findings and Current Challenges

The current challenges relating to the aggregation of electricity supply plans are as follows.

1. Importance of Coordination of Scheduled Maintenance of Generators toward Stable Supply

In the aggregation of electricity supply plans, it is projected that the adequate 8% reserve margin will be secured for both the short and mid-to-long terms in supply–demand balance evaluation utilizing cross-regional interconnection lines. On the other hand, it is also projected that the supply–demand balance, especially in FY 2020–2022, will be tight due to a decrease of supply capacity of thermal power generation, which includes newly planned suspension or retirement.

For FY 2020 and 2021, adequate reserve margin is projected to be secured as a result of monthly supply–demand evaluation. For FY 2022, the evaluation will be implemented in the following year. For aggregation in the next year, proper coordination of the scheduled maintenance of generators in the peak demand period is important to secure the necessary supply capacity for a stable supply of electricity.

However, in the case that securing the necessary supply capacity fails, the Organization shall strive to secure supply capacity unavoidably utilizing the scheme of solicitation and procurement of supply capacity with the cooperation of the relevant GT&D companies in the current stage where capacity market that procure supply capacity is not introduced yet.

The Organization recommends the Government to review the cost allocation of the above procurement of supply capacity, and its treatment of wheeling charges according to the interim report of the "Subcommittee on Electricity Resilience toward a Decarbonized Society". (https://www.meti.go.jp/shingikai/enecho/denryoku_gas/datsu_tansoka/pdf/20190730_report.pdf only in Japanese)

<Further Utilization of Renewable Energy Generation>

Smooth and effective coordination is expected of the scheduled maintenance of generators in the peak demand period including winter, according to the scheme for coordinating scheduled maintenance of supply capacity (requirement for coordination) two years ahead of actual supply–demand after the introduction of the capacity market.

In these circumstances, the scheduled maintenance of pumped storage generators is avoided during the off-peak period so as not to curtail output of renewable energy, and further utilize energy generated by renewable energy generation, which contributes to reducing CO2 emission. However, after introduction of the capacity market, the scheme for coordinating scheduled maintenance will encourage maintenance work during the off-peak period, which will lead to curtailment of output from renewable energy generation. It is noted that the effective utilization of renewable energy generation will decrease as a result.

The Organization recommends review of the need to assess the value of energy generation that is capable of avoiding scheduled maintenance during the off-peak period so as to utilize renewable energy generation in the process of the larger integration of renewable energy generation.

2. Electricity Supply Plan after Introduction of the Capacity Market

As the electricity supply plan reviews the situation of stable supply and formation of transmission and distribution facilities, its fundamental purpose and role will not change even after the introduction of the capacity market. After its introduction, it is crucial to confirm the existence of sufficient generating facilities (i.e., supply capacity) to procure the necessary supply capacity through the market for the upcoming 10-year period at the annual aggregation of the supply plans. Therefore, the Organization shall focus on understanding the trends in new generator development, suspension or retirement plans of existing facilities owned by generation companies, as well as the possibility of utilizing suspended generation facilities, with the cooperation of the GT&D companies.

In particular, regarding the suspension or retirement of generators, it is crucial to secure the necessary supply capacity, including the transmission capability of transmission and distribution facilities, in the case that significant suspension or retirement of generators is included in the aggregation of the supply plans. Furthermore, to contribute to future projection or review of necessary measures, it is vital for the Organization to understand the trend in suspension or retirement of generators in advance, and cooperate with the Government and GT&D companies to prepare an appropriate response.

On the other hand, the situation continues in which the ratio of supply capacity procurement from the wholesale market is high for procuring action by medium or small-sized retail companies that grow their shares. In future, the scheme for supply capacity to be secured in the long-term through the capacity market will be in place; at the same time, it is projected that the trend of procuring supply capacity from the market or short-term bilateral contracts by retail companies, including the retail departments of former general electric utilities, will continue or increase.

In circumstances that include the diversification of supply capacity procurement by retail companies, and review of the imbalanced charge system, the Organization believes that it is time to reconsider the confirmation method for the situation of supply capacity procurement by retail companies.

3. Drawing up a Replacement Plan for Existing Aged Transmission and Distribution Facilities

As a result of the review of the adequacy of new installation or replacement plans for transmission and distribution facilities for the upcoming 10-year period by the Organization, it is necessary to proceed with the review while paying attention to the four points below in order to adequately replace aged facilities in the future.

Appropriate decisions regarding replacement timing of facilities

The replacement work for existing transmission and distribution facilities that were installed after the period of economic expansion (the 1960s to the 1970s) is an increasing trend. To maintain and manage transmission and distribution facilities, appropriate decisions regarding replacement timing are required.

Securing a highly skilled workforce

It will be crucial to secure a highly skilled workforce for replacement work to respond to the increasing volume of construction work on cross-regional interconnection lines and grid connection of renewable energy generators.

Coordination of maintenance work schedules

The coordination of maintenance work schedules between EPCOs will be important to implement construction work while securing a stable electricity supply, in the conditions under which the period and the frequency of maintenance work will increase at the replacement work.

