Outlook for Electricity Supply–Demand and Cross-regional Interconnection Lines:

Actual Data for Fiscal Year 2021

November 2022

OCCTO
電力広域的運営推進機関
Organization for Cross-regional Coordination of Transmission Operators,JAPAN

FOREWORD

The Organization for Cross-regional Coordination of Transmission Operators, Japan (hereinafter, the Organization), prepares and publishes its annual report according to the provisions of Article 181 of the Operational Rules regarding the matters specified below.

i. Actual electric supply and demand (including evaluation and analysis of quality of electricity in light of frequency, voltage, and blackouts of each regional service area)
ii. State of electric network
iii. Actual Network Access Business until the previous year.
iv. Forecast on electric demand and electric network (including forecast of improvement of restriction on network interconnection of generation facilities) for the next fiscal year and a mid- and long-term period based on a result of compiling of electricity supply plans and their issues.
v. Evaluation and verification of proper standards of reserve margin and balancing capacities of each regional service area based on the next article, as well as contents of review as needed

The Organization published the actual data for electricity supply–demand and network system utilization ahead of the Annual Report because of the completion of actual data collection up to fiscal year 2021.

SUMMARY

This report is presented to review the outlook for electricity supply–demand and cross-regional interconnection lines in fiscal year 2021 (FY 2021), based on the provisions of Article 181 of the Operational Rules of the Organization.

This report is comprised of two parts: the electricity supply and demand situation, and the interconnection line situation.

Regarding supply and demand, the peak demand nationwide (16,460 $\times 10^4$ kW), was recorded in August, and the monthly peak electric energy requirement nationwide (87,962 GWh) was recorded in January.

The reserve margin against summer and winter peak demands was 14.2% and 11.0%, respectively.

Power exchange instructions were issued by the Organization for Cross-regional Coordination of Transmission Operators, Japan (the Organization hereafter) 21 times, with 11 of them being issued for improvements in supply-demand tightness caused by the Fukushima Earthquake in March 2022.
Additionally, long-cycle frequency control was implemented 72 times during the year.

Instructions for output shedding of the renewable-energy generating facilities were issued for 252,834 MW in FY 2021, which increased from 108,019 MW of output shedding in the previous year. The actual output shed on the day totaled 116,980 MW in FY 2021.

The total volume of utilization of the interconnection lines was 111,076 GWh, which was a significant increase from the 100,007 GWh in FY 2020.

In FY 2021, 379 interconnection line maintenance events occurred, which required 909 days-worth of work in FY 2021.

We hope that the information of this report proves useful.

CONTENTS

Note:
Data for Chapter I include figures at the sending end, i.e., the electricity supplied to the public network system from power plants with energy deducted for station services from FY 2016 beyond. As for the data before FY 2015 which include figures at the generating and receiving end, please see 2016 Annual Report.
https://www.occto.or.jp/en/information_disclosure/annual_report/files/annual_report_FY2016.pdf

CHAPTER I: ACTUAL ELECTRICITY SUPPLY AND DEMAND

1. Regional Service Areas for 10 General Transmission and Distribution (GT&D) Companies, and the Definition of a Season

(1) Regional Service Areas for 10 GT&D Companies

A regional service area is a specific area to which a GT&D company supplies electricity through cross-regional interconnection lines. Japan is divided into 10 regional service areas as shown in Figure 1-1. The regional service areas served by GT&D companies other than the Okinawa Electric Power Company (EPCO), are connected by cross-regional interconnection lines.

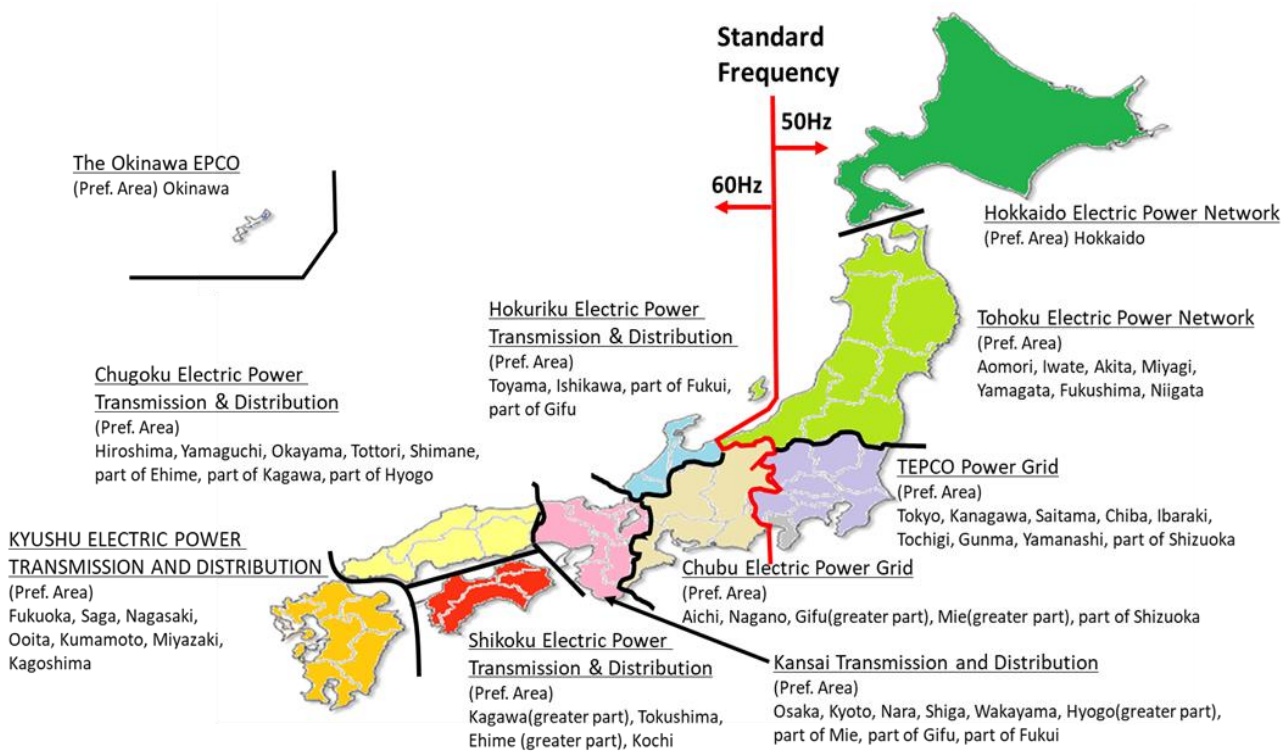

Figure 1-1: The 10 Regional Service Areas in Japan and their Prefectural Distribution

(2) Definition of Seasons

This report divides the seasons into the summer and winter periods. The summer period starts from July and ends in September, and the winter period starts from December and ends in February.
In this report, we compared our outlook of the actual weather for the previous year with the Seasonal Climate Report over Japan prepared by the Japan Meteorological Agency (JMA). The JMA defines the summer and winter periods as June–August and December–February, respectively.
Note that the definitions of the summer period differed between this report and that of the JMA

2. Outlook for Actual Weather Nationwide

(1) Weather During the Summer Period (from June to August 2021)

Table 1-1 shows anomalies in the temperature and precipitation ratios from June to August in FY 2021.

(a) Seasonal precipitation amounts were significantly above normal on the Pacific side of eastern Japan and in western Japan, mainly due to active stationary fronts and moist air inflow in August. Seasonal precipitation amounts on the Sea of Japan side of northern Japan were significantly below normal.

(b) Seasonal mean temperatures and seasonal sunshine durations were significantly above normal in northern Japan. Seasonal mean temperatures were above normal in eastern Japan and seasonal sunshine durations were above normal on Sea of Japan side of eastern Japan. These can be attributed to high-pressure systems in early June and late July.

(c) Sunshine durations were below normal in Okinawa/Amami due to tropical low-pressure systems passed around the region.

Table 1-1: Anomalies in temperature, precipitation, and sunshine duration by weather region from June to August 2021

Weather Region	Mean Temperature Anomaly[°C]	Precipitation Ratio[%]	Sunshine Duration Ratio[%]
Northern	+1.4	78	126
Eastern	+0.4	140	104
Western	+0.1	140	96
Okinawa/Amami	+0.0	141	89

Source: Japan Meteorological Agency (JMA), Tokyo Climate Center.
Seasonal Climate Report over Japan for Summer (FY 2021).
https://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=8&year=2021
https://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=8&year=2021

(2) Weather During the Winter Period (from December 2021 to February 2022)

Table 1-2 shows the anomalies in temperature and the ratios of rainfall and snowfall from December to February in FY 2021.

(a) The winter monsoon was stronger than normal around eastern and western Japan since late December, but the strength of the monsoon varied throughout this winter. Seasonal temperatures were below normal in eastern and western Japan.

(b) Seasonal precipitation amounts were significantly below normal in western Japan and seasonal sunshine durations were above normal in western Japan and on the Pacific side of eastern Japan due to less passage of low-pressure systems.

(c) In Okinawa/Amami, seasonal precipitation amounts were above normal and seasonal sunshine durations were below normal due to fronts and frequent passage of low-pressure systems since late January.

Table 1-2: Anomalies in temperature, precipitation, sunshine duration and snowfall by weather region from December 2021 to February 2022

Weather Region	Mean Temperature Anomaly[°C]	Precipitation Ratio[%]	Sunshine Duration Ratio[%]	Snowfall Ratio[%]
Northern	+0.1	110	106	107
Eastern	-0.5	97	106	98
Western	-0.5	57	112	67
Okinawa/Amami	+0.0	113	86	-

Source：Japan Meteorological Agency, Tokyo Climate Center.
Seasonal Climate Report over Japan for Winter (FY 2021).
https://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=2&year=2022
https://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=2&year=2022

3. Actual Nationwide Peak Demand

Peak demand refers to the highest consumption of electricity during a given period. Table 1-3 shows the monthly peak demand for regional service areas in FY 2021. Figures 1-2 and 1-3 show the nationwide monthly peak demand for FY 2021 and the actual annual peak demands from FY 2016 to 2021, respectively. Table 1-4 presents the actual nationwide peak demand at the sending-end data since FY 2016. In this report, "peak demand" refers to the maximum hourly value of the electric energy requirement.

The values in red are the maximum monthly peak demand (i.e., the annual peak demand), and those in blue are the minimum monthly peak demand for each regional service area. The names of the regional service areas are indicated in the names of the GT&D companies.

The maximum monthly peak demand nationwide for FY 2021 was registered as 16,640 × 10^4 kW in August, which was lower than the previous year's data, and stayed almost the same level as FY 2019's peak demand during 6 years since they were recorded at the sending-end data.

Table 1-3: Monthly peak demand for regional service areas[1]

[10^4kW]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	398	361	369	449	469	362	389	435	490	501	495	463
Tohoku	1,085	989	1,105	1,412	1,490	1,106	1,090	1,193	1,440	1,483	1,463	1,249
Tokyo	3,525	3,737	4,152	5,407	5,665	4,265	4,121	4,130	4,621	5,374	5,278	4,534
Chubu	1,742	1,821	2,076	2,401	2,480	2,126	1,998	1,998	2,291	2,448	2,375	2,107
Hokuriku	375	348	397	498	523	416	406	421	508	541	549	448
Kansai	1,752	1,813	2,158	2,639	2,826	2,424	2,092	1,965	2,369	2,540	2,526	2,196
Chugoku	724	748	852	1,023	1,108	918	826	839	970	1,044	1,068	924
Shikoku	331	348	388	477	503	472	393	370	437	470	495	420
Kyushu	975	1,040	1,291	1,503	1,559	1,398	1,257	1,139	1,409	1,466	1,470	1,204
Okinawa	104	146	149	153	149	160	145	107	98	102	104	102
Nationwide	10,757	10,939	12,502	15,670	16,460	12,977	12,502	12,363	14,519	15,119	14,932	13,174

[1] "Nationwide peak demand" means the maximum aggregated demand in a given period for regional service areas of the 10 GT&D companies, not the addition of each regional peak demand.

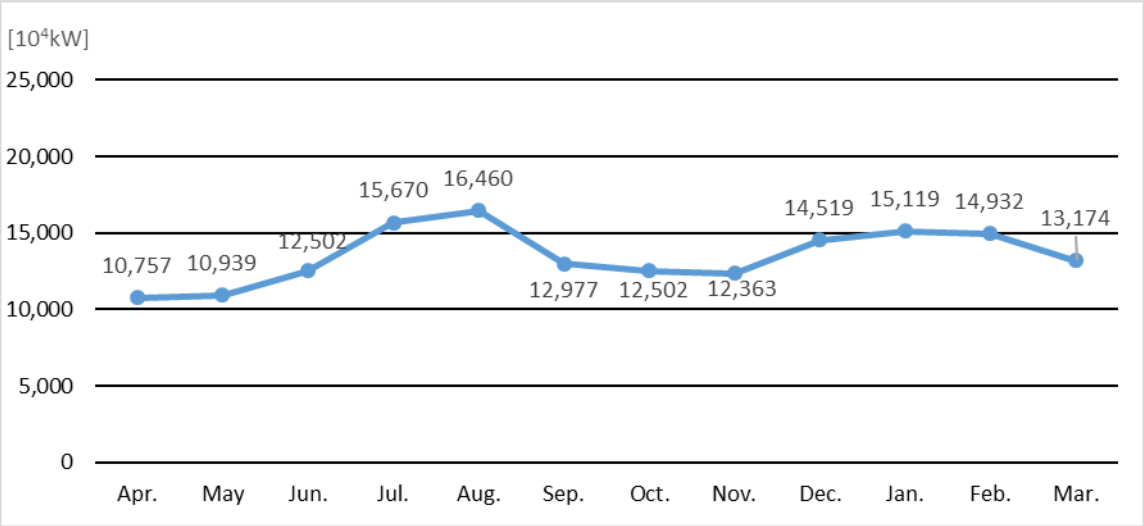

Figure 1-2: Nationwide monthly peak demand

Table 1-4: Actual annual peak demand (from FY 2016–2021, at the sending-end)

[10^4 kW]

	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Nationwide	15,589	15,577	16,482	16,461	16,645	16,460

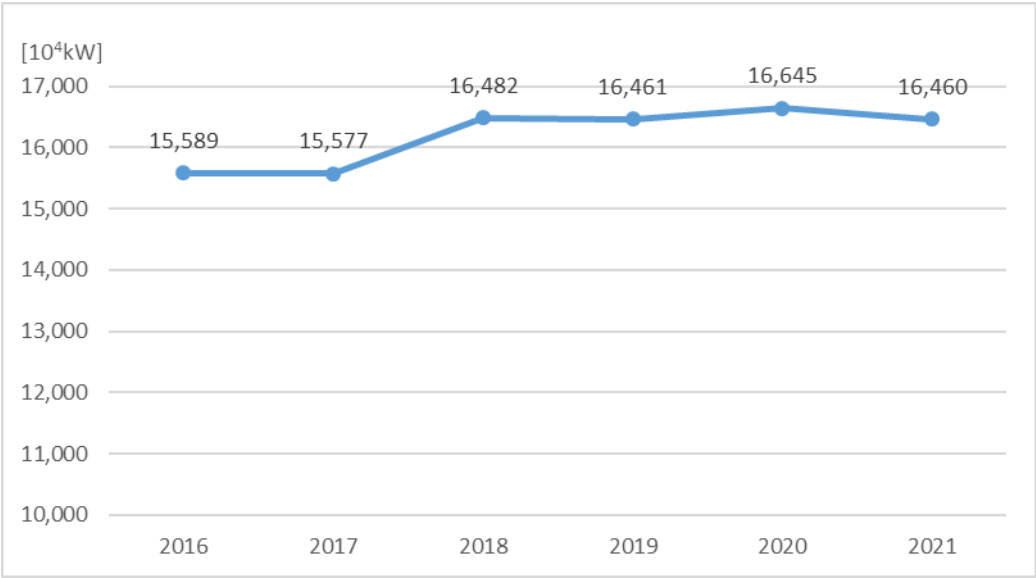

Figure 1-3: Actual annual peak demand (Nationwide)

4. Actual Nationwide Electric Energy Requirements

Table 1-5 shows the monthly electric energy requirements for regional service areas in FY 2021. Figures 1-4 and 1-5 show the nationwide monthly electric energy requirements and the actual annual electric energy requirements from FY 2016 to 2021, respectively. Table 1-6 presents the actual annual electric energy requirement at the sending-end data since FY 2016.
The values in red are the maximum monthly energy requirement, and those in blue are the minimum monthly energy requirement for each regional service area.
The actual annual nationwide electric energy requirement for FY 2020 was 885,171 GWh, which was higher than that for the previous year, which was the lowest in 6 years since they were recorded at the sending-end data.

Table 1-5: Monthly and annual electric energy requirements for regional service areas[2]

[GWh]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido	2,388	2,217	2,104	2,395	2,323	2,114	2,307	2,481	3,051	3,280	2,886	2,818	30,364
Tohoku	6,240	5,955	6,095	7,005	6,958	6,066	6,313	6,649	8,058	8,786	7,938	7,491	83,554
Tokyo	20,330	20,143	21,643	25,825	26,820	21,570	21,681	21,623	26,021	28,506	25,864	23,571	283,597
Chubu	9,971	9,623	10,505	12,271	11,801	10,605	10,352	10,479	12,117	12,956	12,043	11,387	134,109
Hokuriku	2,217	2,073	2,179	2,550	2,460	2,211	2,231	2,342	2,802	3,051	2,839	2,621	29,577
Kansai	10,367	10,142	11,113	13,331	13,151	11,439	11,143	10,857	12,782	14,017	12,924	12,006	143,270
Chugoku	4,415	4,339	4,564	5,329	5,247	4,729	4,652	4,788	5,549	5,905	5,551	5,137	60,207
Shikoku	2,006	1,961	2,065	2,434	2,428	2,155	2,105	2,113	2,465	2,675	2,468	2,274	27,151
Kyushu	6,039	6,077	6,737	8,010	7,738	7,066	6,635	6,520	7,790	8,185	7,622	6,876	85,295
Okinawa	556	718	751	826	818	831	726	576	567	600	520	560	8,048
Nationwide	64,529	63,248	67,757	79,977	79,744	68,785	68,145	68,428	81,200	87,962	80,655	74,741	885,171

[2] Here and elsewhere, the annual total may not equal the sum of 12 months due to independent rounding.

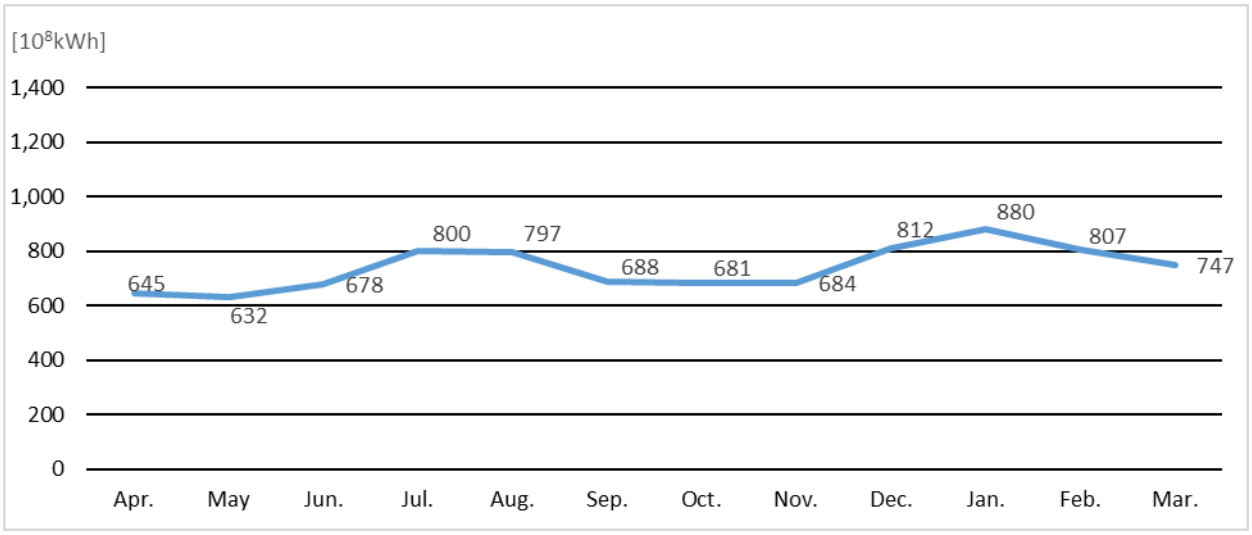

Figure 1-4: Nationwide monthly electric energy requirements

Table 1-6: Actual annual electric energy requirement (from FY 2016–2021, at the sending-end)

[GWh]

	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Nationwide	890,451	900,902	896,473	878,383	867,842	885,171

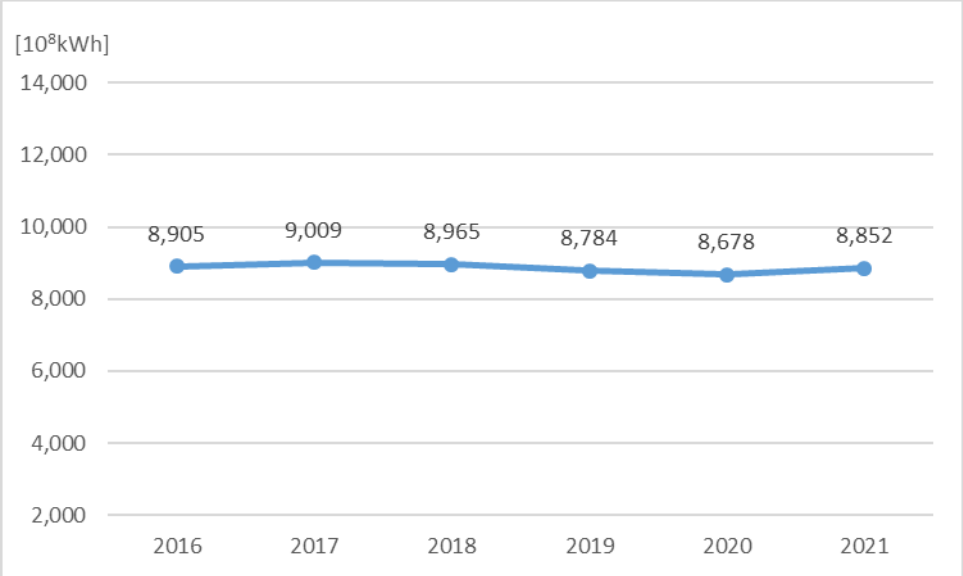

Figure 1-5: Actual annual electric energy requirements (Nationwide)

5. Nationwide Load Factor

The load factor describes the ratio of the average demand to the peak demand within a given period. Table 1-7 shows the monthly load factor for regional service areas in FY 2021, while Figures 1-6 and 1-7 show the nationwide monthly and annual load factors, respectively. Table 1-8 presents the actual annual load factor at the sending-end data since FY 2016.

The values in red and blue are the highest and lowest load factors, respectively, for each regional service area.

The nationwide annual load factor for FY 2021 was 61.4%, which was higher than that for the previous year, which was the minimum figure for 6 years since they were recorded at the sending-end data. The improvement was estimated to be attributable to an increase in the electric energy requirement due to the recovery of economic activities, despite the decrease in the peak demand due to mild summer.

Table 1-7: Monthly and annual load factors for regional service areas[3]

[%]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido	83.4	82.6	79.2	71.6	66.6	81.0	79.6	79.3	83.8	88.0	86.8	81.9	69.2
Tohoku	79.9	80.9	76.6	66.7	62.8	76.2	77.8	77.4	75.2	79.6	80.8	80.6	64.0
Tokyo	80.1	72.5	72.4	64.2	63.6	70.2	70.7	72.7	75.7	71.3	72.9	69.9	57.1
Chubu	79.5	71.0	70.3	68.7	64.0	69.3	69.7	72.8	71.1	71.1	75.5	72.6	61.7
Hokuriku	82.2	80.1	76.2	68.8	63.3	73.8	73.8	77.3	74.2	75.8	77.0	78.6	61.5
Kansai	82.2	75.2	71.5	67.9	62.6	65.5	71.6	76.7	72.5	74.2	76.1	73.5	57.9
Chugoku	84.7	78.0	74.4	70.1	63.7	71.6	75.7	79.3	76.9	76.0	77.3	74.7	62.1
Shikoku	84.2	75.9	73.9	68.6	64.9	63.4	72.1	79.3	75.9	76.6	74.3	72.8	61.6
Kyushu	86.0	78.5	72.5	71.6	66.7	70.2	71.0	79.5	74.3	75.1	77.1	76.7	62.4
Okinawa	74.1	66.2	69.9	72.5	73.9	72.2	67.3	74.5	77.4	78.7	74.5	73.8	57.5
Nationwide	83.3	77.7	75.3	68.6	65.1	73.6	73.3	76.9	75.2	78.2	80.4	76.3	61.4

[3] "Nationwide load factor" refers to the load factor calculated for all of Japan. It is not simply the average of each regional load factor.

$$\text{Monthly Load Factor (\%)} = \frac{\text{Monthly Energy Requirement}}{\text{Monthly Peak Demand} \cdot \text{Calendar Hours (24H} \cdot \text{Monthly Days)}}$$

$$\text{Annual Load Factor (\%)} = \frac{\text{Annual Energy Requirement}}{\text{Annual Peak Demand} \cdot \text{Calendar Hours (24H} \cdot \text{Annual Days)}}$$

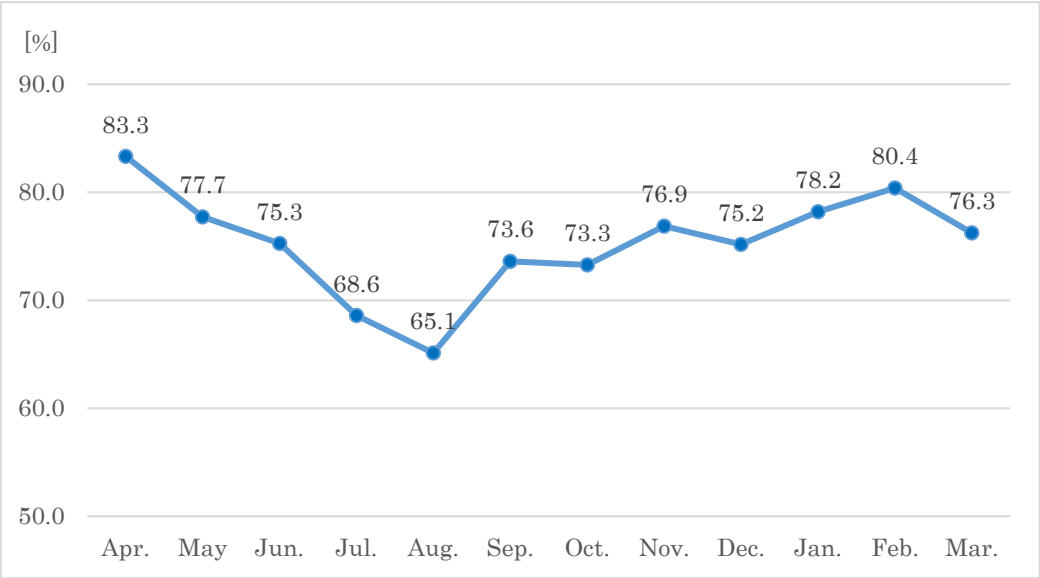

Figure 1-6: Nationwide monthly load factor

Table 1-8: Actual annual load factor (from FY 2016–2021)

[%]

	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Nationwide	65.8	66.0	62.1	60.7	59.5	61.4

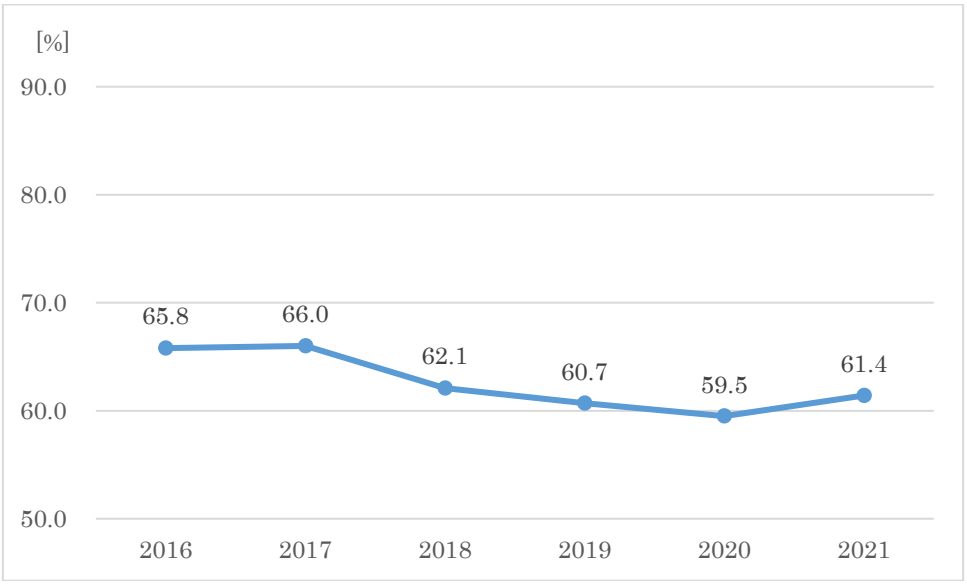

Figure 1-7: Actual annual load factor (Nationwide)

6. Nationwide Supply–Demand Status During the Peak Demand

(1) Nationwide Supply–Demand Status During the Summer Peak Demand Period (July–September)

Table 1-9 shows the supply–demand status during the summer peak demand period for regional service areas in FY 2021.

The actual nationwide summer peak demand for FY 2021 was 16,460 × 10^4 kW, which was registered at 14:00 on August 5, against the supply capacity of 18,804 × 10^4 kW with a reserve margin of 14.2%. This was the highest figure for the past 6 years since data were recorded at the sending-end. Table 1-10 presents the summer peak supply–demand status data since FY 2016.

Table 1-9: Supply–demand status during the summer peak demand period for nationwide and regional service areas[4]

Area	Peak Demand [10^4kW]	Occurrence Date & Time			Daily Maximum Temperature [℃]	Supply Capacity [10^4kW]	Reserve Capacity [10^4kW]	Reserve Margin [%]	Daily Energy Supply [10^4kWh]	Daily Load Facter [%]
Hokkaido	469	8/6	Fri.	11:00～12:00	35.0	547	79	16.8	9,243	82.2
Tohoku	1,490	8/4	Wed.	11:00～12:00	33.4	1,759	269	18.1	27,840	77.8
Tokyo	5,665	8/26	Thur.	13:00～14:00	35.7	6,248	583	10.3	103,835	76.4
Chubu	2,480	8/30	Mon.	14:00～15:00	35.7	2,910	430	17.4	44,436	74.7
Hokuriku	523	8/5	Thur.	14:00～15:00	34.1	585	62	11.9	9,982	79.6
Kansai	2,826	8/5	Thur.	14:00～15:00	38.9	3,191	365	12.9	51,705	76.2
Chugoku	1,108	8/5	Thur.	13:00～14:00	36.9	1,208	100	9.1	20,922	78.7
Shikoku	503	8/5	Thur.	13:00～14:00	37.0	622	119	23.6	9,480	78.6
Kyushu	1,559	8/5	Thur.	16:00～17:00	36.4	1,778	219	14.0	29,966	80.1
Okinawa	160	9/10	Fri.	13:00～14:00	33.5	232	72	45.1	3,066	79.9
Nationwide	16,460	8/5	Thur.	13:00～14:00	-	18,804	2,344	14.2	308,249	78.0

[4] The daily maximum and mean temperatures were provided by the JMA based on the data for the cities where the headquarters of the GT&D companies (except for the Okinawa EPCO) are located. (Instead, for the regional service area of the Okinawa EPCO, the data from Naha, the prefectural capital of Okinawa, were used).

$$\text{Daily Load Factor (\%)} = \frac{\text{Daily Energy Requirement}}{\text{Daily Peak Demand} \times 24\text{H}}$$

"Supply capacity" in the table above refers to the maximum power that can be generated during the peak demand. This capacity is the addition of the installed generating capacity including the deducted portion, such as generator suspension for maintenance work, derating with a decrease in river flow, and unplanned generator outages.

Table 1-10: Actual supply–demand status for summer peak demand (FY 2016–2021)

FY	Peak Demand [10^4kW]	Occurrence Date & Time			Daily Maximum Temperature [℃]	Supply Capacity [10^4kW]	Reserve Capacity [10^4kW]	Reserve Margin [%]	Daily Energy Supply [10^4kWh]	Daily Load Facter [%]
2016	15,589	8/9	Tue.	14:00~15:00	-	17,764	2,176	14.0	297,969	79.6
2017	15,550	8/24	Thur.	14:00~15:00	-	17,716	2,165	13.9	300,493	80.5
2018	16,482	8/3	Fri.	14:00~15:00	-	18,749	2,267	13.8	315,434	79.7
2019	16,461	8/2	Fri.	14:00~15:00	-	18,584	2,122	12.9	314,988	79.7
2020	16,645	8/20	Thur.	14:00~15:00	-	18,608	1,964	11.8	310,303	77.7
2021	16,460	8/5	Thur.	13:00~14:00	-	18,804	2,344	14.2	308,249	78.0

(2) Nationwide Supply–Demand Status During the Winter Peak Demand Period (December–February)

Table 1-11 shows the supply–demand status during the winter peak demand period for regional service areas in FY 2021. Table 1-12 presents the winter peak supply–demand status data since FY 2016.

The actual nationwide winter peak demand for FY 2021 was 15,119 × 10^4 kW, which occurred at 10:00 on January 14, against a supply capacity of 16,783 × 10^4 kW, with a reserve margin of 11.0%. No area had a reserve margin below 3% (the minimum acceptable margin criteria).

Table 1-11: Supply–demand status during the winter peak demand period for regional service areas[5]

Area	Peak Demand [10^4kW]	Occurrence Date & Time			Daily Mean Temperature [℃]	Supply Capacity [10^4kW]	Reserve Capacity [10^4kW]	Reserve Margin [%]	Daily Energy Supply [10^4kWh]	Daily Load Facter [%]
Hokkaido	501	1/11	Tue.	13:00~14:00	-1.3	563	61	12.2	11,161	92.8
Tohoku	1,483	1/18	Tue.	09:00~10:00	-0.7	1,694	211	14.2	31,994	89.9
Tokyo	5,374	1/6	Thur.	16:00~17:00	0.7	5,606	232	4.3	107,790	83.6
Chubu	2,448	1/14	Fri.	09:00~10:00	2.0	2,640	192	7.8	49,114	83.6
Hokuriku	549	2/17	Thur.	10:00~11:00	-0.4	592	43	7.9	11,690	88.7
Kansai	2,540	1/14	Fri.	09:00~10:00	3.6	2,716	177	7.0	51,689	84.8
Chugoku	1,068	2/17	Thur.	09:00~10:00	0.4	1,189	120	11.3	22,361	87.2
Shikoku	495	2/17	Thur.	11:00~12:00	1.9	543	49	9.8	10,019	84.4
Kyushu	1,470	2/17	Thur.	18:00~19:00	1.7	1,546	76	5.1	30,522	86.5
Okinawa	104	2/21	Mon.	19:00~20:00	14.4	138	34	32.7	2,112	84.7
Nationwide	15,119	1/14	Fri.	09:00~10:00	-	16,783	1,665	11.0	317,617	87.5

Table 1-12: Actual supply–demand status for winter peak demand (FY 2016–2021)

FY	Peak Demand [10^4kW]	Occurrence Date & Time			Daily Mean Temperature [℃]	Supply Capacity [10^4kW]	Reserve Capacity [10^4kW]	Reserve Margin [%]	Daily Energy Supply [10^4kWh]	Daily Load Facter [%]
2016	14,914	1/24	Tue.	18:00~19:00	-	16,354	1,440	9.7	314,968	88.0
2017	15,577	1/25	Thur.	18:00~19:00	-	16,915	1,339	8.6	330,605	88.4
2018	14,603	1/10	Thur.	09:00~10:00	-	16,104	1,501	10.3	308,436	88.0
2019	14,619	2/7	Fri.	09:00~10:00	-	16,808	2,189	15.0	303,347	86.5
2020	15,607	1/8	Fri.	09:00~10:00	-	17,012	1,406	9.0	329,833	88.1
2021	15,119	1/14	Fri.	09:00~10:00	-	16,783	1,665	11.0	317,617	87.5

7. Nationwide Lowest Demand Period

Table 1-13 and 1-14 show the status of the lowest demand period for nationwide and regional service areas in FY 2021 and the actual annual lowest demands at the sending-end from FY 2016 to FY 2021, respectively.