Compatibility in both reducing national cost sharing and securing adequacy and reliability

It will be indispensable to invest in securing the adequacy and reliability of the electric system while reducing national cost sharing.

Based on the above points, the Organization believes that it is necessary to draw up an appropriate replacement plan that properly evaluates the aging condition or outage severity of existing facilities, and ensures this priority in replacement nationwide.

The Organization will review the scheme for proper improvement and repair of aged facilities based on objective evaluation as part of the master plan for the electric system (see footnote[37]).

In addition, the Organization recommends the Government to take the necessary steps to secure investment in wheeling charge reform to effectively implement replacement of critical infrastructure facilities that support a stable electricity supply.

VIII. Conclusions

1. Electricity Demand Forecast

The AAGRs of both peak demand nationwide (average of the three highest daily loads) and electric energy requirement nationwide in the mid-to-long-term are forecast to decrease by 0.1%. AAGRs have become negative, and this is attributable to a number of major factors, such as efforts to reduce electricity use, wider utilization of energy-saving electric appliances, a shrinking population, and load-leveling measures.

2. Electricity Supply and Demand

Regarding the supply–demand balance evaluation in each regional service area during the upcoming 10-year period, the criterion of a stable supply, that is, a reserve margin of 8% (supply capacity over peak demand by deducting the capacity of the largest generating unit and balancing capacity with frequency control [Generator I] in Okinawa) is projected to be secured in all areas and years by sharing power from other areas with sufficient supply capacity through cross-regional interconnection lines. The Organization will continuously and carefully evaluate the supply–demand balance, by monitoring the submission of changing supply plans and the accompanying supply–demand balance.

3. Analysis of the Transition of Power Generation Sources Nationwide

Regarding the transition of installed power generation capacity and net electricity generation, renewable energy such as solar power is projected to increase greatly. For nuclear power plants, energy generation is calculated as zero given their capacity is reported as "uncertain".

4. Development Plans for Transmission and Distribution Facilities

Regarding the development plans for major transmission lines or substations, a long distance transmission line is planned anew, and there are no changes for cross-regional interconnection lines from the previous year's plans.

5. Cross-regional Operation

For procuring supply capacity or energy from external service areas, aggregated results are almost the same as the previous year in both areas with higher procurement from external service areas and in areas with higher transmission to external areas.

6. Analysis of Characteristics of Electric Power Companies

Distributions are calculated for retail companies and generation companies according to business scale and business areas, and aggregated to the projection during the 10-year period. In addition, the ratios of the secured supply capacity are reviewed. In particular, small and medium-sized retail companies have planned their supply capacity as "unspecified procurement," as in the previous year's plan. As a result, the ratios of the secured supply capacity indicate a declining tendency.

7. Findings and Challenges

The Organization has communicated its opinions to METI concerning three major challenges in relation to the aggregation of electricity supply plans for FY 2020.

Attached are the Appendices on the aggregation of the electricity supply plans.

APPENDIX 1 Supply–Demand Balance for FY 2020 and 2021 (Short-term)

i) Projection for FY 2020

Tables A1-1 to A1-4 show the monthly supply–demand balance,[17] such as peak demand, monthly supply capacity, monthly reserve capacity, and reserve margin for each regional service area in FY 2020, respectively. Table A1-5 shows the monthly projection of the reserve margin for each regional service area recalculated with power exchanges to areas below the 8% reserve margin from areas with over 8% reserve margin with additional supply capacity according to provision of Article 48 of the Act. Further, Table A1-6 shows the monthly peak demand, monthly supply capacity, monthly reserve capacity, and reserve margin at the designated time.

Table A1-1 Monthly Peak Demand Forecast for Each Regional Service Area in FY 2020 (10^4kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	400	362	364	410	419	394	437	455	490	500	493	455
Tohoku	1,057	985	1,062	1,267	1,295	1,159	1,058	1,180	1,316	1,369	1,354	1,258
Tokyo	3,852	3,728	4,120	5,319	5,319	4,552	3,781	4,019	4,454	4,775	4,775	4,335
50 Hz areas Total	5,309	5,075	5,546	6,996	7,033	6,105	5,276	5,654	6,260	6,644	6,622	6,048
Chubu	1,868	1,887	2,034	2,464	2,464	2,258	1,967	1,945	2,190	2,297	2,297	2,098
Hokuriku	386	367	403	497	497	442	374	412	468	492	492	456
Kansai	1,810	1,863	2,135	2,672	2,672	2,306	1,908	1,984	2,384	2,459	2,459	2,191
Chugoku	745	750	823	1,043	1,043	912	781	836	1,009	1,033	1,033	912
Shikoku	346	348	397	498	498	435	359	370	459	459	459	410
Kyushu	1,040	1,056	1,202	1,539	1,539	1,327	1,131	1,154	1,473	1,493	1,493	1,270
60 Hz areas Total	6,195	6,271	6,994	8,713	8,713	7,680	6,520	6,701	7,983	8,233	8,233	7,337
Interconnected	11,504	11,346	12,540	15,709	15,746	13,785	11,796	12,355	14,243	14,877	14,855	13,385
Okinawa	103	120	138	145	146	142	130	112	98	103	101	95
Nationwide	11,607	11,466	12,678	15,854	15,892	13,927	11,926	12,467	14,341	14,980	14,956	13,480