Table 1-13: Lowest demand period for nationwide and regional service areas[5]

	Lowest Demand [10^4kW]	Occurrence Date & Time			Daily Mean Temperature [℃]	Daily Energy Supply [10^4kWh]
Hokkaido	217	8/15	Sun.	01:00~02:00	19.8	6,087
Tohoku	594	8/15	Sun.	01:00~02:00	18.4	16,633
Tokyo	1,955	5/5	Wed.	06:00~07:00	18.3	56,394
Chubu	858	5/5	Wed.	01:00~02:00	17.1	24,335
Hokuriku	198	8/15	Sun.	01:00~02:00	23.2	5,548
Kansai	985	5/5	Wed.	01:00~02:00	17.3	28,201
Chugoku	451	5/6	Thur.	00:00~01:00	17.4	13,349
Shikoku	195	5/2	Sun.	07:00~08:00	13.6	5,308
Kyushu	626	5/2	Sun.	08:00~09:00	13.9	17,077
Okinawa	57	4/26	Mon.	01:00~02:00	22.0	1,839
Nationwide	6,332	5/5	Wed.	01:00~02:00	-	171,847

Table 1-14: Actual annual lowest demand (FY 2016–2021, at the sending-end)

[10^4 kW]

	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Nationwide	6,516	6,477	6,496	6,398	6,065	6,332

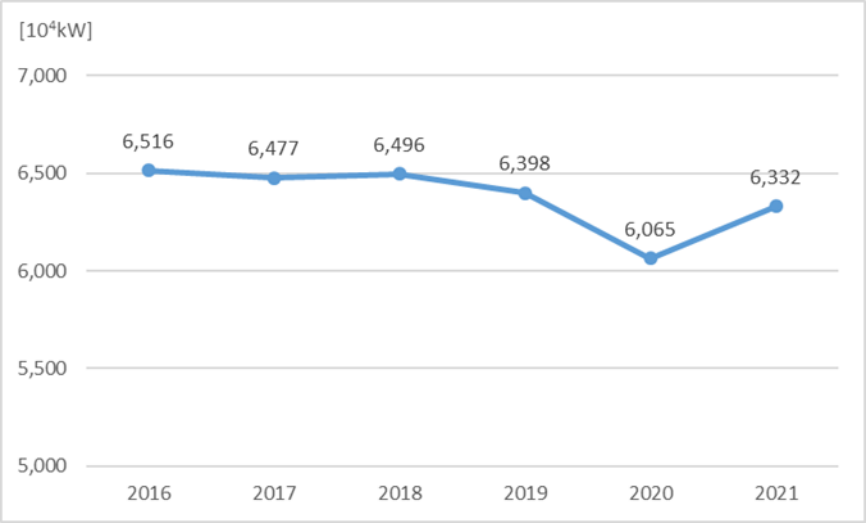

Figure 1-8: Actual annual lowest demand (Nationwide)

[5] See footnote 4.

8. Nationwide Peak Daily Energy Supply

Tables 1-15 and 1-16 show the summer peak daily energy supply for nationwide and regional service areas in FY 2021 (July–September 2021) and the winter peak daily energy supply for nationwide and regional service areas in FY 2021 (from December 2021 to February 2022), respectively.[6]

Table 1-15: Summer peak daily energy Supply for nationwide and regional service areas

Area	Peak Daily Energy Supply [10^4kWh]	Occurrence Date		Daily Mean Temperature [˚C]
Hokkaido	9,243	8/6	Fri.	29.2
Tohoku	27,840	8/4	Wed.	28.5
Tokyo	103,835	8/26	Thur.	30.5
Chubu	46,221	8/5	Thur.	30.4
Hokuriku	9,982	8/5	Thur.	34.1
Kansai	51,705	8/5	Thur.	31.3
Chugoku	20,922	8/5	Thur.	31.2
Shikoku	9,480	8/5	Thur.	31.3
Kyushu	29,966	8/5	Thur.	31.7
Okinawa	3,066	9/10	Fri.	29.9
Nationwide	308,249	8/5	Thur.	-

Table 1-16: Winter peak daily energy supply for nationwide and regional service areas

Area	Peak Daily Energy Supply [10^4kWh]	Occurrence Date		Daily Mean Temperature [˚C]
Hokkaido	11,480	1/31	Mon.	-7.8
Tohoku	31,994	1/18	Tue.	-0.7
Tokyo	107,790	1/6	Thur.	0.7
Chubu	49,114	1/14	Fri.	2.0
Hokuriku	11,690	2/17	Thur.	-0.4
Kansai	51,809	1/21	Fri.	3.4
Chugoku	22,361	2/17	Thur.	0.4
Shikoku	10,019	2/17	Thur.	1.9
Kyushu	30,522	2/17	Thur.	1.7
Okinawa	2,112	2/21	Mon.	14.4
Nationwide	318,052	1/21	Fri.	-

[6] See footnote 4.

9. Instructions, Requests Issued and Controls Implemented by the Organization

Instructions and Requests

According to the provisions of paragraph 1 of Article 28-44 of the Electricity Business Act (the Act hereafter), the Organization finds it necessary to improve the electricity supply–demand status, the Organization may require members such as EPCOs to undertake certain necessary actions, if the status of the electricity supply–demand from an electricity business conducted by a member has worsened or is likely to worsen.

During FY 2021, the Organization issued instructions to GT&D companies on 21 occasions for them to exchange power according to the provisions of items 1–3, paragraph 1 of Article 111 of the Operational Rules (Table 1-17). The instructions included measures for improving the supply–demand status during the winter of 2021/22. Furthermore, the Fukushima Earthquake on March 16, 2022 caused the shutdown of six generators, totaling 3,350 MW, and the snowfall and midwinter temperature TEPCO Power Grid (PG) area had a supply capacity shortage and, sharply increasing the heating demand. The Organization issued the instructions for exchanging power according to the provisions of the paragraphs 1 and 2 of Article 111 and requested generation companies and electric suppliers to procure additional supply capacity, the same as in the previous year. Moreover, the Organization requested retail companies to reduce their demand.

For the details of the instructions and requests, please see <Reference> Details of Actual Power Exchange Instructions, and Instructions and Requests to Generation Companies and Retail Companies Issued by the Organization.[7] The specific instructions are stated below.

(1) Instructions for the improvement of supply–demand status (from May to July 2021 and January 2022)

The Organization has issued instructions to the GT&D companies that the supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of the shortage of supply capacity in the corresponding area, following a decrease in solar power output, and unexpected demand growth caused by higher temperatures.

- Shikoku EPCO Transmission & Distribution
  May 19: 500 MW at most, following an unexpected decrease in solar power output, (one instruction)
- Hokuriku EPCO Transmission & Distribution
  July 15：200 MW, following generator shutdown (one instruction)
- Hokuriku EPCO Transmission & Distribution
  January 11：200 MW, following generator troubles (one instruction)

(2) Instructions for improving the supply–demand status during winter of 2021/22 (from January to February, 2022)

[7] https://www.occto.or.jp/oshirase/shiji/jukyu_taiou_2021.html (in Japanese only)

Unexpected demand growth caused by cold weather led to a shortage of supply capacity, which contributes to keeping the balance between supply and demand in the corresponding area. The Organization has issued instructions six times to the areas of GT&D companies that the supply–demand status may degrade without power exchanges through cross-regional interconnection lines, according to the provisions of paragraph 1 of Article 28-44 of the Act.

・TEPCO PG

1) January 6, 2022 at 13:30–20:00, 1220 MW at most
2) January 6, 2022 at 15:30–20:00, 1320 MW at most
3) January 6, 2022 at 20:00–24:00, 2760 MW at most
4) January 7, 2022 at 00:00–09:00, 2740 MW at most
5) February 10, 2022 at 10:00–13:00, 800 MW at most
6) February 10, 2022 at 13:30–17:00, 751 MW at most

(3) Instructions and Requests for improvement of supply–demand status triggered by the Fukushima Earthquake in March, 2022

a. Instructions to GT&D companies.

The Organization issued instructions on 12 occasions on March 17–23, 2022, as stated below. According to the provisions of paragraph 1 of Article 28-44 of the Act and Article 111 of the Operating Rule of the Organization, the instructions were issued to GT&D companies for supplying electricity to the GT&D companies in the corresponding areas.

・Tohoku EPCO Network

1) March 17, 2022 at 02:30–06:00, 1400 MW at most
2) March 17, 2022 at 06:00–11:00, 1000 MW at most
3) March 18, 2022 at 09:00–12:00, 500 MW
4) March 18, 2022 at 12:00–16:00, 600 MW
5) March 22, 2022 at 10:30–16:00, 613.6 MW at most
6) March 22, 2022 at 16:00–17:00, 95.9 MW at most

・TEPCO PG

1) March 18, 2022 at 16:00–24:00, 943.6 MW at most
2) March 19, 2022 at 00:00–04:00, 600 MW
3) March 22, 2022 at 07:00–16:00, 1417.8 MW at most
4) March 22, 2022 at 16:00–24:00, 927.4 MW at most
5) March 23, 2022 at 00:00–11:00, 1000 MW at most

b. Requests to member electric power suppliers

The Fukushima Earthquake caused the shutdown of generators, which are sited in the regional service areas of Tohoku EPCO Network and TEPCO PG. Further. Moreover, due to cold waves and bad weather, the Eastern Region of Japan experienced a tight supply–demand condition. The

Organization requested electric power suppliers that are members of the Organization four times on March 21–22 to improve the balance between supply and demand, according to the provisions of paragraph 2 of Article 111 of the Operational Rules.

Table 1-17: Actual instructions to GT&D companies issued by the Organization (FY 2015–2021)

[occasions]

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Nationwide	2	2	10	25	6	226	21

Controls

The Organization implemented long-cycle cross-regional frequency controls[8] to send surplus electric energy generated from renewable energy generating facilities in the Kyushu EPCO area to the Chugoku and Shikoku EPCO areas through cross-regional interconnection lines by utilizing their available transfer capability (ATC), according to the provisions of Article 132 of the Operational Rules. The Organization received the request from the Kyushu EPCO to control the inability to reduce power supply.[9] Such controls were implemented on 72 occasions during FY 2021.

[8] This refers to the frequency control by utilizing the balancing capacity of other regional service areas of member GT&D companies through interconnection lines. This is used when the balancing capacity for redundancy becomes or might become insufficient in a regional service area.

[9] This refers to the ability to decrease the power supply from generators, such as thermal power generators. The output of renewable energy can fluctuate over a short period. Then, controlling the output of thermal power generators according to such fluctuations is essential. Among such output controls, the capacity to vary the output of generators is generally called the "balancing capacity for redundancy."

10. Output Shedding of Renewable Energy Generating Facilities Operated by Electric Power Companies Other than GT&D Companies

GT&D companies may order renewable energy generating facilities from other EPCOs to shed their output in cases of expected oversupply of demand for its regional service areas after shedding the output of generators, other than the renewable energy generating facilities of the GT&D companies, according to the provisions of the Ministerial Ordinance of Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electric Utilities.

Tables 1-18 and 1-19 show the actual output shedding of renewable-energy-generating facilities in FY 2021 for the Kyushu mainland and isolated islands, respectively.[10] In Table 1-18, "Shedding Instructed" indicates the total effect of the instructions issued on both the day ahead, which is shed by offline control, and the current day, which is shed by online control. The actual shed capacity is expressed in parentheses for that day. A bar in parentheses indicates that there was no output shedding for that day. The necessary output shedding for the isolated island is indicated in Table 1-19. It is calculated by deducting the demand from the supply capacity and procured by offline control.

Output shedding of renewable energy generating facilities was implemented in cases where the balancing capacity for redundancy might become insufficient. The shedding period was from 09:00 to 16:00 in each implementation for the isolated islands, and from 8:00 to 16:00 on the Kyushu mainland, except for a few cases.

Instructions for output shedding were issued only for the regional service area of Kyushu GT&D. In the midst of the increasing capacity of variable renewable energy, such as solar and wind power, instructions for output shedding of the renewable energy generating facilities were issued for 252,834 MW of output shedding in FY 2021, which increased from 108,019 MW of output shedding in the previous year. The actual output shed on the day totaled 116,980 MW in FY 2021.

The Organization confirms and verifies whether the output shedding of renewable-energy-generating facilities that Kyushu EPCO implemented to facilities of EPCOs according to the provisions of Article 180 of the Operational Rules. The result of the confirmation and verification was that it was appropriate.

[10] http://www.occto.or.jp/oshirase/shutsuryokuyokusei/index.html (in Japanese only).

Table 1-18: Instructed and actual output shedding of renewable-energy-generating facilities for FY 2021 (Kyushu Mainland, 10^4 kW)[11]

Date	Shedding Instructed (Actually shed)	Date	Shedding Instructed (Actually shed)
2021/4/1(Thur.)	201.2(123.4)	2021/10/1(Fri.)	87.9(0.0)
2021/4/2(Fri.)	225.9(0.0)	2021/10/2(Sat.)	237.2(165.1)
2021/4/5(Sat.)	367.2(280.4)	2021/10/3(Sun.)	282.0(222.6)
2021/4/6(Tue.)	356.7(224.1)	2021/10/4(Mon.)	8.1(0.0)
2021/4/7(Wed.)	372.0(271.9)	2021/10/5(Tue.)	77.3(0.0)
2021/4/8(Thur.)	283.1(0.0)	2021/10/6(Wed.)	111.3(0.0)
2021/4/9(Fri.)	356.5(170.6)	2021/10/7(Thur.)	38.9(0.0)
2021/4/10(Sat.)	362.2(286.0)	2021/10/8(Fri.)	51.3(0.0)
2021/4/11(Sun.)	441.4(332.2)	2021/10/9(Sat.)	122.6(0.0)
2021/4/14(Wed.)	308.0(116.7)	2021/10/10(Sun.)	240.4(35.6)
2021/4/15(Thur.)	360.8(312.9)	2021/10/16(Sat.)	163.1(0.0)
2021/4/17(Sat.)	257.4(127.1)	2021/10/17(Sun.)	274.8(95.6)
2021/4/18(Sun.)	463.4(381.9)	2021/10/18(Mon.)	86.9(0.0)
2021/4/19(Mon.)	374.8(278.9)	2021/10/22(Fri.)	185.8(0.0)
2021/4/20(Tue.)	365.1(285.0)	2021/10/23(Sat.)	378.0(168.7)
2021/4/21(Wed.)	271.8(203.4)	2021/10/24(Sun.)	372.4(47.2)
2021/4/22(Thur.)	256.3(167.2)	2021/10/26(Tue.)	303.9(101.5)
2021/4/23(Fri.)	64.8(74.7)	2021/10/27(Wed.)	149.1(41.1)
2021/4/24(Sat.)	331.1(193.0)	2021/10/28(Thur.)	201.4(39.2)
2021/4/25(Sun.)	434.1(331.9)	2021/10/29(Fri.)	128.1(66.7)
2021/4/26(Mon.)	316.7(274.4)	2021/10/31(Sun.)	242.3(66.9)
2021/4/27(Tue.)	242.6(29.6)	2021/11/1(Mon.)	112.4(0.0)
2021/4/30(Fri.)	254.6(87.8)	2021/11/4(Thur.)	186.5(13.4)
2021/5/1(Sat.)	234.2(22.4)	2021/11/5(Fri.)	130.3(23.0)
2021/5/2(Sun.)	298.1(101.4)	2021/11/7(Sun.)	309.9(213.3)
2021/5/3(Mon.)	363.1(345.4)	2021/11/14(Sun.)	134.4(0.0)
2021/5/4(Tue.)	384.8(143.1)	2021/11/17(Wed.)	89.2(32.5)
2021/5/5(Wed.)	53.5(107.5)	2021/11/18(Thur.)	205.8(0.0)
2021/5/6(Thur.)	260.3(243.9)	2021/11/19(Fri.)	154.2(36.0)
2021/5/8(Sat.)	224.3(0.0)	2021/11/20(Sat.)	151.9(90.7)
2021/5/9(Sun.)	373.8(289.4)	2021/11/27(Sat.)	35.9(0.0)
2021/5/10(Mon.)	259.6(107.9)	2021/11/28(Sun.)	103.6(114.6)
2021/5/19(Wed.)	196.9(102.4)	2021/12/5(Sun.)	185.8(0.0)
2021/5/22(Sat.)	266.6(63.1)	2021/12/22(Wed.)	66.3(0.0)
2021/5/23(Sun.)	332.7(348.5)	2021/12/30(Thur.)	104.8(0.0)
2021/5/25(Tue.)	267.3(50.8)	2021/12/31(Fri.)	178.7(149.5)
2021/5/28(Fri.)	298.1(0.0)	2022/1/1(Sat.)	251.4(218.3)
2021/5/29(Sat.)	339.2(301.8)	2022/1/2(Sun.)	177.6(45.5)
2021/5/30(Sun.)	342.6(341.5)	2022/1/3(Mon.)	230.6(183.0)
2021/5/31(Mon.)	284.7(205.1)	2022/1/4(Tue.)	190.7(0.0)
2021/6/1(Tue.)	157.6(133.4)	2022/1/10(Mon.)	207.6(35.6)
2021/6/6(Sun.)	174.3(23.0)	2022/2/11(Fri.)	167.5(0.0)
2021/6/7(Mon.)	119.8(0.0)	2022/2/26(Sat.)	135.2(24.7)
2021/6/19(Sat.)	25.7(0.0)	2022/2/27(Sun.)	218.9(174.1)
2021/6/20(Sun.)	166.9(137.2)	2022/2/28(Mon.)	75.6(0.0)
2021/6/23(Wed.)	46.9(0.0)	2022/3/2(Wed.)	208.0(24.2)
2021/7/11(Sun.)	38.6(38.8)	2022/3/3(Thur.)	225.4(34.8)
2021/8/29(Sun.)	81.6(0.0)	2022/3/5(Sat.)	353.5(117.6)
2021/9/18(Sat.)	148.7(0.0)	2022/3/6(Sun.)	420.3(236.9)
2021/9/19(Sun.)	310.7(193.8)	2022/3/8(Tue.)	252.8(59.9)
2021/9/20(Mon.)	115.7(42.6)	2022/3/9(Wed.)	234.4(29.0)
2021/9/23(Thur.)	119.0(0.0)	2022/3/10(Thur.)	230.8(41.7)
2021/9/24(Fri.)	62.1(0.0)	2022/3/12(Sat.)	287.2(73.3)
2021/9/25(Sat.)	173.9(72.0)	2022/3/15(Tue.)	266.8(133.4)
2021/9/26(Sun.)	233.7(134.0)	2022/3/16(Wed.)	287.3(128.9)
		2022/3/20(Sun.)	226.1(13.1)
		2022/3/24(Thur.)	227.4(0.0)
		2022/3/25(Fri.)	172.7(11.1)
		2022/3/27(Sun.)	320.4(287.6)

[11] The instructions were issued for the hours between 08:00 and 16:00, other than the 8:00–17:00 period from May 19 to June 23 and the 9:00–12:00 period in July 11. Dates expressed in blue refer to days without actual shedding.