Table A1-2 Monthly Projection of Supply Capacity for Each Regional Service Area in FY 2020 (10^4kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	596	615	587	528	553	566	541	631	573	570	561	577
Tohoku	1,300	1,310	1,307	1,452	1,504	1,366	1,244	1,369	1,529	1,595	1,573	1,541
Tokyo	4,281	4,402	4,958	5,808	5,851	5,463	4,541	4,484	5,018	5,361	5,410	5,032
50 Hz areas Total	6,176	6,327	6,852	7,787	7,909	7,395	6,326	6,484	7,119	7,526	7,544	7,150
Chubu	2,185	2,292	2,492	2,687	2,726	2,741	2,500	2,398	2,637	2,663	2,657	2,588
Hokuriku	550	519	503	629	601	541	421	453	494	539	547	549
Kansai	2,199	2,147	2,323	2,903	2,909	2,781	2,170	2,152	2,437	2,586	2,624	2,486
Chugoku	961	997	1,138	1,295	1,285	1,220	1,109	1,050	1,140	1,183	1,169	1,160
Shikoku	467	450	508	610	614	557	551	464	539	555	542	516
Kyushu	1,382	1,436	1,457	1,731	1,716	1,625	1,394	1,317	1,509	1,607	1,656	1,601
60 Hz areas Total	7,745	7,840	8,420	9,855	9,852	9,465	8,145	7,834	8,755	9,131	9,196	8,900
Interconnected	13,921	14,167	15,272	17,642	17,761	16,860	14,471	14,318	15,875	16,657	16,740	16,049
Okinawa	180	187	182	187	187	187	189	167	161	162	170	177
Nationwide	14,100	14,354	15,454	17,829	17,948	17,047	14,660	14,485	16,036	16,819	16,911	16,226

Table A1-3 Monthly Projection of Reserve Capacity for Each Regional Service Area in FY 2020 (10^4kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	196	253	223	118	134	172	104	176	83	70	68	122
Tohoku	243	325	245	185	209	207	186	189	213	226	219	283
Tokyo	429	674	838	489	532	911	760	465	564	586	635	697
50 Hz areas Total	867	1,252	1,306	791	876	1,290	1,050	830	859	882	922	1,102
Chubu	317	405	458	223	262	483	533	453	447	366	360	490
Hokuriku	164	152	100	132	104	99	48	41	26	47	55	94
Kansai	389	284	188	231	237	475	262	168	53	127	165	295
Chugoku	216	247	315	252	242	308	328	214	131	150	136	248
Shikoku	121	102	111	112	116	122	192	94	80	96	83	106
Kyushu	342	380	255	192	177	298	263	163	36	114	163	331
60 Hz areas Total	1,550	1,569	1,426	1,142	1,139	1,785	1,625	1,133	773	898	963	1,563
Interconnected	2,417	2,821	2,732	1,933	2,015	3,075	2,676	1,963	1,632	1,780	1,885	2,665
Okinawa	76	67	44	42	41	45	58	55	63	59	69	82
Nationwide	2,493	2,888	2,776	1,975	2,055	3,120	2,734	2,018	1,695	1,839	1,955	2,746

Table A1-4 Monthly Projection of Reserve Margin for Each Regional Service Area in FY 2020

(resources within own service area only, at the sending end; see Table 2-5)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	48.9%	69.9%	61.3%	28.7%	31.9%	43.6%	23.8%	38.6%	16.9%	13.9%	13.8%	26.9%
Tohoku	23.0%	33.0%	23.1%	14.6%	16.2%	17.9%	17.6%	16.0%	16.2%	16.5%	16.2%	22.5%
Tokyo	11.1%	18.1%	20.3%	9.2%	10.0%	20.0%	20.1%	11.6%	12.7%	12.3%	13.3%	16.1%
50 Hz areas Total	16.3%	24.7%	23.5%	11.3%	12.5%	21.1%	19.9%	14.7%	13.7%	13.3%	13.9%	18.2%
Chubu	17.0%	21.4%	22.5%	9.1%	10.6%	21.4%	27.1%	23.3%	20.4%	15.9%	15.7%	23.4%
Hokuriku	42.6%	41.3%	24.7%	26.6%	20.9%	22.4%	12.8%	9.9%	**5.7%**	9.6%	11.2%	20.6%
Kansai	21.5%	15.3%	8.8%	8.6%	8.9%	20.6%	13.7%	8.5%	**2.2%**	**5.2%**	**6.7%**	13.5%
Chugoku	29.0%	32.9%	38.2%	24.1%	23.2%	33.7%	41.9%	25.6%	13.0%	14.5%	13.1%	27.1%
Shikoku	34.9%	29.3%	28.1%	22.4%	23.4%	28.1%	53.4%	25.5%	17.4%	20.8%	18.1%	25.8%
Kyushu	32.9%	36.0%	21.2%	12.5%	11.5%	22.5%	23.2%	14.1%	**2.4%**	**7.6%**	10.9%	26.0%
60 Hz areas Total	25.0%	25.0%	20.4%	13.1%	13.1%	23.2%	24.9%	16.9%	9.7%	10.9%	11.7%	21.3%
Interconnected	21.0%	24.9%	21.8%	12.3%	12.8%	22.3%	22.7%	15.9%	11.5%	12.0%	12.7%	19.9%
Okinawa	74.0%	55.8%	31.9%	28.8%	27.9%	31.5%	44.8%	49.4%	63.6%	57.8%	68.2%	85.6%
Nationwide	21.5%	25.2%	21.9%	12.5%	12.9%	22.4%	22.9%	16.2%	11.8%	12.3%	13.1%	20.4%