Table 1-19: Output shedding needed for FY 2020 (Isolated islands of Kyushu, kW)[12]

Date	Tanegashima	Iki	Tokunoshima	Tsushima
2021/4/6(Tue.)		1,210		
2021/4/7(Wed.)	390	1,700	1,000	
2021/4/8(Thur.)		1,030		
2021/4/9(Fri.)	4,050	810		
2021/4/10(Sat.)	1,130	2,040		
2021/4/11(Sun.)	680	2,190	550	
2021/4/14(Wed.)	1,180	1,610		
2021/4/15(Thur.)		1,050		
2021/4/16(Fri.)	60			
2021/4/17(Sat.)		2,300		
2021/4/18(Sun.)	4,580	1,820	620	
2021/4/19(Mon.)	5,170	1,820		
2021/4/20(Tue.)	4,430	1,290		
2021/4/21(Wed.)	3,180	140		
2021/4/24(Sat.)	1,790	290		
2021/4/25(Sun.)	4,910	2,510		
2021/4/26(Mon.)	4,580	3,030		
2021/4/27(Tue.)	740			
2021/4/30(Fri.)	4,850	1,820		
2021/5/1(Sat.)	3,770	1,090		
2021/5/2(Sun.)	2,590	310	270	
2021/5/3(Mon.)	4,660	1,910	260	
2021/5/4(Tue.)	3,510			
2021/5/5(Wed.)		740		
2021/5/6(Thur.)	3,070			
2021/5/9(Sun.)	2,420	800		
2021/5/10(Mon.)	2,290			
2021/5/23(Sun.)	3,110	610		
2021/5/25(Tue.)	1,260	750		
2021/5/29(Sat.)	810	1,390		
2021/5/30(Sun.)	1,160	1,600		
2021/5/31(Mon.)	1,730			
2021/6/1(Tue.)	1,500			
2021/6/6(Sun.)		1,190		
2021/9/19(Sun.)		1,190		
2021/10/2(Sat.)	620			
2021/10/22(Fri.)	510			
2021/10/23(Sat.)	400	380		
2021/10/26(Tue.)	290	730		
2021/10/27(Wed.)	580			
2021/10/28(Thur.)	790	630		
2021/10/29(Fri.)	780			
2021/10/31(Sun.)		1,080		
Period of Instruction	08:00-16:00			

Date	Tanegashima	Iki	Tokunoshima	Tsushima
2021/11/2(Tue.)	2,100	300		
2021/11/3(Wed.)	2,340	520		
2021/11/4(Thur.)	2,180	1,100		
2021/11/6(Sat.)		870		
2021/11/7(Sun.)	170	1,940		
2021/11/15(Mon.)	1,500			
2021/11/16(Tue.)	1,180			
2021/11/17(Wed.)	390	260		
2021/11/18(Thur.)		250		
2021/11/20(Sat.)	990			
2021/11/26(Fri.)	270			
2021/11/27(Sat.)	1,530	300		
2021/11/28(Sun.)		1,080		
2021/12/4(Sat.)	1,280			
2021/12/7(Tue.)	1,250			
2021/12/8(Wed.)	1,180			
2021/12/15(Wed.)	580			
2021/12/23(Thur.)	320			
2022/1/3(Mon.)	550			
2022/1/4(Tue.)	120			
2022/1/10(Mon.)	2,280			
2022/1/19(Wed.)	970			
2022/1/31(Mon.)	1,930			
2022/2/11(Fri.)	2,720			
2022/2/24(Thur.)	1,030			
2022/2/25(Fri.)	2,070			
2022/2/26(Sat.)	2,160			
2022/2/27(Sun.)	4,870		990	
2022/2/28(Mon.)	3,260			
2022/3/2(Wed.)	630			
2022/3/3(Thur.)	3,310			
2022/3/5(Sat.)	3,130			
2022/3/6(Sun.)	2,700			
2022/3/8(Tue.)	3,090			
2022/3/9(Wed.)	2,950			
2022/3/10(Thur.)	2,850			
2022/3/12(Sat.)	3,400	280		
2022/3/13(Sun.)	270			
2022/3/14(Mon.)	1,750			
2022/3/15(Tue.)	3,030			
2022/3/16(Wed.)	3,870	900		
2022/3/19(Sat.)	970			
2022/3/20(Sun.)	2,290			
2022/3/24(Thur.)	3,840			
2022/3/25(Fri.)	360			
2022/3/27(Sun.)	1,770	1,440		1,850
2022/3/29(Tue.)		1,230		
2022/3/30(Wed.)	260			
Period of Instruction	08:00-16:00			

[12] The instructions were issued for the hours between 08:00 and 16:00, other than the 9:00–16:00 period at the Iki island on October 23, 26, 28, and 31.

CHAPTER II: ACTUAL UTILIZATION OF CROSS-REGIONAL INTERCONNECTION LINES

1. Cross-Regional Interconnection Lines and their Management

(1) Cross-Regional Interconnection Lines

Cross-regional interconnection lines are transmission lines with 250 kV or more AC/DC convertors that regularly connect the regional service areas of member GT&D companies. The electric power supply outside each service area is made available through interconnection lines. The Organization directs members to supply electricity through cross-regional interconnection lines and secure the supply–demand balance in case of an insufficient supply capacity for each regional service area. Figure 2-1 and Table 2-1 show the cross-regional interconnection lines in Japan.

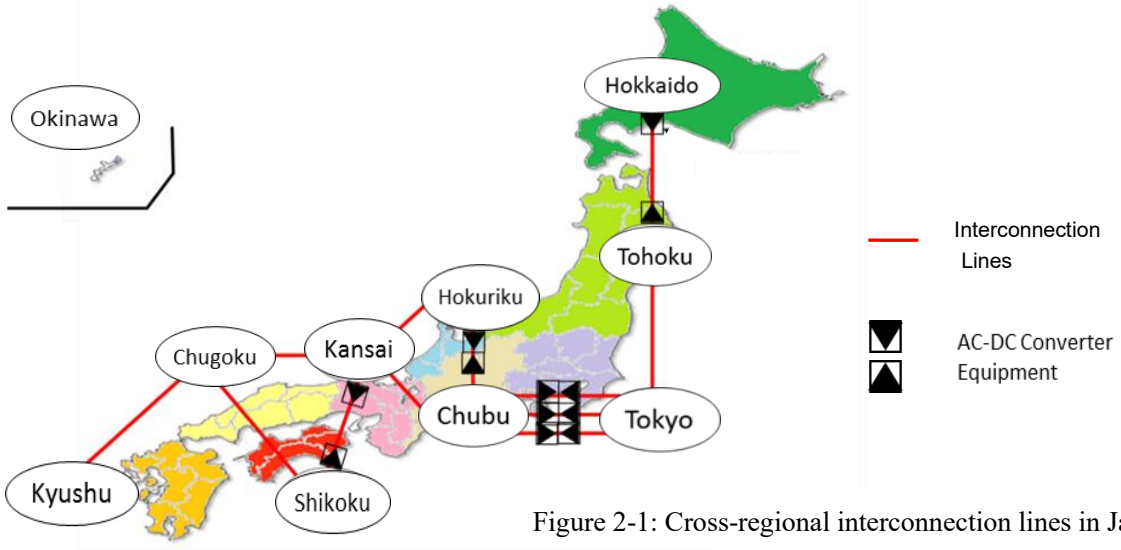

Figure 2-1: Cross-regional interconnection lines in Japan

Table 2-1: Summary of cross-regional interconnection lines (at the end of FY 2021)

Interconnection Lines	Areas・Directions				Corresponding Facilities	AC/DC
Interconnection facilities between Hokkaido and Honshu	Forward	Hokkaido	→	Tohoku	Hokkaido-Honshu HVDC Link, New Hokkaido-Honshu HVDC Link	DC
	Counter	Tohoku	→	Hokkaido		
Interconnection line between Tohoku and Tokyo	Forward	Tohoku	→	Tokyo	Soma–Futaba bulk line, Iwaki bulk line	AC
	Counter	Tokyo	→	Tohoku		
Interconnection facilities between Tokyo and Chubu	Forward	Tokyo	→	Chubu	Sakuma FC Shin Shinano FC Higashi Shimizu FC Hida–Shinano FC	DC
	Counter	Chubu	→	Tokyo		
Interconnection line between Chubu and Kansai	Forward	Chubu	→	Kansai	Mie–Higashi Omi line	AC
	Counter	Kansai	→	Chubu		
Interconnection facilities between Chubu and Hokuriku	Forward	Chubu	→	Hokuriku	Interconnection facilities of Minami Fukumitsu HVDC BTB Converter Station and Minami Fukumitsu Substation	DC
	Counter	Hokuriku	→	Chubu		
Interconnection line between Hokuriku and Kansai	Forward	Hokuriku	→	Kansai	Echizen–Reinan line	AC
	Counter	Kansai	→	Hokuriku		
Interconnection lines between Kansai and Chugoku	Forward	Kansai	→	Chugoku	Seiban–Higashi Okayama line, Yamazaki–Chizu line	AC
	Counter	Chugoku	→	Kansai		
Interconnection facilities between Kansai and Shikoku	Forward	Kansai	→	Shikoku	Interconnection facilities between Kihoku and Anan AC/DC Converter Station	DC
	Counter	Shikoku	→	Kansai		
Interconnection line between Chugoku and Shikoku	Forward	Chugoku	→	Shikoku	Honshi interconnection line	AC
	Counter	Shikoku	→	Chugoku		
Interconnection line between Chugoku and Kyushu	Forward	Chugoku	→	Kyushu	Kanmon interconnection line	AC
	Counter	Kyushu	→	Chugoku		

(2) Management of Cross-Regional Interconnection Lines

The Organization manages the interconnection lines according to the Operational Rules. The Organization has currently revised the cross-regional interconnection utilization rules from those based on a first-come, first-served principle to being based on an "implicit auction scheme"[13] with respect to the effective utilization of interconnection lines, security of fairness and transparency among interconnection line users, and environmental development of the energy trading market. An implicit auction scheme allocates all capabilities of the interconnection lines through the energy trading market, rather than directly allocate the position or right of utilization through auctions. The rule revision is described in Figure 2-2.

.

Termination of capability allocation plans and changes of timing at capability registration

Figure 2-2 describes the before-and-after introduction of the implicit auction scheme. Before introduction, the capability allocation was implemented on an accumulated first-come, first-served basis, and the resulting ATC at 10:00 on the day before was used for day-ahead spot trading in the energy market. After the introduction, virtually all the ATC was traded in the day-ahead spot market. With this arrangement, there are no capability allocation plans, with the capability being registered after the day-ahead spot market, according to the revision of cross-regional interconnection lines from a first-come, first-served basis to the implicit auction scheme.

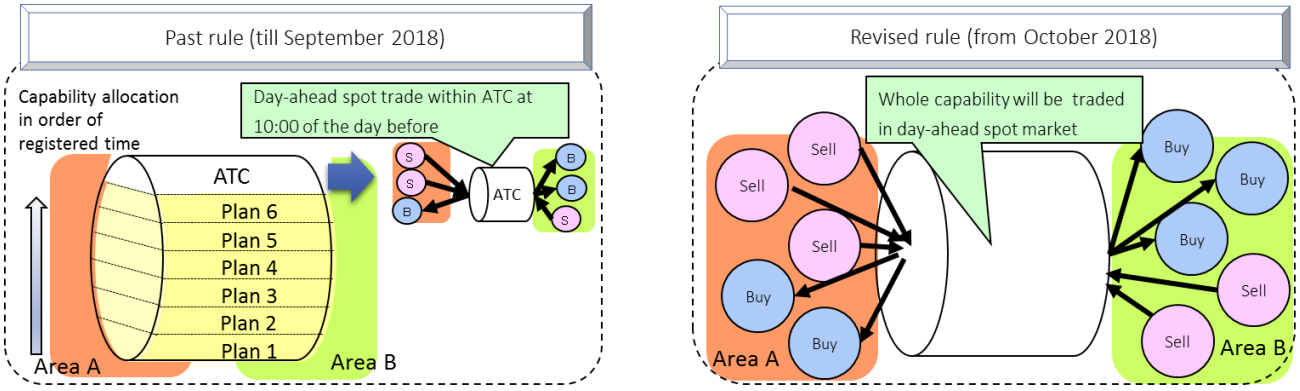

Figure 2-2: Management of interconnection lines

[13] http://www.occto.or.jp/occtosystem/kansetsu_auction/kansetsu_auction_gaiyou.html (in Japanese only).

2. Actual Utilization of Cross-Regional Interconnection Lines

The following section records the actual utilization of cross-regional interconnection lines that were managed according to the provisions of Article 124 of the Operational Rules.

(1) Actual Utilization of Cross-regional Interconnection Lines in FY 2021

Table 2-2 and Figure 2-3 show the monthly and annual utilization of cross-regional interconnection lines for regional service areas in FY 2021.

Table 2-2: Monthly and annual utilization of cross-regional interconnection lines for regional service areas[14]

[GWh]

		Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido - Honshu	→Tohoku (Forward)	82	89	149	124	290	112	200	386	333	313	258	271	2,607
	→Hokkaido (Counter)	86	63	52	67	19	23	13	10	9	9	7	24	382
Tohoku-Tokyo	→Tokyo (Forward)	1,818	1,794	2,005	2,316	2,679	2,621	2,501	2,496	3,082	3,072	2,865	1,844	29,092
	→Tohoku (Counter)	80	68	33	60	62	35	57	44	121	90	71	175	897
Tokyo-Chubu	→Chubu (Forward)	194	413	764	778	303	652	707	607	722	507	280	274	6,200
	→Tokyo (Counter)	442	329	87	181	500	162	138	123	103	252	317	409	3,043
Chubu-Kansai	→Kansai (Forward)	254	299	449	325	193	401	150	396	67	178	94	157	2,964
	→Chubu (Counter)	374	1,079	663	1,271	2,235	759	1,321	950	2,783	2,029	2,004	1,782	17,251
Chubu-Hokuriku	→Hokuriku (Forward)	30	7	5	3	1	10	7	12	16	0	0	4	96
	→Chubu (Counter)	139	1	3	43	179	781	430	253	143	24	39	29	2,063
Hokuriku - Kanasai	→Kansai (Forward)	362	438	235	484	601	3	82	0	256	157	97	289	3,005
	→Hokuriku (Counter)	23	16	22	46	31	0	1	0	16	46	98	77	376
Kansai-Chugoku	→Chugoku (Forward)	66	89	28	68	46	32	31	69	23	42	32	39	564
	→Kansai (Counter)	954	794	911	1,013	1,653	1,366	1,667	967	1,423	1,707	1,380	1,221	15,056
Kansai-Shikoku	→Shikoku (Forward)	0	1	3	0	16	4	3	0	0	0	0	0	28
	→Kansai (Counter)	478	763	600	817	779	331	406	480	855	958	898	979	8,343
Chugoku - Shikoku	→Shikoku (Forward)	14	9	7	11	14	19	11	4	6	7	6	5	113
	→Chugoku (Counter)	78	49	81	103	218	57	252	184	157	184	183	210	1,756
Chugoku - Kyushu	→Kyushu (Forward)	8	13	9	14	27	13	4	20	8	19	2	4	142
	→Chugoku (Counter)	1,274	912	979	1,168	1,514	1,523	1,581	1,383	1,607	1,829	1,664	1,665	17,098

* Based on the scheduled power flows of cross-regional interconnection lines. Figures are shown before offsetting is performed.
* The figures in red and blue represent the annual maximum and minimum capabilities for each line and direction, respectively.

[14] Figures were rounded off to the first decimal place, the minimum figure in blue is judged before rounding off.

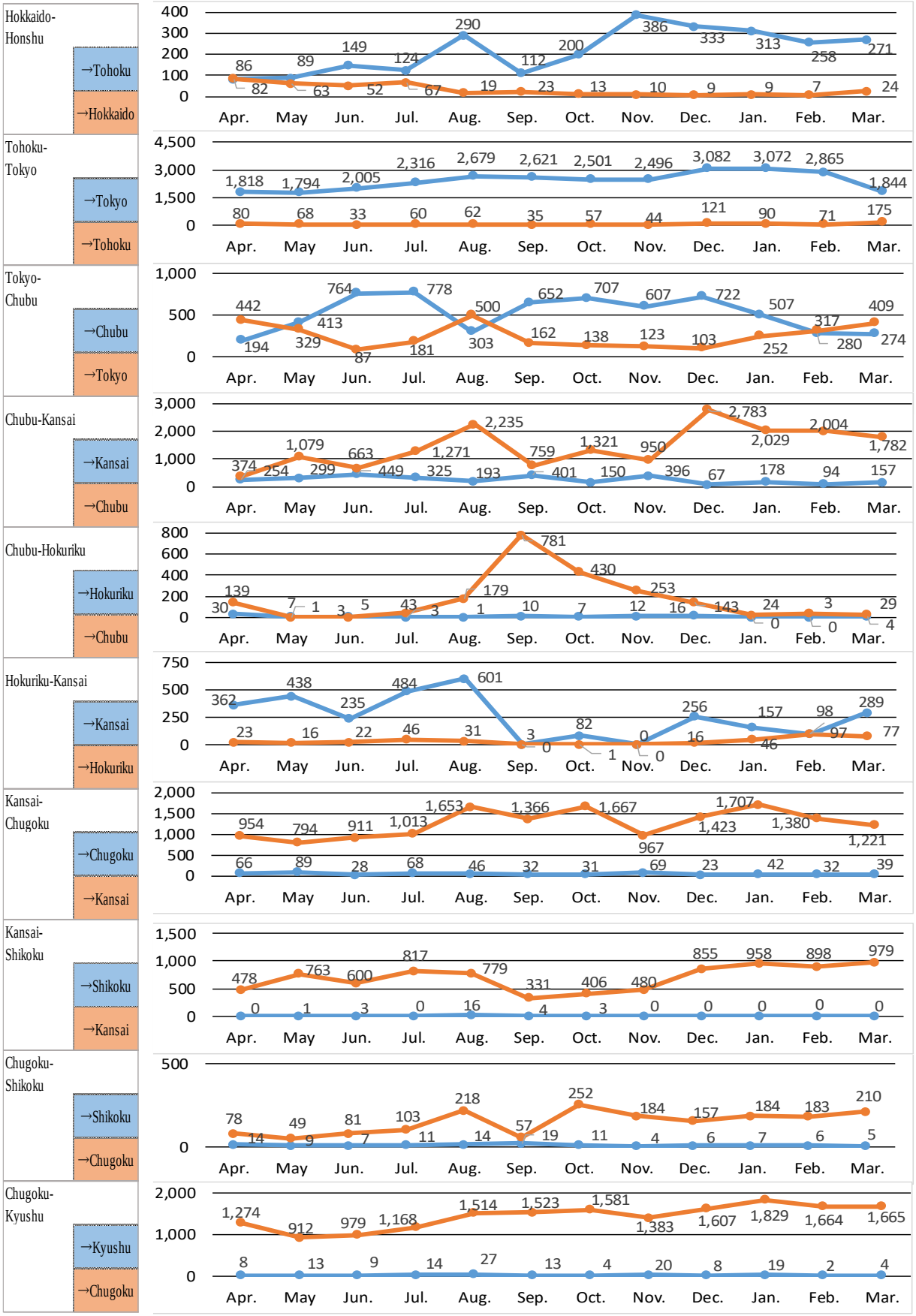

Figure 2-3: Monthly utilization of cross-regional interconnection lines for regional service areas

(2) Actual Utilization of Cross-Regional Interconnection Lines from FY 2012 to FY 2021

Table 2-3 and Figure 2-4 show the annual utilization of cross-regional interconnection lines for regional service areas from FY 2012 to FY 2021.