Below 8% criteria

Table A1-5 Monthly Projection of Reserve Margin for Each Regional Service Area in FY 2020

(with power exchanges through cross-regional interconnection lines and generating facilities not included in the electricity supply plans, at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	41.9%	61.2%	61.3%	18.0%	25.8%	35.0%	20.0%	26.9%	13.8%	13.2%	13.1%	18.5%
Tohoku	14.2%	21.9%	20.6%	10.9%	11.6%	20.2%	20.0%	13.9%	13.8%	13.2%	13.1%	18.5%
Tokyo	14.2%	21.9%	20.6%	10.9%	11.6%	20.2%	20.0%	13.9%	13.8%	13.1%	13.1%	18.5%
Chubu	25.0%	24.6%	20.6%	13.2%	13.2%	23.3%	25.0%	17.4%	13.8%	11.3%	12.6%	21.4%
Hokuriku	25.0%	24.6%	20.6%	13.2%	13.2%	23.3%	25.0%	16.9%	8.5%	11.3%	12.6%	21.4%
Kansai	25.0%	24.6%	20.6%	13.2%	13.2%	23.3%	25.0%	16.9%	8.5%	11.3%	12.6%	21.4%
Chugoku	25.0%	24.6%	20.6%	13.2%	13.2%	23.3%	25.0%	16.9%	8.5%	11.3%	12.6%	21.4%
Shikoku	25.0%	24.6%	20.6%	13.2%	13.2%	23.3%	25.0%	16.9%	8.5%	11.3%	12.6%	21.4%
Kyushu	25.0%	27.0%	20.6%	13.2%	13.2%	23.3%	25.0%	16.9%	8.5%	11.3%	12.6%	21.4%
Interconnected	21.0%	24.9%	21.8%	12.4%	12.8%	22.4%	22.8%	16.1%	11.6%	12.1%	12.9%	20.1%
Okinawa	74.0%	55.8%	31.9%	28.8%	27.9%	31.5%	44.8%	49.4%	63.6%	57.8%	68.2%	85.6%
Nationwide	21.5%	25.2%	21.9%	12.5%	13.0%	22.5%	23.0%	16.4%	12.0%	12.4%	13.2%	20.6%

Improve to over 8%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection line.

Table A1-6 Monthly Projection of Supply Demand Balance in Okinawa in FY 2020 (10^4kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Peak Demand	103	121	143	147	150	146	130	112	98	103	101	95
Supply Capacity	180	190	190	195	200	198	189	167	161	162	170	177
Reserve Capacity	76	69	47	48	50	52	58	55	63	59	69	82
Reserve Margin	74.0%	56.6%	32.9%	32.5%	33.5%	35.6%	44.8%	49.4%	63.6%	57.8%	68.2%	85.6%

ii) Projection for FY 2021

Tables A1-7 to A1-10 show the monthly supply–demand balance,[17] such as peak demand, monthly supply capacity, monthly reserve capacity, and reserve margin for each regional service area in FY 2021, respectively. Table A1-11 shows the monthly projection of the reserve margin for each regional service area recalculated with power exchanges to areas below the 8% reserve margin from areas with over 8% reserve margin with additional supply capacity according to provision of Article 48 of the Act. Further, Table A1-12 shows the monthly peak demand, monthly supply capacity, monthly reserve capacity, and reserve margin at the designated time.

Table A1-7 Monthly Peak Demand Forecast for Each Regional Service Area in FY 2021 (10^4kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	399	361	363	409	418	393	436	453	488	498	491	453
Tohoku	1,055	984	1,060	1,265	1,293	1,157	1,056	1,177	1,313	1,366	1,351	1,255
Tokyo	3,845	3,720	4,112	5,307	5,307	4,542	3,774	4,010	4,443	4,762	4,762	4,326
50 Hz area Total	5,299	5,065	5,535	6,981	7,018	6,092	5,266	5,640	6,244	6,626	6,604	6,034
Chubu	1,875	1,894	2,041	2,473	2,473	2,266	1,974	1,952	2,198	2,305	2,305	2,106
Hokuriku	385	366	402	495	495	440	372	411	466	490	490	454
Kansai	1,805	1,858	2,129	2,663	2,663	2,300	1,903	1,978	2,378	2,449	2,449	2,186
Chugoku	747	752	825	1,046	1,046	914	783	839	1,011	1,036	1,036	914
Shikoku	345	347	395	496	496	433	358	368	457	457	457	408
Kyushu	1,040	1,055	1,201	1,538	1,538	1,326	1,130	1,154	1,472	1,492	1,492	1,269
60 Hz areas Total	6,197	6,272	6,993	8,711	8,711	7,679	6,520	6,702	7,982	8,229	8,229	7,337
Interconnected	11,496	11,337	12,528	15,692	15,729	13,771	11,786	12,342	14,226	14,855	14,833	13,371
Okinawa	104	121	141	146	147	143	131	112	99	103	102	96
Nationwide	11,599	11,457	12,668	15,838	15,876	13,914	11,917	12,454	14,325	14,958	14,935	13,466

Table A1-8 Monthly Projection of Supply Capacity for Each Regional Service Area in FY 2021 (10^4kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	573	558	570	541	533	547	535	607	647	639	636	556
Tohoku	1,325	1,356	1,357	1,586	1,613	1,395	1,309	1,394	1,564	1,657	1,643	1,537
Tokyo	4,491	4,549	4,663	5,545	5,584	5,283	4,410	4,327	4,910	5,082	4,989	4,623
50 Hz area Total	6,389	6,462	6,589	7,672	7,730	7,225	6,253	6,328	7,120	7,378	7,269	6,716
Chubu	2,261	2,272	2,439	2,632	2,637	2,533	2,310	2,230	2,367	2,453	2,397	2,320
Hokuriku	475	488	495	568	542	511	481	475	535	534	536	528
Kansai	2,317	2,267	2,503	2,889	2,899	2,702	2,318	2,266	2,513	2,652	2,693	2,455
Chugoku	945	1,017	1,078	1,320	1,328	1,212	1,046	973	1,072	1,165	1,179	1,109
Shikoku	473	510	527	617	612	582	533	444	530	545	536	495
Kyushu	1,497	1,462	1,562	1,869	1,924	1,848	1,531	1,468	1,712	1,758	1,648	1,567
60 Hz areas Total	7,967	8,016	8,605	9,896	9,941	9,388	8,218	7,857	8,730	9,108	8,989	8,473
Interconnected	14,356	14,478	15,194	17,568	17,671	16,612	14,471	14,185	15,850	16,485	16,257	15,190
Okinawa	166	188	209	209	213	202	196	175	167	166	162	165
Nationwide	14,522	14,667	15,403	17,777	17,885	16,814	14,668	14,360	16,018	16,651	16,420	15,355

Table A1-9 Monthly Projection of Reserve Capacity for Each Regional Service Area in FY 2021 (10^4kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	174	197	207	132	115	154	99	154	159	141	145	103
Tohoku	270	372	297	321	320	238	253	217	251	291	292	282
Tokyo	646	829	551	238	277	741	636	317	467	320	227	297
50 Hz area Total	1,090	1,397	1,054	691	712	1,133	987	688	876	752	665	682
Chubu	386	378	398	159	164	267	336	278	169	148	92	214
Hokuriku	90	122	94	73	47	71	109	65	70	44	46	74
Kansai	512	409	374	226	236	402	415	288	135	203	244	269
Chugoku	198	265	253	274	282	298	263	134	61	129	143	195
Shikoku	128	163	132	121	116	149	175	76	73	88	79	87
Kyushu	457	407	361	331	386	522	401	314	240	266	156	298
60 Hz areas Total	1,771	1,745	1,612	1,185	1,230	1,709	1,698	1,155	749	879	760	1,137
Interconnected	2,860	3,142	2,666	1,876	1,942	2,841	2,685	1,843	1,625	1,630	1,424	1,819
Okinawa	62	67	68	63	66	58	65	63	68	63	60	69
Nationwide	2,923	3,209	2,734	1,938	2,008	2,900	2,750	1,906	1,693	1,693	1,485	1,888

Table A1-10 Monthly Projection of Reserve Margin for Each Regional Service Area in FY 2021

(resources within own service area only, at the sending end; see Table 2-10)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	43.5%	54.4%	56.9%	32.3%	27.6%	39.1%	22.7%	34.1%	32.5%	28.3%	29.6%	22.8%
Tohoku	25.6%	37.8%	28.0%	25.4%	24.7%	20.6%	23.9%	18.4%	19.1%	21.3%	21.6%	22.5%
Tokyo	16.8%	22.3%	13.4%	**4.5%**	**5.2%**	16.3%	16.8%	**7.9%**	10.5%	**6.7%**	**4.8%**	**6.9%**
50 Hz areas Total	20.6%	27.6%	19.0%	9.9%	10.1%	18.6%	18.7%	12.2%	14.0%	11.3%	10.1%	11.3%
Chubu	20.6%	20.0%	19.5%	**6.4%**	**6.6%**	11.8%	17.0%	14.2%	**7.7%**	**6.4%**	**4.0%**	10.2%
Hokuriku	23.5%	33.5%	23.4%	14.8%	9.4%	16.1%	29.2%	15.8%	15.0%	9.1%	9.4%	16.3%
Kansai	28.4%	22.0%	17.6%	8.5%	8.9%	17.5%	21.8%	14.6%	**5.7%**	8.3%	10.0%	12.3%
Chugoku	26.5%	35.2%	30.7%	26.2%	27.0%	32.6%	33.6%	16.0%	**6.1%**	12.4%	13.8%	21.4%
Shikoku	37.1%	47.0%	33.4%	24.5%	23.4%	34.5%	48.9%	20.8%	15.9%	19.4%	17.3%	21.2%
Kyushu	43.9%	38.6%	30.1%	21.6%	25.1%	39.3%	35.5%	27.2%	16.3%	17.9%	10.4%	23.5%
60 Hz areas Total	28.6%	27.8%	23.1%	13.6%	14.1%	22.2%	26.0%	17.2%	9.4%	10.7%	9.2%	15.5%
Interconnected	24.9%	27.7%	21.3%	12.0%	12.3%	20.6%	22.8%	14.9%	11.4%	11.0%	9.6%	13.6%
Okinawa	60.1%	55.7%	48.3%	42.9%	44.9%	40.7%	49.7%	55.9%	68.8%	60.9%	59.3%	72.1%
Nationwide	25.2%	28.0%	21.6%	12.2%	12.7%	20.8%	23.1%	15.3%	11.8%	11.3%	9.9%	14.0%