Table 2-3 Annual utilization of cross-regional interconnection lines for regional service areas (FY 2012 –2021)

[GWh]

		FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Hokkaido-Honshu	→Tohoku (Forward)	214	182	143	146	237	340	130	279	947	2,607
	→Hokkaido (Counter)	673	505	617	804	1,033	1,270	1,005	2,117	1,154	382
Tohoku-Tokyo	→Tokyo (Forward)	16,084	22,450	21,273	22,587	23,097	28,238	27,298	27,575	31,396	29,092
	→Tohoku (Counter)	4,520	3,891	4,029	3,714	4,660	7,071	3,139	252	541	897
Tokyo-Chubu	→Chubu (Forward)	1,579	2,829	2,702	693	2,729	3,954	1,711	354	1,497	6,200
	→Tokyo (Counter)	1,288	536	2,755	4,513	5,144	5,328	5,116	4,147	3,016	3,043
Chubu-Kansai	→Kansai (Forward)	7,487	7,049	7,131	3,412	5,538	8,106	3,675	980	4,413	2,964
	→Chubu (Counter)	5,726	4,928	6,342	7,577	6,544	9,889	9,980	7,175	13,285	17,251
Chubu-Hokuriku	→Hokuriku (Forward)	452	170	231	108	241	353	134	7	91	96
	→Chubu (Counter)	183	310	296	172	59	108	76	40	458	2,063
Hokuriku-Kanasai	→Kansai (Forward)	1,590	1,406	2,265	2,047	2,033	2,949	2,033	2,918	3,223	3,005
	→Hokuriku (Counter)	464	587	491	502	640	1,260	2,540	547	620	376
Kansai-Chugoku	→Chugoku (Forward)	2,836	2,326	2,252	948	716	4,493	4,734	578	584	564
	→Kansai (Counter)	6,788	5,468	5,994	9,138	13,179	16,727	13,388	9,793	12,416	15,056
Kansai-Shikoku	→Shikoku (Forward)	208	0	1	2	2	1	82	31	10	28
	→Kansai (Counter)	8,938	9,073	9,362	9,611	8,856	9,510	8,840	9,956	8,623	8,343
Chugoku-Shikoku	→Shikoku (Forward)	3,575	3,583	2,677	3,423	3,294	4,061	2,579	131	245	113
	→Chugoku (Counter)	3,564	3,694	3,912	4,631	7,638	7,540	4,023	4,143	1,445	1,756
Chugoku-Kyushu	→Kyushu (Forward)	4,210	3,838	3,596	2,174	1,935	3,014	1,998	138	177	142
	→Chugoku (Counter)	13,596	13,847	11,218	14,947	15,476	18,183	18,280	16,311	15,864	17,098

* Based on the scheduled power flows of cross-regional interconnection lines
* The figures in red and blue represent the annual maximum and the minimum capabilities in each line and direction between FY 2012 and FY 2021, respectively.
* Figures were rounded off to the first decimal place.

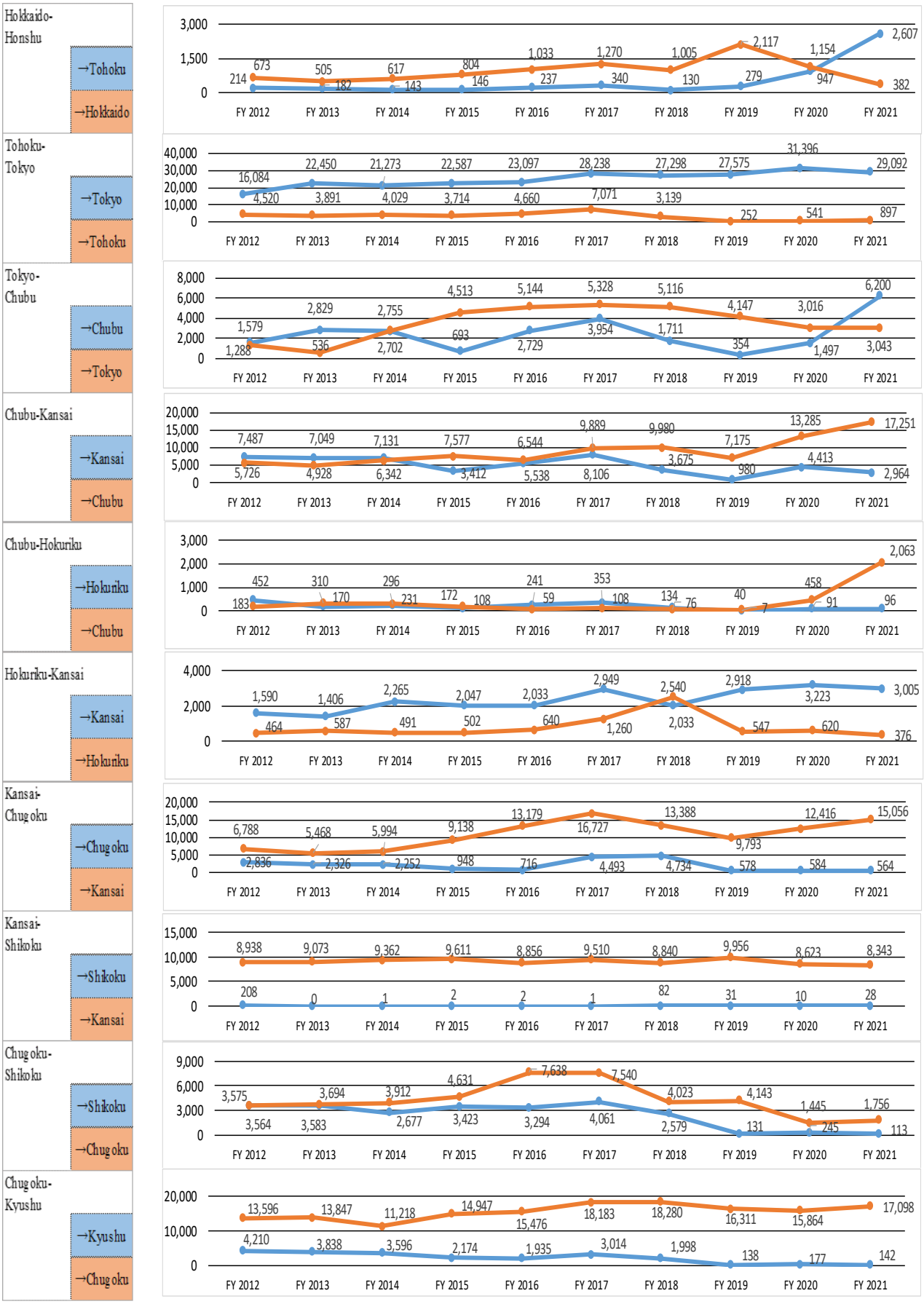

Figure 2-4: Annual utilization of cross-regional interconnection lines for regional service areas (FY 2012–2021)

(3) Monthly Utilization of Cross-Regional Interconnection Lines by Transaction in FY 2021

Table 2-4 shows the monthly and annual utilization of cross-regional interconnection lines by transaction in FY 2021. A bilateral contract includes the transactions at the balancing market that started from April 2021.

Table 2-4: Monthly and annual utilization of cross-regional interconnection lines by transaction

[GWh]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Bilateral	27	70	17	30	34	16	11	0	3	46	9	102	366
Day-ahead	6,246	6,476	6,615	7,990	10,311	8,215	8,977	7,858	10,912	10,429	9,688	8,612	102,328
1 Hour-ahead	484	682	455	870	1,015	670	576	526	813	948	598	745	8,382

* The figures in red and blue represent the annual maximum and minimum capabilities, respectively.
* The implicit auction scheme was introduced in October 2018.

(4) Annual Utilization of Cross-Regional Interconnection Lines by Transaction from FY 2012 to FY 2021

Table 2-5 and Figures 2-5, 2-6, and 2-7 show the annual utilization of cross-regional interconnection lines by transaction for FY 2012 to FY 2021. Day-ahead and 1 hour-ahead transactions comprised records for the decade (from FY 2012 to FY 2021), which was attributable to the introduction of the implicit auction scheme in October 2018, which made the whole utilization of cross-regional interconnection lines available through the spot market, and the activation of the spot market.

Table 2-5: Annual utilization of cross-regional interconnection lines by transaction (FY 2012–2021)

[GWh]

	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Bilateral	76,328	73,289	71,558	75,947	84,843	109,842	56,710	255	1,103	366
Day-ahead	7,155	11,632	14,174	13,152	14,817	18,350	51,120	83,216	91,229	102,328
1 Hour-ahead	493	1,750	1,554	2,050	3,392	4,203	2,932	4,000	7,675	8,382

* "Hour-ahead" means transactions that are 4 h ahead of the gate closure in FY 2015. From FY 2016, it refers to the transactions that are 1 h ahead of the gate closure.

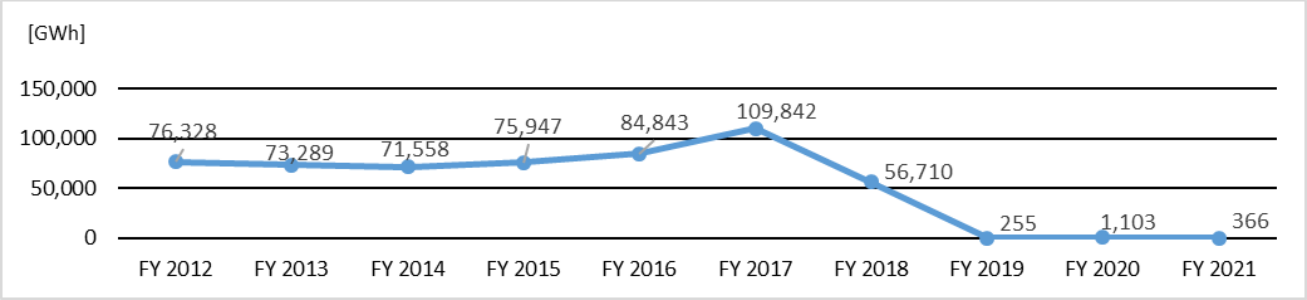

Figure 2-5: Annual utilization of cross-regional interconnection lines by bilateral transaction (FY 2012–2021)

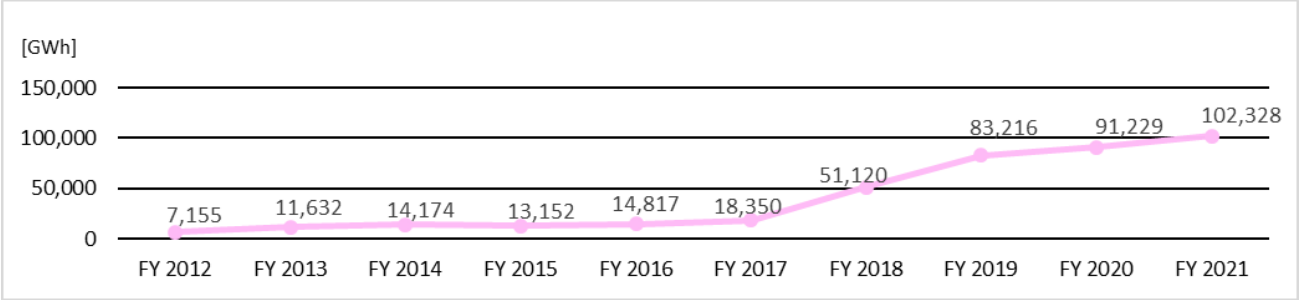

Figure 2-6: Annual utilization of cross-regional interconnection lines by day-ahead transaction (FY 2012–2021)

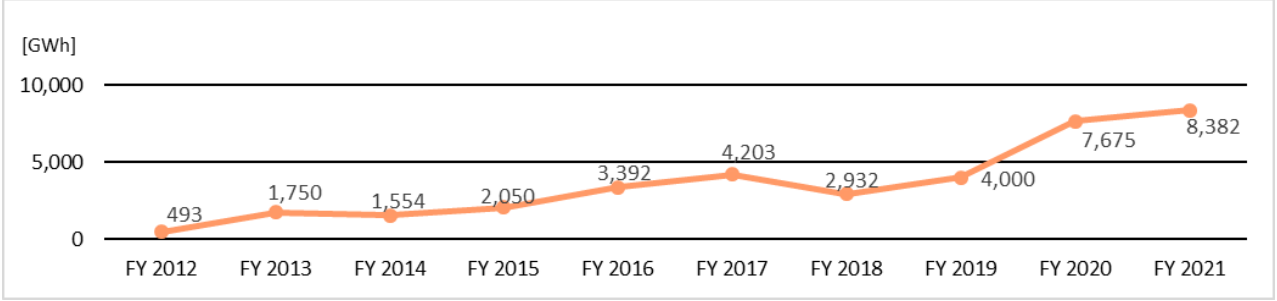

Figure 2-7: Annual utilization of cross-regional interconnection lines by hour-ahead transaction (FY 2012–2021)

3. Status of Maintenance Work on Cross-Regional Interconnection Lines

The following describes the details of the actual maintenance work on cross-regional interconnection lines, as reported by the GT&D companies according to the provisions of Article 167 of the Operational Rules.

(1) Actual Monthly Maintenance Work on Cross-Regional Interconnection Lines in FY 2021

Table 2-6 shows the monthly and annual maintenance works on cross-regional interconnection lines in FY 2021, and Figure 2-8 shows the nationwide monthly planned outage rate for FY 2021.

Table 2-6: Monthly and annual maintenance works on cross-regional interconnection lines

Interconnection	Corresponding Facilities	Apr.		May		Jun.		Jul.		Aug.		Sep.		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		Annual	
		Nos.	Days	Nos.	Days	Nos.	Days	Nos.	Days	Nos.	Days	Nos.	Days	Nos.	Days	Nos.	Days	Nos.	Days	Nos.	Days	Nos.	Days	Nos.	Days	**Nos.**	**Days**
Hokkaido-Honshu	Hokkaido and Honshu HVDC Link, New Hokkaido and Honshu HVDC Link	0	0	16	16	11	18	0	0	6	3	8	30	14	30	6	17	7	31	2	2	0	0	1	7	71	154
Tohoku-Tokyo	Soma-Futaba bulk line, Iwaki bulk line	0	0	0	0	6	5	0	0	0	0	0	0	0	0	6	6	0	0	0	0	0	0	0	0	12	11
Tokyo-Chubu	Sakuma FC C.S.	2	2	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	3	3	6	0	0	4	31	14	44
	Shin Shinano FC C.S.	0	0	1	1	5	11	0	0	0	0	3	3	4	17	3	9	9	4	2	2	0	0	0	0	27	47
	Higashi Shimizu FC C.S.	0	0	1	1	0	0	1	1	0	0	1	2	3	12	0	0	0	0	0	0	0	0	0	0	6	16
	Hida-Shinano FC	4	3	1	1	0	0	3	3	0	0	6	9	8	8	17	16	2	7	0	0	0	0	2	17	43	64
Chubu-Kansai	Mie-Higashi Omi line	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	2
Chubu-Hokuriku	Minami Fukumitsu HVDC BTB C.S., Minami Fukumitsu Substation	2	7	0	0	5	18	1	2	1	4	1	30	1	26	1	30	1	9	0	0	0	0	0	0	13	126
Hokuriku-Kansai	Echizen-Reinan line	1	5	0	0	0	0	2	2	4	4	27	30	12	26	3	30	6	9	0	0	0	0	0	0	55	106
Kansai-Chugoku	Seiban-Higashi Okayama line, Yamazaki-Chizu line	4	15	0	0	5	15	1	1	0	0	10	25	3	29	0	0	0	0	0	0	0	0	4	31	27	116
Kansai-Shikoku	Kihoku and Anan AC/DC C.S.	7	10	1	1	11	10	0	0	1	11	10	6	3	23	1	25	0	0	0	0	0	0	0	0	34	86
Chugoku-Shikoku	Honshi interconnection line	8	16	8	31	5	30	10	13	0	0	0	0	0	0	0	0	7	6	0	0	0	0	2	18	40	114
Chugoku-Kyushu	Kanmon interconnection line	9	12	15	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	28	23
Nationwide (Cumulative works for the same facilities deducted)		46	72	43	60	48	107	18	22	12	22	66	135	48	171	38	135	36	69	7	10	0	0	17	106	379	909

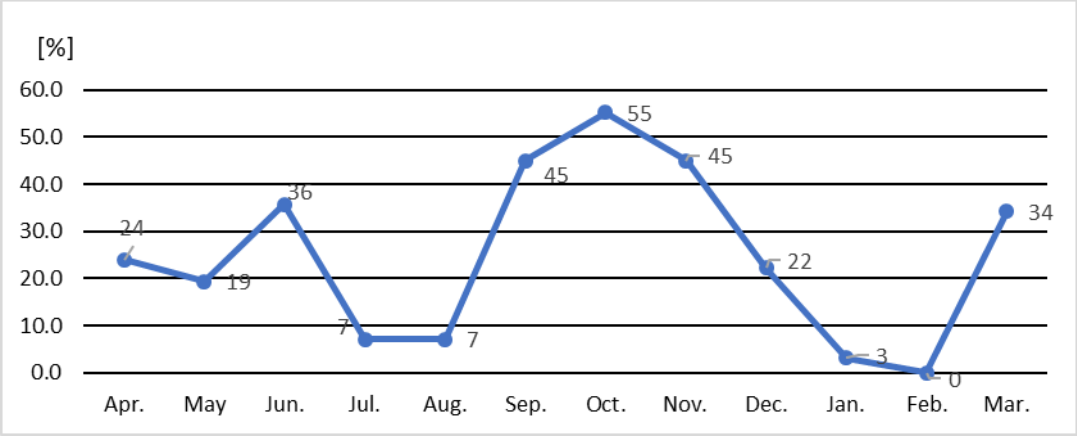

Figure 2-8: Nationwide monthly planned outage rate

$$\text{* Monthly Planned Outage Rate (\%)} = \frac{\text{Total days of planned outage in the month}}{\text{10 interconnection lines} \times \text{calendar days}}$$

(2) Annual Maintenance Works on Cross-regional Interconnection Lines from FY 2012 to FY 2021

Table 2-7 shows the annual maintenance work on cross-regional interconnection lines for FY 2012 to FY 2021.

The annual maintenance work on cross-regional interconnection lines for FY 2021 occurred on 379 occasions in nationwide. The annual maintenance work days on the facilities of Echizen–Reinan, Honshi, and Kanmon interconnection lines were recorded. The nationwide annual maintenance work in FY 2021 was almost the same level as that in the previous year, which was the highest annual total for the past decade.

Table 2-7: Annual maintenance work on cross-regional interconnection lines (FY 2012–2021)

	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	Total	10-years Average
Number	58	38	63	91	218	267	205	353	385	379	2,057	206

* The significant increase from FY 2015 to FY 2016 is attributable to the introduction of the Cross-Regional Operation System, which made detailed data management available.

4. Forced Outage of Cross-Regional Interconnection Lines

(1) Forced Outage of Cross-Regional Interconnection Lines in FY 2021

Table 2-8 shows the forced outage of cross-regional interconnection lines in FY 2021.

Table 2-8: Forced outage of cross-regional interconnection lines

Date	Facility	Background
July 20	Hida–Shinano FC	Substrate failure
July 31	Shin Shinano FC unit No.2	Secondary accident of network
August 23	Sakuma FC	Secondary accident of network
September 1	Hokkaido and Honshu HVDC Link	Unknown
September 7	Hida–Shinano FC	Substrate failure
September 15	Shin Shinano FC unit No.2	Trip
September 17	Hida–Shinano FC	Multipul failures
September 22	Higashi Shimizu FC	Secondary accident of network
December 1	Sakuma FC	Secondary accident of network
January 8	Sakuma FC	Trip
March 16	Soma Fubtaba Trunk Line	Generators shutdown

* The forced outage affecting the Total Transfer Capability is described.

(2) Annual Forced Outage of Cross-regional Interconnection Lines from FY 2012 to FY 2021

Table 2-9 shows the annual forced outage of cross-regional interconnection lines from FY 2012 to FY 2021. The number of annual forced outages of cross-regional interconnection lines in FY 2021 was 11, which was recorded for the past decade.