Below 8% criteria

Table A1-11 Monthly Projection of Reserve Margin for Each Regional Service Area in FY 2021

(with power exchanges through cross-regional interconnection lines and generating facilities not included in the electricity supply plans, at the sending end; see Table 2-12)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	31.0%	46.1%	54.6%	27.2%	24.2%	41.4%	19.4%	23.4%	21.5%	17.6%	18.8%	14.6%
Tohoku	21.8%	26.5%	17.6%	9.5%	9.7%	16.1%	19.4%	12.1%	11.3%	12.9%	15.3%	14.6%
Tokyo	20.6%	26.5%	17.6%	9.5%	9.7%	16.1%	19.4%	12.1%	11.3%	10.8%	8.0%	10.5%
Chubu	24.3%	26.5%	22.6%	9.9%	10.3%	16.1%	19.9%	16.0%	11.3%	10.8%	8.6%	14.7%
Hokuriku	24.3%	28.4%	22.6%	14.8%	13.9%	16.1%	19.9%	16.0%	11.3%	10.8%	9.7%	15.6%
Kansai	26.0%	28.4%	22.6%	14.8%	13.9%	24.7%	29.0%	17.1%	11.3%	10.8%	9.7%	15.6%
Chugoku	26.0%	28.4%	22.6%	14.8%	13.9%	24.7%	29.0%	17.1%	11.3%	10.8%	9.7%	15.6%
Shikoku	26.0%	28.4%	22.6%	14.8%	13.9%	24.7%	29.0%	17.1%	11.3%	10.8%	9.7%	15.6%
Kyushu	42.0%	29.3%	22.6%	14.8%	20.7%	34.0%	30.8%	19.0%	11.3%	10.8%	9.7%	17.2%
Interconnected	25.1%	27.9%	21.5%	12.1%	12.5%	20.8%	23.1%	15.2%	11.6%	11.2%	9.8%	13.8%
Okinawa	60.1%	55.7%	48.3%	42.9%	44.9%	40.7%	49.7%	55.9%	68.8%	60.9%	59.3%	72.1%
Nationwide	25.4%	28.2%	21.8%	12.4%	12.8%	21.0%	23.3%	15.6%	12.0%	11.5%	10.2%	14.3%

Improve to over 8%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection line.

Table A1-12 Monthly Projection of Supply Demand Balance in Okinawa in FY 2021 (10^4kW at the sending end)

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Peak Demand	104	122	144	148	151	147	131	112	99	103	102	96
Supply Capacity	166	191	214	217	227	212	196	175	167	166	162	165
Reserve Capacity	62	69	70	69	76	66	65	63	68	63	60	69
Reserve Margin	60.1%	56.6%	49.0%	46.6%	50.2%	44.7%	49.7%	55.9%	68.8%	60.9%	59.3%	72.1%

APPENDIX 2 Long-Term Supply–Demand Balance for the 10-year Period FY 2020–2029

Tables A2-1 to A2-4 show a 10-year projection of the annual peak demand, annual supply capacity, annual reserve capacity, and reserve margin for each regional service area from FY 2020 to FY 2029, respectively. Table A2-5 shows the annual projection of the reserve margin for each regional service area recalculated with power exchanges from areas with over 8% reserve margin to areas below the 8% reserve margin with additional supply capacity according to provision of Article 48 of the Act. Tables A2-6 to A2-9 show a 10-year projection of the annual peak demand, annual supply capacity, annual reserve capacity, and reserve margin for winter peak areas of Hokkaido and Tohoku, respectively. Table A2-10 shows the 10-year projection of the reserve margin for each regional service area recalculated with power exchanges to areas below the 8% reserve margin from areas with over 8% reserve margin with additional supply capacity according to provision of Article 48 of the Act. Further, Table A2-11 shows the annual peak demand, monthly supply capacity, monthly reserve capacity, and reserve margin for the projected period at the designated time.

Table A2-1 Annual Peak Demand Forecast for Each Regional Service Area
(at 15:00[23] in August, 10^4kW at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	419	418	418	419	419	419	419	420	420	420
Tohoku	1,295	1,293	1,289	1,283	1,277	1,271	1,265	1,258	1,251	1,244
Tokyo	5,319	5,307	5,304	5,302	5,298	5,295	5,291	5,302	5,298	5,295
50 Hz areas Total	7,033	7,018	7,011	7,004	6,994	6,985	6,975	6,980	6,969	6,959
Chubu	2,464	2,473	2,462	2,451	2,440	2,429	2,418	2,421	2,411	2,401
Hokuriku	497	495	493	491	491	491	491	490	490	490
Kansai	2,672	2,663	2,653	2,643	2,634	2,626	2,617	2,608	2,600	2,591
Chugoku	1,043	1,046	1,046	1,045	1,043	1,042	1,041	1,040	1,038	1,037
Shikoku	498	496	494	492	491	490	488	487	485	484
Kyushu	1,539	1,538	1,538	1,539	1,540	1,541	1,543	1,544	1,545	1,546
60 Hz area Total	8,713	8,711	8,686	8,661	8,639	8,619	8,598	8,590	8,569	8,549
Interconnected	15,746	15,729	15,697	15,665	15,633	15,604	15,573	15,570	15,538	15,508
Okinawa	146	147	148	149	150	151	152	152	153	154
Nationwide	15,892	15,876	15,845	15,814	15,783	15,755	15,725	15,722	15,692	15,662

Table A2-2 Annual Projection of Supply Capacity for Each Regional Service Area
(at 15:00[23] in August, 10^4kW at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	553	533	533	629	629	632	627	676	676	676
Tohoku	1,504	1,613	1,647	1,674	1,692	1,701	1,740	1,747	1,755	1,763
Tokyo	5,851	5,584	5,595	5,784	5,805	6,018	5,998	6,003	6,046	6,050
50 Hz areas Total	7,909	7,730	7,775	8,088	8,126	8,351	8,365	8,427	8,477	8,489
Chubu	2,726	2,637	2,732	2,739	2,824	2,815	2,814	2,821	2,821	2,824
Hokuriku	601	542	552	564	565	559	563	564	562	564
Kansai	2,909	2,899	2,903	2,872	2,870	2,756	2,766	2,771	2,756	2,757
Chugoku	1,285	1,328	1,346	1,299	1,306	1,311	1,312	1,309	1,302	1,305
Shikoku	614	612	558	605	611	611	615	617	611	614
Kyushu	1,716	1,924	1,826	1,834	1,755	1,766	1,682	1,678	1,669	1,673
60 Hz area Total	9,852	9,941	9,917	9,914	9,931	9,819	9,751	9,760	9,722	9,738
Interconnected	17,761	17,671	17,692	18,002	18,057	18,170	18,116	18,187	18,199	18,227
Okinawa	187	213	199	214	218	213	212	213	213	213
Nationwide	17,948	17,885	17,891	18,215	18,275	18,383	18,329	18,399	18,411	18,440

Table A2-3 Annual Projection of Reserve Capacity for Each Regional Service Area
(at 15:00[23] in August, 10^4kW at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	134	115	115	210	210	213	208	256	256	256
Tohoku	209	320	358	391	415	430	475	489	504	519
Tokyo	532	277	291	482	507	723	707	701	748	755
50 Hz areas Total	876	712	764	1,084	1,132	1,366	1,390	1,447	1,508	1,530
Chubu	262	164	270	288	384	386	396	400	410	423
Hokuriku	104	47	59	73	74	68	72	74	72	74
Kansai	237	236	250	229	236	130	149	163	156	166
Chugoku	242	282	300	255	262	269	271	270	264	268
Shikoku	116	116	64	113	120	121	127	130	126	130
Kyushu	177	386	288	295	215	225	139	134	124	127
60 Hz areas Total	1,139	1,230	1,231	1,253	1,292	1,200	1,153	1,170	1,153	1,189
Interconnected	2,015	1,942	1,995	2,337	2,424	2,566	2,543	2,617	2,660	2,719
Okinawa	41	66	51	64	68	62	61	60	59	59
Nationwide	2,055	2,008	2,046	2,402	2,492	2,628	2,604	2,677	2,720	2,777