Table 2-9: Annual forced outage of cross-regional interconnection lines (FY 2012–2021)

	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	Total	10-years Average
Number	6	9	1	3	3	3	6	9	8	11	59	6

5. Actual Employment of the Transmission Margin

"Employment of the transmission margin" refers to the supply of electricity by GT&D companies utilizing their transmission margin to interconnection lines where the supply–demand balance is restricted or insufficient to reduce power supply, among other such possibilities. Table 2-10 shows the actual employment of the transmission margin for FY 2021 according to the provisions of Article 152 of the Operational Rules.

The actual employment of the transmission margin for FY 2021 was 7 days. This employment was performed in the interconnection facilities between Tokyo and Chubu, where the flow is from Chubu to Tokyo. Five of 7 days were allocated to implement countermeasures for the Fukushima Earthquake that occurred on March 16, 2022.

Table 2-10: Actual employment of the transmission margin

Date	Facility	Background
January 6, 2022	Interconnection facilities between Tokyo and Chubu (Flow from Chubu to Tokyo)	Insufficient ATC of the corresponding facilities which is necessary for the instruction of power exchanges because of shortage of supply capacity in TEPCO PG area due to unexpected demand growth caused by cold weather
February 10, 2022	Interconnection facilities between Tokyo and Chubu (Flow from Chubu to Tokyo)	Insufficient ATC of the corresponding facilities which is necessary for the instruction of power exchanges because of shortage of supply capacity in TEPCO PG area due to unexpected demand growth caused by cold weather
March 18, 2022	Interconnection facilities between Tokyo and Chubu (Flow from Chubu to Tokyo)	Insufficient ATC of the corresponding facilities which is necessary for the instruction of power exchanges because of shortage of supply capacity in Tohoku NW regional service area due to earthquake occurred on March 16, 2022.
March 18 & 19, 2022	Interconnection facilities between Tokyo and Chubu (Flow from Chubu to Tokyo)	Insufficient ATC of the corresponding facilities which is necessary for the instruction of power exchanges because of shortage of supply capacity in TEPCO PG area due to earthquake occurred on March 16, 2022.
March 22 & 23, 2022	Interconnection facilities between Tokyo and Chubu (Flow from Chubu to Tokyo)	Insufficient ATC of the corresponding facilities which is necessary for the instruction of power exchanges because of shortage of supply capacity in TEPCO PG area due to earthquake occurred on March 16, 2022, as well as unexpected demand growth triggered by cold weather.

Table 2-11: Actual employment of transmission margin (FY 2015–2021)

[days]

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Nationwide	1	0	3	15	1	16	7

6. Actual Available Transfer Capabilities of Each Cross-Regional Interconnection Line

The actual ATC values calculated and published are shown in Figures 2-10 to 2-19. (Figures 2-9 and Table 2-12 present how to interpret the ATC graphs.)

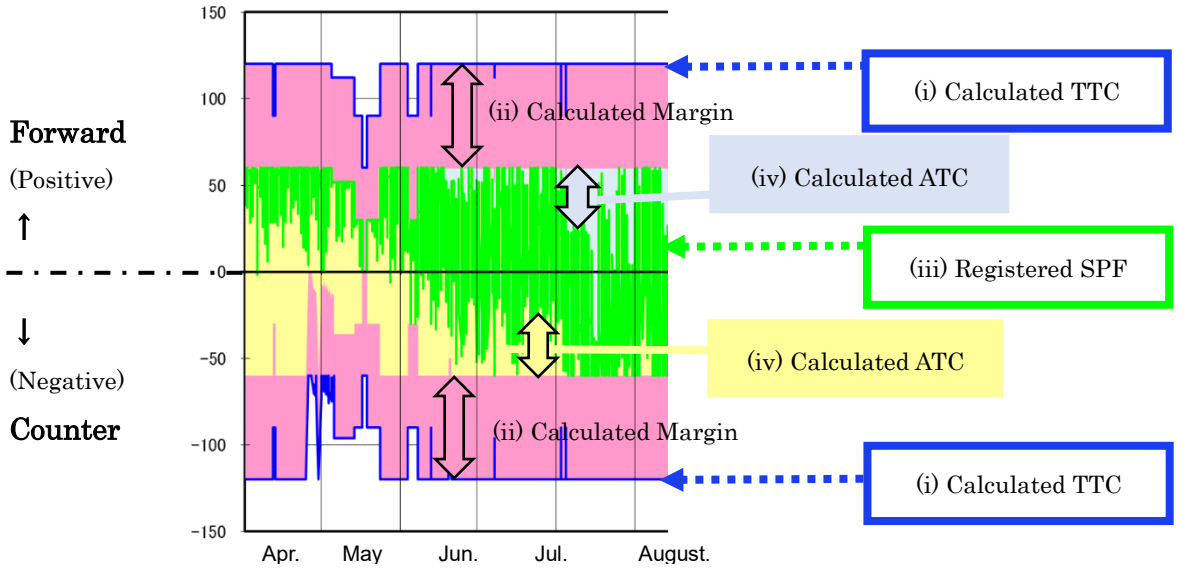

Figure 2-9: How to interpret an ATC graph

Table 2-12: Explanation of ATC graph components

	By the end of September, 2018	After October, 2018 (introduction of implicit auction scheme)
(i) Calculated TTC	The maximum electricity that can be sent to the distribution facilities while securing supply reliability without damaging the transmission and distribution facilities	The same as the left
(ii) Calculated Transmission Margin	The amount of electricity managed by the Organization as a part of total TTC by the directions of scheduled power flows of the interconnection lines to receive electricity from other regional service areas through interconnection lines under abnormal situations of electric network, supply shortage or other emergent situations, to keep stabilizing the electric network, or to develop an environment of market trading of electricity, or to procure balancing capacity from other regional service areas. Power flows of allocation plans utilizing transmission margin and those employing transmission margin shall be deducted.	The amount of electricity managed by the Organization as a part of total transfer capability of the interconnection lines to receive electricity from other regional service areas through interconnection lines under abnormal situations of electric network, supply shortage or other emergent situations, to keep stabilizing the electric network, or to procure balancing capacity from other regional service areas. Scheduled power flows employing transmission margin shall be deducted.
(iii) Registered SPF	Sum of the registered power flows stated below: 1) allocation plans in "first come, first seerved" principle 2) trade in day-ahead spot market 3) trade in 1 hour-ahead market	Sum of the registered power flows stated below: 1) trade in day-ahead spot market 2) trade in 1 hour-ahead market
(iv) Calculated ATC	(iv) = (i) - (ii) - (iii) The necessary capability for long-cycle cross-regional frequency control shall be immediately deducted from ATC at the decision of its implementation.	The same as the left

The actual flows on the transmission lines are offset in each direction. Therefore, the scheduled power flow is the offset value between the forward and counter flows, not the simple sum of both directions. In addition, offset values on the graphs are observed as Scheduled Power Flow, rather than observing the capacity of each forward flow and counter flow.

(Reference) Publishing actual ATC
Detailed network system information including actual ATC is available at the URL below.
URL http://occtonet.occto.or.jp/public/dfw/RP11/OCCTO/SD/LOGIN_login#

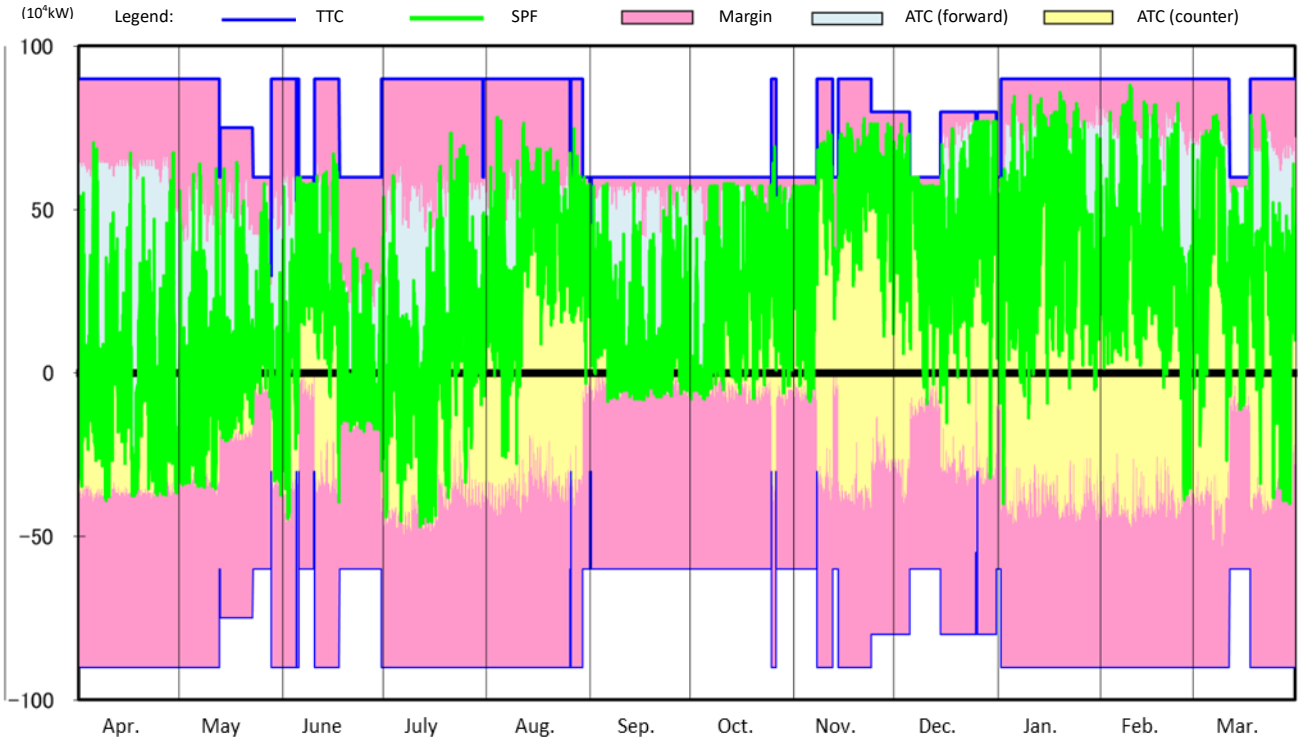

Figure 2-10: Actual ATC for interconnection facilities between Hokkaido and Honshu
(Hokkaido–Honshu HVDC Link, and New Hokkaido–Honshu HVDC Link)

Note: Hokkaido to Tohoku is considered a forward (positive) flow, with Tohoku to Hokkaido being a counter (negative) flow.

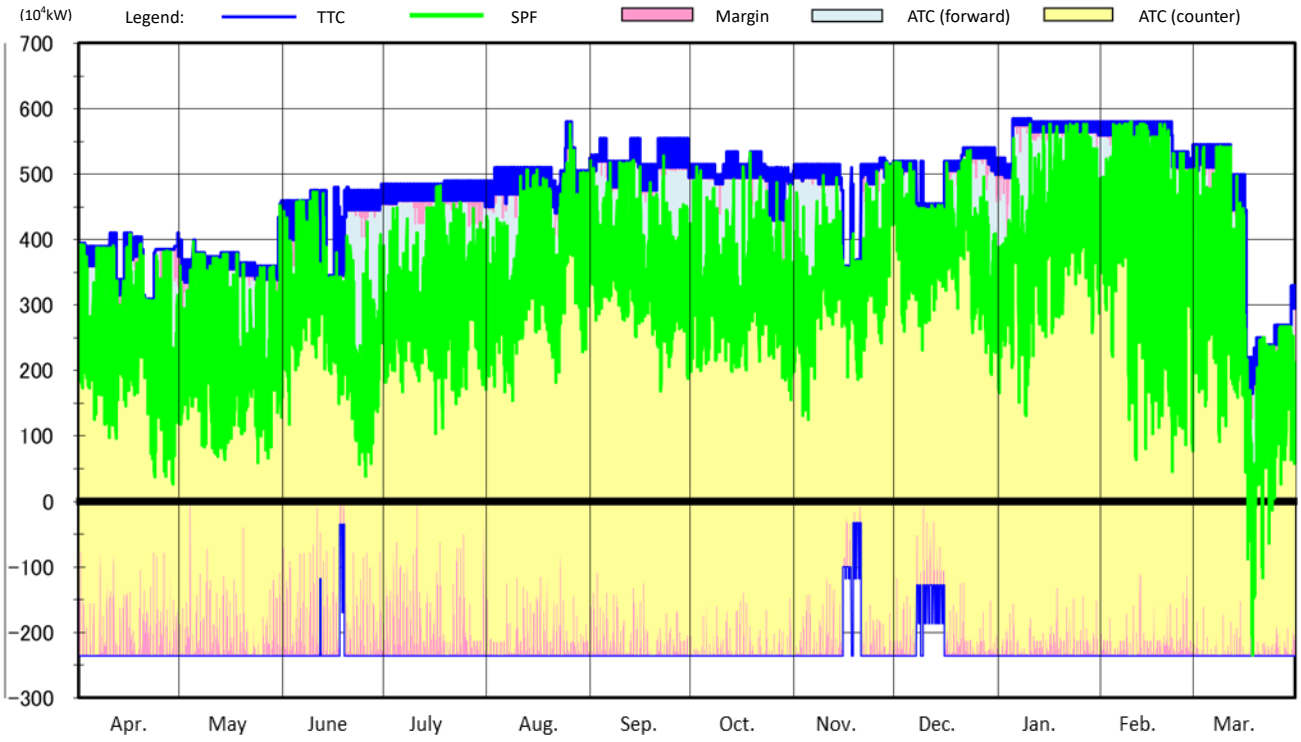

Figure 2-11: Actual ATC for interconnection lines between Tohoku and Tokyo
(Soma–Futaba Bulk Line and Iwaki Bulk Line)

Note: Tohoku to Tokyo is considered a forward (positive) flow, with Tokyo to Tohoku being a counter (negative) flow.

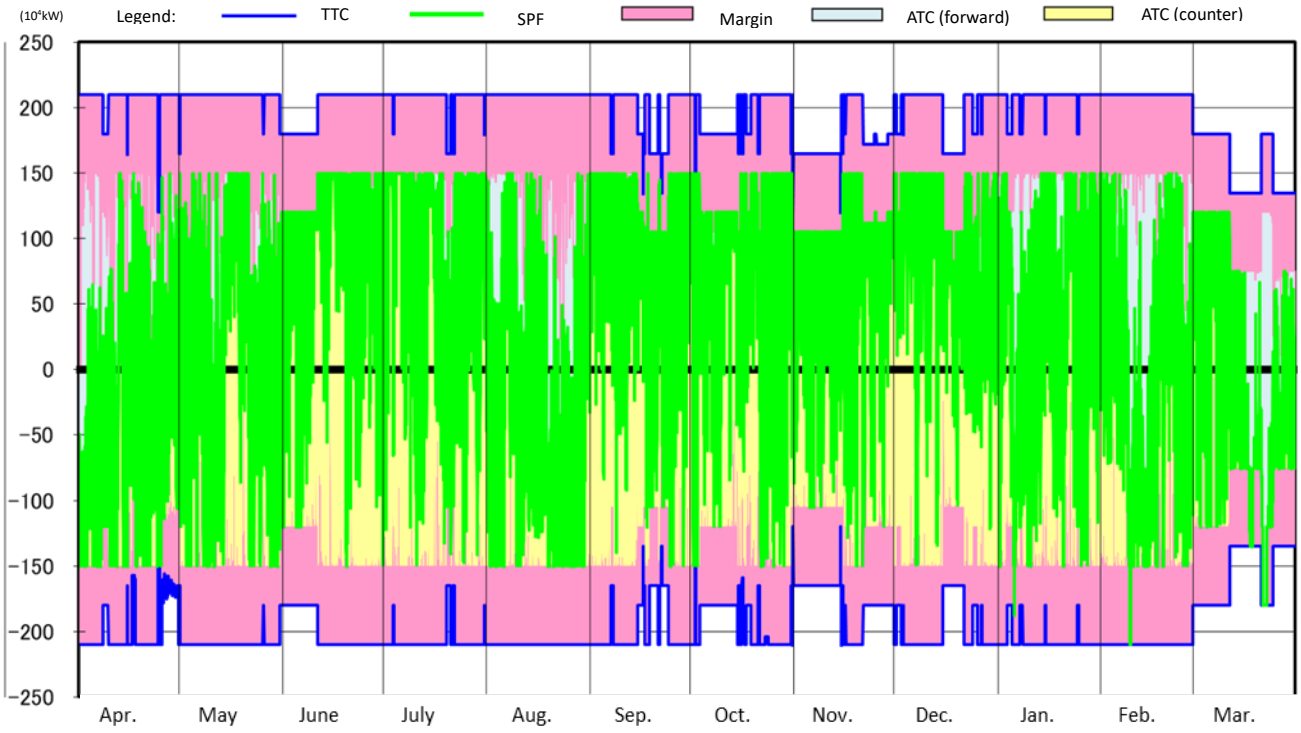

Figure 2-12: Actual ATC for interconnection facilities between Tokyo and Chubu
(Sakuma, Shin Shinano and Higashi Shimizu and Hida–Shinano F.C.)

Note: Tokyo to Chubu is considered a forward (positive) flow, with Chubu to Tokyo being a counter (negative) flow.

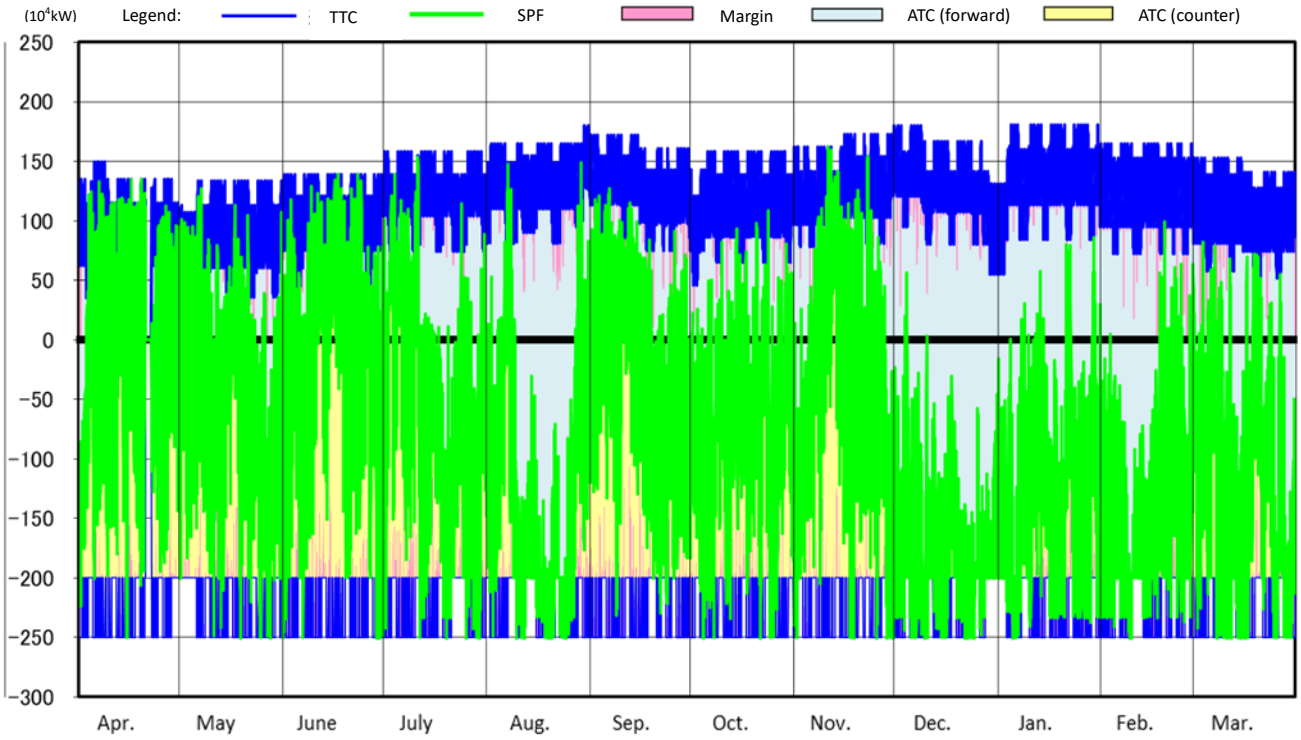

Figure 2-13: Actual ATC for the interconnection line between Chubu and Kansai (Mie–Higashi Omi Line)

Note: Chubu to Kansai is considered a forward (positive) flow, with Kansai to Chubu being a counter (negative) flow.

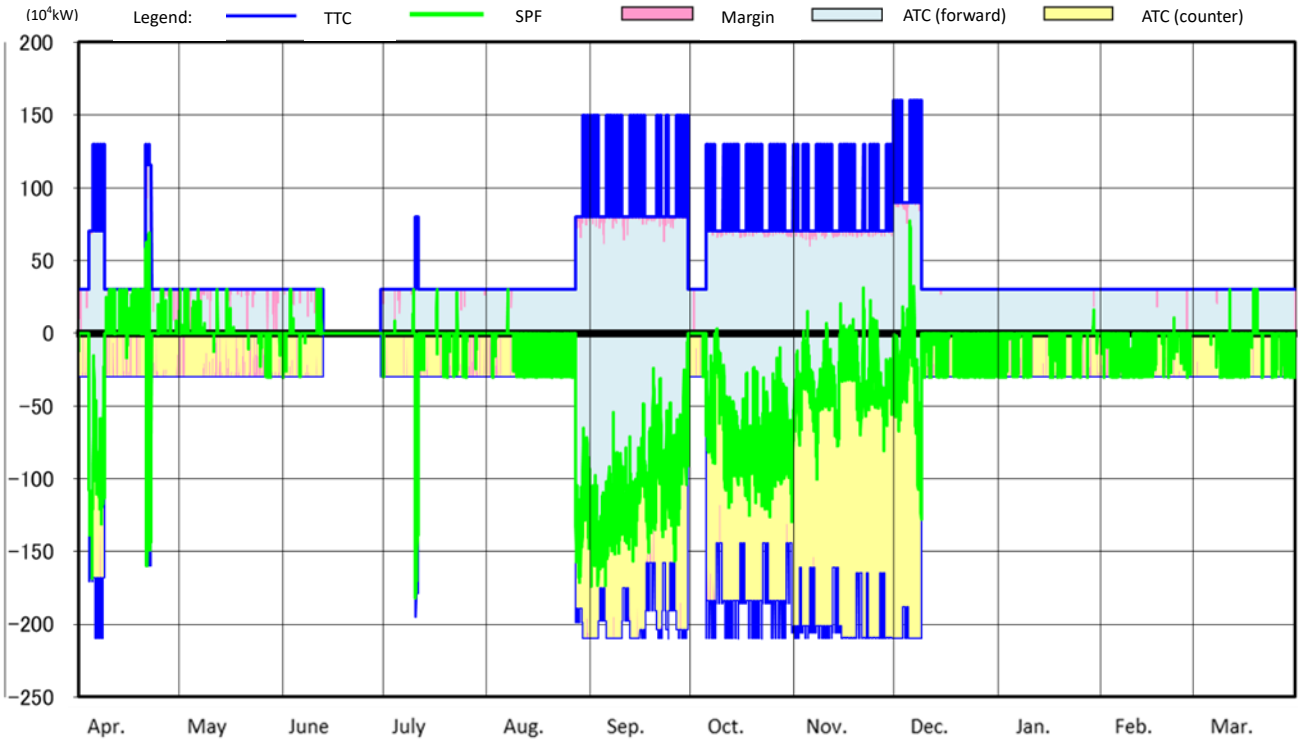

Figure 2-14: Actual ATC for interconnection facilities between Chubu and Hokuriku
(Minami Fukumitsu HVDC BTB Converter Station and Minami Fukumitsu Substation)

Note: Chubu to Hokuriku is considered a forward (positive) flow, with Hokuriku to Chubu being a counter (negative) flow.

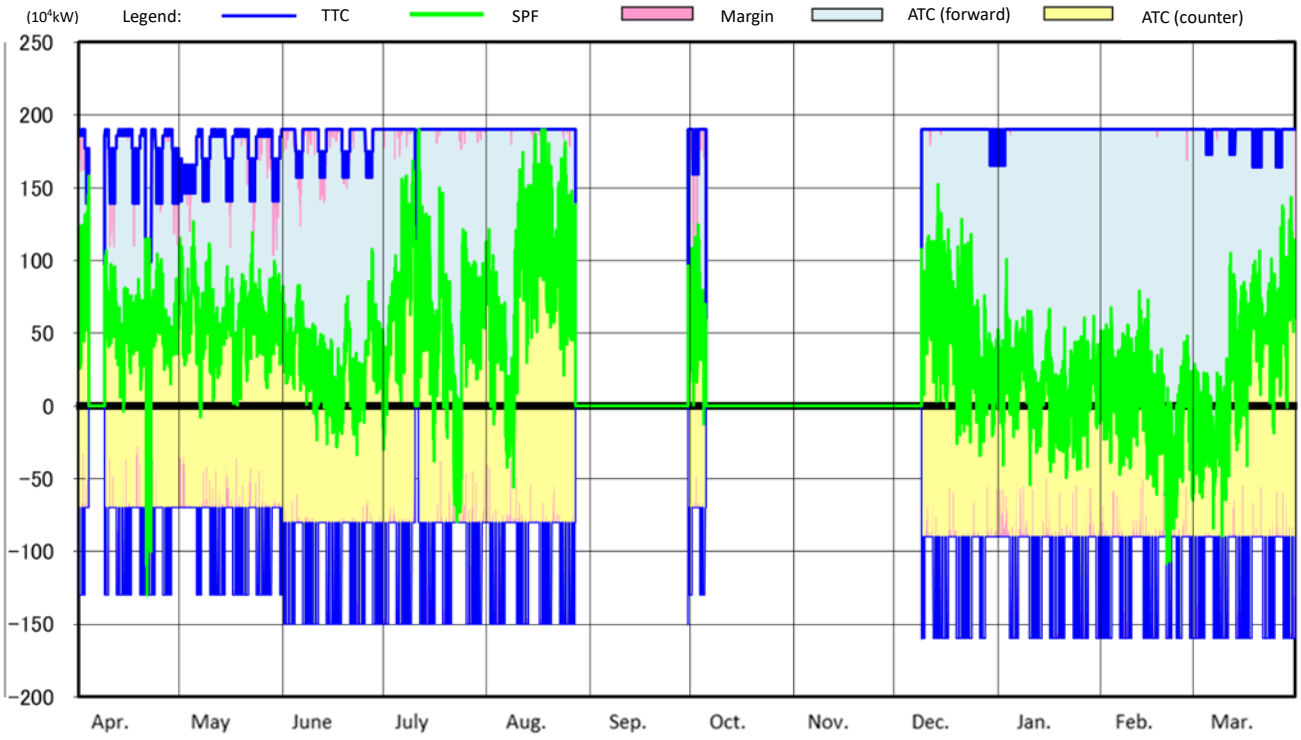

Figure 2-15: Actual ATC for the interconnection line between Hokuriku and Kansai (Echizen–Reinan Line)

Note: Hokuriku to Kansai is considered a forward (positive) flow, with Kansai to Hokuriku being a counter (negative) flow.

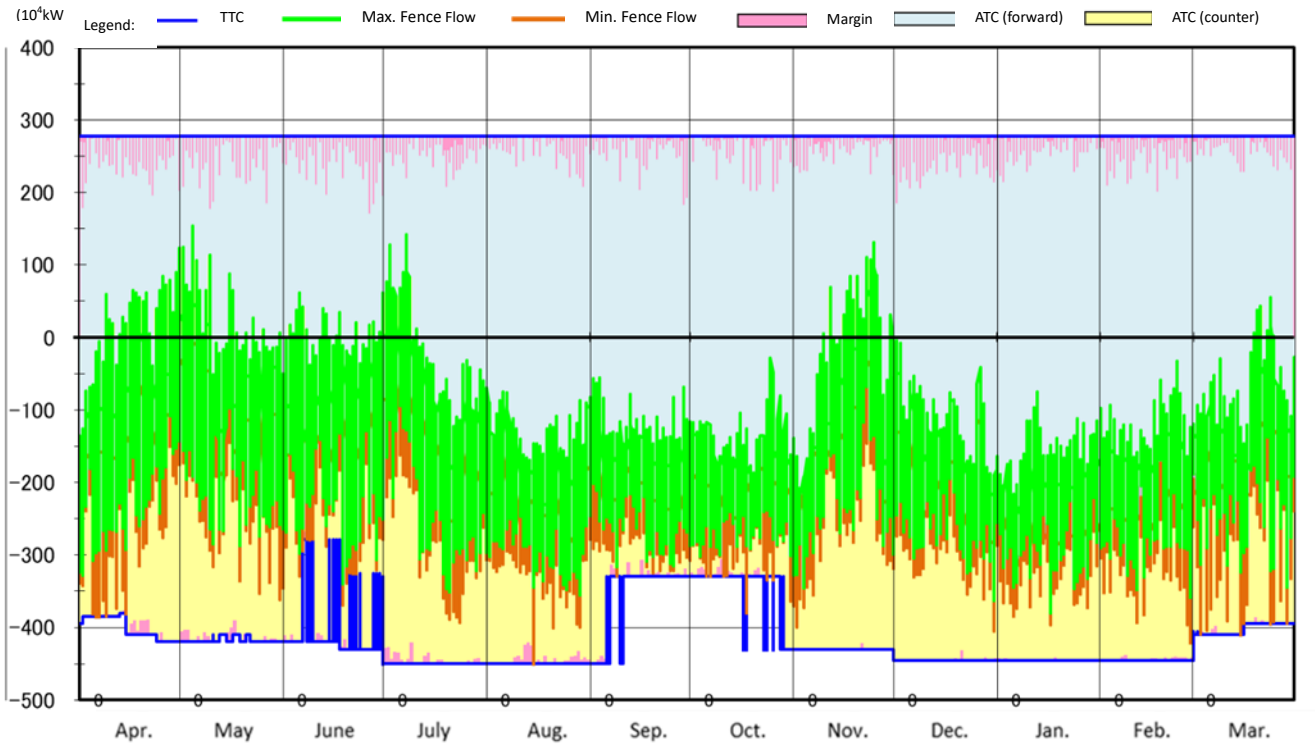

Figure 2-16: Actual ATC for interconnection lines between Kansai and Chugoku
(Seiban–Higashi Okayama Line and Yamazaki–Chizu Line)

Note: Kansai to Chugoku is considered a forward (positive) flow, with Chugoku to Kansai being a counter (negative) flow.

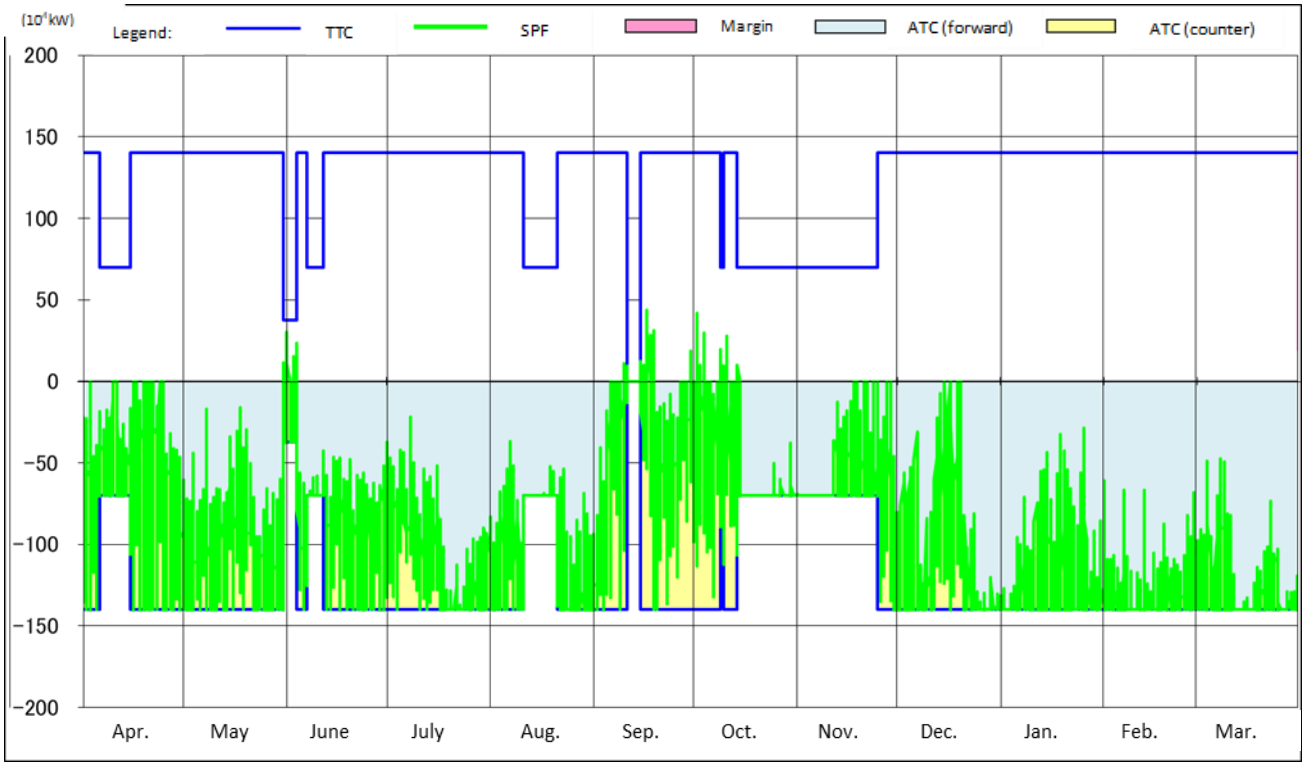

Figure 2-17: Actual ATC for interconnection facilities between Kansai and Shikoku
(Interconnection facilities between Kihoku and Anan AC/DC Converter Station)

Note: Kansai to Shikoku is considered a forward (positive) flow, with Shikoku to Kansai being a counter (negative) flow.
*The ATC for the forward flow is calculated and chosen as the smaller from the following.
・TTC—transfer margin—SPF.
・TTC of Minami Awa Bulk Line— (Supply Capacity of Tachibanawan Thermal Power Station—SPF of Anan—Kihoku DC Bulk Line).

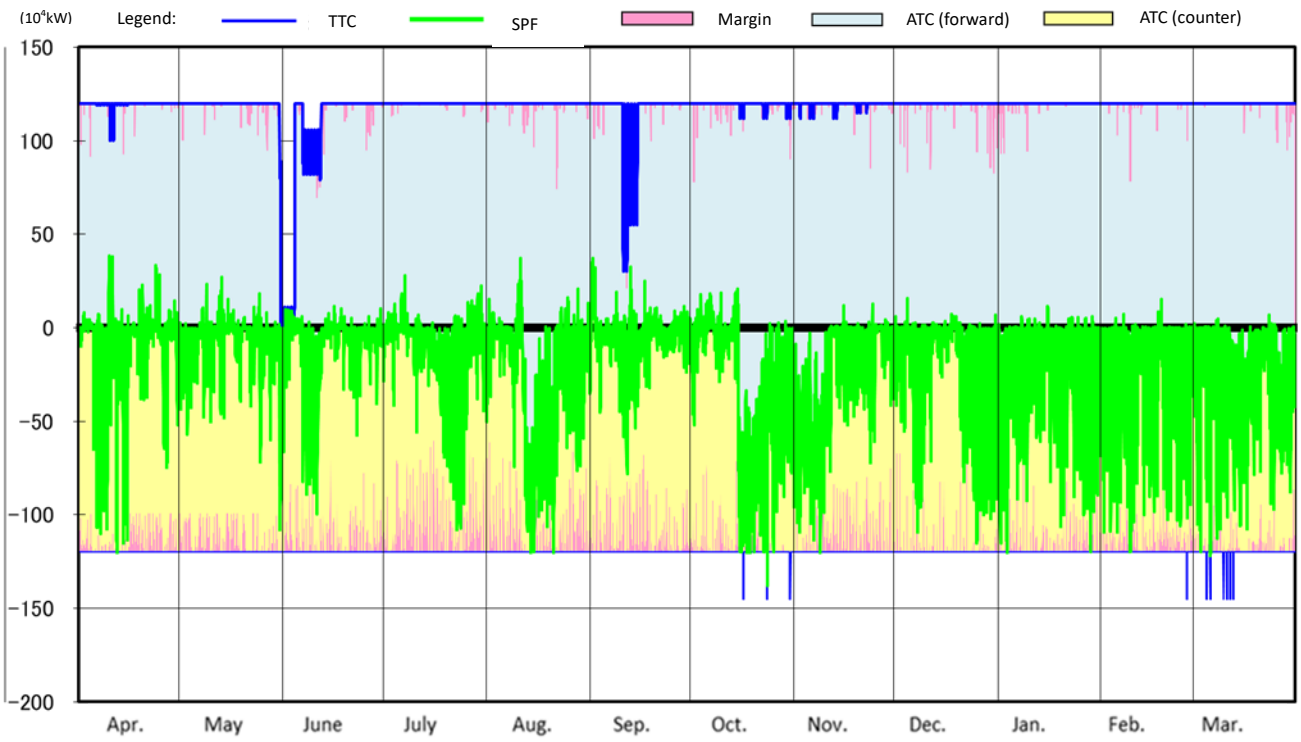

Figure 2-18: Actual ATC for the interconnection line between Chugoku and Shikoku (Honshi Interconnection Line)
Note: Chugoku to Shikoku is considered a forward (positive) flow, with Shikoku to Chugoku being a counter (negative) flow.