Table A2-4 Annual Projection of Reserve Margin for Each Regional Service Area
(resource within own service area only, at 15:00[23] in August, at the sending end; see Table 2-15)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	31.9%	27.6%	27.4%	50.2%	50.0%	50.9%	49.7%	61.1%	61.0%	61.1%
Tohoku	16.2%	24.7%	27.8%	30.5%	32.5%	33.9%	37.6%	38.9%	40.3%	41.7%
Tokyo	10.0%	**5.2%**	**5.5%**	9.1%	9.6%	13.7%	13.4%	13.2%	14.1%	14.3%
50 Hz areas Total	12.5%	10.1%	10.9%	15.5%	16.2%	19.6%	19.9%	20.7%	21.6%	22.0%
Chubu	10.6%	**6.6%**	11.0%	11.8%	15.7%	15.9%	16.4%	16.5%	17.0%	17.6%
Hokuriku	20.9%	9.4%	11.9%	14.8%	15.1%	13.9%	14.6%	15.0%	14.7%	15.0%
Kansai	8.9%	8.9%	9.4%	8.7%	9.0%	**5.0%**	**5.7%**	**6.2%**	**6.0%**	**6.4%**
Chugoku	23.2%	27.0%	28.7%	24.4%	25.1%	25.8%	26.0%	25.9%	25.4%	25.8%
Shikoku	23.4%	23.4%	13.0%	23.0%	24.5%	24.7%	26.0%	26.7%	26.1%	27.0%
Kyushu	11.5%	25.1%	18.7%	19.2%	14.0%	14.6%	9.0%	8.7%	8.0%	8.2%
60 Hz areas Total	13.1%	14.1%	14.2%	14.5%	15.0%	13.9%	13.4%	13.6%	13.5%	13.9%
Interconnected	12.8%	12.3%	12.7%	14.9%	15.5%	16.4%	16.3%	16.8%	17.1%	17.5%
Okinawa	27.9%	44.9%	34.4%	43.2%	45.3%	40.9%	40.0%	39.4%	38.7%	38.0%
Nationwide	12.9%	12.7%	12.9%	15.2%	15.8%	16.7%	16.6%	17.0%	17.3%	17.7%

Below 8% criteria

Table A2-5 Annual Projection of Reserve Margin for Each Regional Service Area
(15:00[23] in August, with power exchanges through cross-regional interconnection lines and generating facilities not included in the electricity supply plans, at the sending end; see Table 2-17)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	25.8%	20.0%	17.4%	40.2%	40.0%	40.8%	40.4%	51.8%	51.7%	51.8%
Tohoku	11.6%	9.7%	16.9%	20.1%	21.8%	23.1%	24.2%	25.6%	16.2%	16.6%
Tokyo	11.6%	9.7%	8.9%	12.4%	12.9%	15.1%	14.9%	15.0%	16.2%	16.6%
Chubu	13.1%	10.3%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Hokuriku	13.1%	13.9%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Kansai	13.1%	13.9%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Chugoku	13.1%	13.9%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Shikoku	13.1%	13.9%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Kyushu	13.1%	20.2%	14.2%	14.5%	15.0%	15.1%	14.9%	15.0%	16.2%	16.6%
Interconnected	12.8%	12.3%	12.7%	14.9%	15.5%	16.4%	16.3%	16.8%	17.1%	17.5%
Okinawa	27.9%	44.9%	34.4%	43.2%	45.3%	40.9%	40.0%	39.4%	38.7%	38.0%
Nationwide	12.9%	12.7%	12.9%	15.2%	15.8%	16.7%	16.6%	17.0%	17.3%	17.7%

Improve to over 8%

* Reserve margins with the same value are shown in the same background color after utilization of cross-regional interconnection line.

Table A2-6 Annual Peak Demand Forecast for Winter Peak Areas of Hokkaido and Tohoku
(at 18:00 in January, 10^4kW at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	500	498	499	499	499	499	500	500	500	501
Tohoku	1,369	1,366	1,362	1,358	1,354	1,350	1,346	1,342	1,338	1,334

Table A2-7 Annual Projection of Supply Capacity for Winter Peak Areas of Hokkaido and Tohoku
(at 18:00 in January, 10^4kW at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	570	639	665	640	643	644	693	693	693	693
Tohoku	1,595	1,657	1,659	1,686	1,701	1,718	1,759	1,771	1,795	1,811

Table A2-8 Annual Projection of Reserve Capacity for Winter Peak areas of Hokkaido and Tohoku
(at 18:00 in January, 10^4kW at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	70	141	166	141	144	145	193	193	193	192
Tohoku	226	291	297	328	347	368	413	429	457	477

Table A2-9 Annual Projection of Reserve Margin for Winter Peak Areas of Hokkaido and Tohoku
(at 18:00 in January; see Table 2-19)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	13.9%	28.3%	33.3%	28.3%	28.8%	29.1%	38.6%	38.5%	38.5%	38.4%
Tohoku	16.5%	21.3%	21.8%	24.2%	25.6%	27.3%	30.7%	32.0%	34.1%	35.8%

Table A2-10 Annual Projection of Reserve Margin for Winter Peak Areas of Hokkaido and Tohoku
(at 18:00 in Januar, with power exchanges through cross-regional interconnection lines and generating facilities not included in the electricity supply plans, at the sending end; see Table 2-21)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hokkaido	16.8%	24.1%	27.8%	26.2%	27.4%	28.7%	33.8%	34.7%	36.3%	37.4%
Tohoku	16.8%	24.1%	25.1%	26.2%	27.4%	28.7%	33.8%	34.7%	36.3%	37.4%

Table A2-11 Annual Projection of Supply Demand Balance in Okinawa (10^4kW at the sending end)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Peak Demand	150	151	152	153	154	155	156	156	157	158
Supply Capacity	200	227	213	228	232	227	227	228	228	229
Reserve Capacity	50	76	61	75	79	73	72	71	71	70
Reserve Margin	33.5%	50.2%	40.2%	48.9%	51.1%	46.9%	46.2%	45.7%	45.2%	44.6%