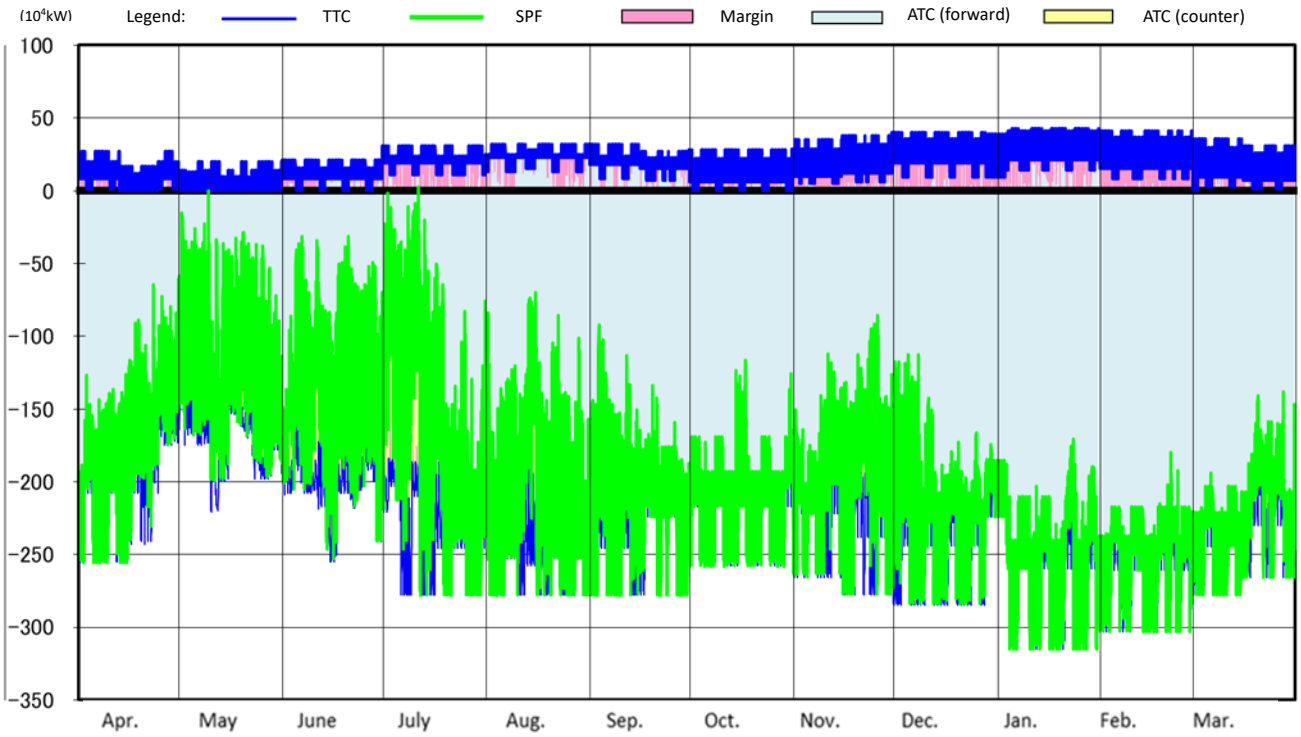

Figure 2-19: Actual ATC for the interconnection line between Chugoku and Kyushu (Kanmon Interconnection Line)

Note: Chugoku to Kyushu is considered a forward (positive) flow, with Kyushu to Chugoku being a counter (negative) flow.

7. Actual Constraints on Cross-Regional Interconnection Lines Nationwide

For the constraints on each regional service area of the 10 GT&D companies, please see the links below.

---

* Constraints maps are published on the websites below (in Japanese only).

Hokkaido Electric Power Network, Inc.:
http://www.hepco.co.jp/network/con_service/public_document/bid_info.html
Tohoku Electric Power Network Co., Inc.:
https://nw.tohoku-epco.co.jp/consignment/system/announcement/
TEPCO Power Grid, Incorporated:
http://www.tepco.co.jp/pg/consignment/system/index-j.html
Chubu Electric Power Grid Co., Inc.:
https://powergrid.chuden.co.jp/takuso_service/hatsuden_kouri/takuso_kyokyu/rule/map/
Hokuriku Electric Power Transmission & Distribution Company:
http://www.rikuden.co.jp/nw_notification/U_154seiyaku.html#akiyouryu
Kansai Transmission and Distribution, Inc.:
https://www.kansai-td.co.jp/consignment/disclosure/distribution-equipment/index.html
Chugoku Electric Power Transmission & Distribution Company, Incorporated:
https://www.energia.co.jp/nw/service/retailer/keitou/access/
Shikoku Electric Power Transmission & Distribution Company, Incorporated:
https://www.yonden.co.jp/nw/line_access/index.html
Kyushu Electric Power Transmission & Distribution Co., Inc.:
https://www.kyuden.co.jp/td_service_wheeling_rule-document_disclosure
The Okinawa Electric Power Company Incorporated:
http://www.okiden.co.jp/business-support/service/rule/plan/index.html

CONCLUSION

Actual Electricity Supply–Demand

For the actual electricity supply–demand, data on the peak demand, the electric energy requirement, the load factor, and the supply–demand status during the peak and lowest demand periods and the peak daily energy supply have been collected. Additionally, instructions with respect to power exchanges (according to the provisions of paragraph 1 of Article 28-44 of the Electricity Business Act) and the actual output shedding of renewable energy generating facilities (according to the provisions of the Ministerial Ordinance of the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electric Utilities) have been aggregated. Furthermore, instructions and requests regarding the tight supply–demand balance in the winter of 2021/2022 are described in detail.

Actual Utilization of Cross-Regional Interconnection Lines

For the actual utilization of cross-regional interconnection lines, data on the utilization, the maintenance work, the forced outages, the employment of transmission margin, and the ATC are collected.

<Reference> Detailes on the Actual Power Exchange Instructions, with Instructions and Requests to Generation Companies and Retail Companies Issued by the Oraganization.

The details on the actual power exchange instructions, with instructions and requests to generation and retail companies issued by the Organization in FY 2021, are listed below. They include measures for avoiding supply–demand tightness during the winter of 2021/2022 and the Fukushima Earthquake, which occurred on March 16, 2022.

Actual power exchange instructions by the Organization

1	Issued at	8:59 on May 19, 2021
	Instruction	・Kansai T&D shall supply 500 MW of electricity at most to Shikoku T&D from 9:30 to 12:00 on May 19. ・Shikoku T&D shall be supplied 500 MW of electricity at most by Kansai T&D from 9:30 to 12:00 on May 19.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of unexpected demand growth and decreasing output of solar power caused by weather change.
2	Issued at	08:33 on July 15, 2021
	Instruction	・Kansai T&D shall supply 200 MW of electricity to Hokuriku T&D from 9:00 to 10:00 on July 15. ・Hokuriku T&D shall be supplied 200 MW of electricity by Kansai T&D from 9:00 to 10:00 on July 15.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a generator shutdown in Hokuriku T&D regional service area.
3	Issued at	13:02 on January 6, 2022
	Instruction	・Hokkaido NW shall supply 250 MW of electricity at most to TEPCO PG from 13:30 to 20:00 on January 6. ・Tohoku NW shall supply 900 MW of electricity at most to TEPCO PG from 13:30 to 20:00 on January 6. ・Chubu PG shall supply 170 MW of electricity to TEPCO PG from 17:00 to 20:00 on January 6. ・TEPCO PG shall be supplied 1220 MW of electricity at most by Hokkaido NW, Tohoku NW, and Chubu PG from 13:30 to 20:00 on January 6.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply-demand balance due to unexpected demand growth caused by cold weather.
4	Issued at	14:56 on January 6, 2022
	Instruction	・Hokkaido NW shall supply 200 MW of electricity at most to TEPCO PG from 15:30 to 19:30 on January 6. ・Tohoku NW shall supply 600 MW of electricity at most to TEPCO PG from 15:30 to 20:00 on January 6. ・Chubu PG shall supply 300 MW of electricity to TEPCO PG from 15:30 to 20:00 on January 6. ・Kansai T&D shall supply 220 MW of electricity at most to TEPCO PG from 15:30 to 17:00 on January 6. ・TEPCO PG shall be supplied 1320 MW of electricity at most by Hokkaido NW, Tohoku NW, Chubu PG, and Kansai T&D from 15:30 to 20:00 on January 6. (The transmission margin of an interconnection line was partly utilized to the power exchange.)
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply-demand balance due to unexpected demand growth caused by cold weather.
5	Issued at	19:17 on January 6, 2022
	Instruction	・Hokkaido NW shall supply 50 MW of electricity to TEPCO PG from 23:30 to 24:00 on January 6. ・Tohoku NW shall supply 1000 MW of electricity at most to TEPCO PG from 20:00 to 24:00 on January 6. ・Chubu PG shall supply 790 MW of electricity at most to TEPCO PG from 22:00 to 24:00 on January 6. ・Kansai T&D shall supply 920 MW of electricity at most to TEPCO PG from 21:00 to 24:00 on January 6. ・TEPCO PG shall be supplied 2760 MW of electricity at most by Hokkaido NW, Tohoku NW, Chubu PG, and Kansai T&D from 20:00 to 24:00 on January 6.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply-demand balance due to unexpected demand growth caused by cold weather.

6	Issued at	21:18 on January 6, 2022
	Instruction	・Tohoku NW shall supply 1200 MW of electricity at most to TEPCO PG from 0:00 to 9:00 on January 7. ・Chubu PG shall supply 1500 MW of electricity at most to TEPCO PG from 0:00 to 9:00 on January 7. ・Kansai T&D shall supply 700 MW of electricity at most to TEPCO PG from 0:00 to 9:00 on January 7. ・TEPCO PG shall be supplied 2740 MW of electricity at most by Tohoku NW, Chubu PG, and Kansai T&D from 0:00 to 9:00 on January 7.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply-demand balance due to unexpected demand growth caused by cold weather.
7	Issued at	5:31 on January 11, 2022
	Instruction	・Kansai T&D shall supply 200 MW of electricity to Hokuriku T&D from 6:00 to 8:00 on January 11. ・Hokuriku T&D shall be supplied 200 MW of electricity by Kansai T&D from 6:00 to 8:00 on January 11.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a generator shutdown in Hokuriku T&D regional service area.
8	Issued at	9:07 on February 10, 2022
	Instruction	・Chubu PG shall supply 629 MW of electricity at most to TEPCO PG from 10:00 to 13:00 on February 10. ・Kansai T&D shall supply 171 MW of electricity to TEPCO PG from 10:00 to 13:00 on February 10. ・TEPCO PG shall be supplied 800 MW of electricity at most by Chubu PG, and Kansai T&D from 10:00 to 13:00 on February 10. (The transmission margin of an interconnection line was partly utilized to the power exchange.)
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply–demand balance due to unexpected demand growth caused by cold weather. An upper reservoir pond of pumped storage hydropower plant, which has an ultimate supply–demand balancing function, may dry up due to further demand growth; further supply–demand tightness is likely to occur. The Organization shall intermittently issue additional instructions for power exchange for tight supply–demand to restore the water level of the upper reservoir pond.
9	Issued at	12:26 on February 10, 2022
	Instruction	・Chubu PG shall supply 629 MW of electricity at most to TEPCO PG from 13:00 to 17:00 on February 10. ・Kansai T&D shall supply 171 MW of electricity to TEPCO PG from 13:00 to 17:00 on February 10. ・TEPCO PG shall be supplied 800 MW of electricity at most by Chubu PG, and Kansai T&D from 13:00 to 17:00 on February 10. (The transmission margin of an interconnection line was partly utilized to the power exchange.)
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply–demand balance due to unexpected demand growth caused by cold weather. An upper reservoir pond of pumped storage hydropower plant, which has an ultimate supply–demand balancing function, may dry up due to further demand growth; further supply–demand tightness is likely to occur. The Organization shall intermittently issue additional instructions for power exchange for tight supply–demand to restore the water level of the upper reservoir pond.
10	Issued at	2:02 on March 17, 2022
	Instruction	・Hokkaido NW shall supply 200 MW of electricity at most to Tohoku NW from 4:00 to 5:30 on March 17. ・TEPCO PG shall supply 1200 MW of electricity at most to to Tohoku NW from 2:30 to 6:00 on March 17. ・Tohoku NW shall be supplied 1400 MW of electricity at most by Hokkaido NW and TEPCO PG from 2:30 to 6:00 on March 17.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a supply capacity shortage in Tohoku NW regional service area due to the earthquqke.
11	Issued at	4:45 on March 17, 2022
	Instruction	・Hokkaido NW shall supply 100 MW of electricity to Tohoku NW from 6:00 to 7:00 on March 17. ・TEPCO PG shall supply 900 MW of electricity at most to to Tohoku NW from 6:00 to 11:00 on March 17. ・Tohoku NW shall be supplied 1000 MW of electricity at most by Hokkaido NW and TEPCO PG from 6:00 to 11:00 on March 17.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a supply capacity shortage in Tohoku NW regional service area due to the earthquqke.

12	Issued at	7:58 on March 18, 2022
	Instruction	・Hokkaido NW shall supply 200 MW of electricity at most to Tohoku NW from 4:00 to 5:30 on March 17. ・TEPCO PG shall supply 1200 MW of electricity at most to to Tohoku NW from 2:30 to 6:00 on March 17. ・Tohoku NW shall be supplied 1400 MW of electricity at most by Hokkaido NW and TEPCO PG from 2:30 to 6:00 on March 17. (The transmission margin of an interconnection line was partly utilized to the power exchange.)
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a supply capacity shortage in Tohoku NW regional service area due to the earthquqke.
13	Issued at	11:19 on March 18, 2022
	Instruction	・Chubu PG shall supply 300 MW of electricity to Tohoku NW from 12:00 to 16:00 on March 18. ・Kansai T&D shall supply 300 MW of electricity to Tohoku NW from 12:00 to 16:00 on March 18. ・Tohoku NW shall be supplied 600 MW of electricity at most by Chubu PG, and Kansai T&D from 12:00 to 16:00 on March 18.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a supply capacity shortage in Tohoku NW regional service area due to the earthquqke.
14	Issued at	15:28 on March 18, 2022
	Instruction	・Hokkaido NW shall supply 250 MW of electricity at most to Tohoku NW from 16:00 to 20:00 on March 18. ・Chugoku NW shall supply 115 MW of electricity to at most to Tohoku NW from 16:00 to 20:00 on March 18. ・Kyushu T&D shall supply 350 MW of electricity at most to Tohoku NW from 16:00 to 21:00 on March 18. ・Tohoku NW shall be supplied 600 MW of electricity at most by Hokkaido NW, Chugoku NW, and Kyushu T&D from 16:00 to 21:00 on March 18. (The transmission margin of an interconnection line was partly utilized to the power exchange.)
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a supply capacity shortage in Tohoku NW regional service area due to the earthquqke.
15	Issued at	15:28 on March 18, 2022
	Instruction	・Hokkaido NW shall supply 350 MW of electricity at most to TEPCO PG from 21:00 to 24:00 on March 18. ・Chubu PG shall supply 400 MW of electricity to TEPCO PG from 21:00 to 24:00 on March 18. ・Hokuriku T&D shall supply 100 MW of electricity at most to TEPCO PG from 16:00 to 21:00 on March 18. ・Chugoku NW shall supply 200 MW of electricity at most to TEPCO PG from 16:00 to 21:00 on March 18. ・Kyushu T&D shall supply 320 MW of electricity at most to TEPCO PG from 16:30 to 21:00 on March 18. ・TEPCO PG shall be supplied 943.6 MW of electricity at most by Hokkaido NW, Chubu PG, Hokuriku T&D, Chugoku NW, and Kyushu T&D from 16:00 to 24:00 on March 18. (Transmission margin of interconnection line was partly utilized to the power exchage.)
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply–demand balance due to unexpected operation more than planned. An upper reservoir pond of pumped storage hydropower plant, which has an ultimate supply–demand balancing function, may dry up, the Organization issued the instructions of power exchange for tight supply–demand to restore the water level of the upper reservoir pond.
16	Issued at	23:03 on March 18, 2022
	Instruction	・Chubu PG shall supply 300 MW of electricity to TEPCO PG from 0:00 to 4:00 on March 19. ・Kansai T&D shall supply 300 MW of electricity to TEPCO PG from 0:00 to 4:00 on March 19. ・TEPCO PG shall be supplied 600 MW of electricity by Chubu PG, and Kansai T&D from 0:00 to 4:00 on March 19.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply–demand balance due to unexpected operation more than planned. An upper reservoir pond of pumped storage hydropower plant, which has an ultimate supply–demand balancing function, may dry up, the Organization issued the instructions of power exchange for tight supply–demand to restore the water level of the upper reservoir pond.

17	Issued at	5:59 on March 22, 2022
	Instruction	・Tohoku NW shall supply 817.8 MW of electricity at most to TEPCO PG from 7:00 to 16:00 on March 22. ・Chubu PG shall supply 300 MW of electricity to TEPCO PG from 7:00 to 16:00 on March 22. ・Hokuriku T&D shall supply 300 MW of electricity at most to TEPCO PG from 7:00 to 9:00 on March 22. ・Kansai T&D shall supply 269.4 MW of electricity at most to TEPCO PG from 7:00 to 16:00 on March 22. ・Chugoku NW shall supply 100 MW of electricity at most to TEPCO PG from 8:00 to 15:00 on March 22. ・Shikoku T&D shall supply 100 MW of electricity at most to TEPCO PG from 8:30 to 15:00 on March 22. ・Kyushu T&D shall supply 103.3 MW of electricity at most to TEPCO PG from 8:30 to 10:00 on March 22. ・TEPCO PG shall be supplied 1417.8 MW of electricity at most by Tohoku NW, Chubu PG, Hokuriku T&D, Kansai T&D, Chugoku NW, Shikoku T&D, and Kyushu T&D from 7:00 to 16:00 on March 22. (The transmission margin of an interconnection line was utilized to the power exchange for TEPCO PG, and the available transfer capacity of the line was utilized to its upper limit.)
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply–demand balance due to unexpected demand growth caused by cold weather. An upper reservoir pond of pumped storage hydropower plant, which has an ultimate supply–demand balancing function, may dry up due to further demand growth; further supply–demand tightness is likely to occur. The Organization shall intermittently issue additional instructions for power exchange for tight supply–demand to restore the water level of the upper reservoir pond.
18	Issued at	9:39 on March 22, 2022
	Instruction	・Hokkaido NW shall supply 613.6 MW of electricity at most to Tohoku NW from 10:30 to 16:00 on March 22. ・Tohoku NW shall be supplied 613.6 MW of electricity at most by Hokkaido NW from 10:30 to 16:00 on March 22
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a supply capacity shortage in Tohoku NW regional service area due to earthquqke occurred on March 16, and unexpected demand growth triggered by cold weather.
19	Issued at	14:18 on March 22, 2022
	Instruction	・Hokkaido NW shall supply 95.9 MW of electricity at most to Tohoku NW from 16:00 to 17:00 on March 22. ・Tohoku NW shall be supplied 95.9 MW of electricity at most by Hokkaido NW from 16:00 to 17:00 on March 22
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a supply capacity shortage in Tohoku NW regional service area due to earthquqke occurred on March 16, and unexpected demand growth triggered by cold weather.
20	Issued at	14:18 on March 22, 2022
	Instruction	・Hokkaido NW shall supply 327.4 MW of electricity at most to TEPCO PG from 17:00 to 24:00 on March 22. ・Chubu PG shall supply 300 MW of electricity to TEPCO PG from 16:00 to 24:00 on March 22. ・Chugoku NW shall supply 100 MW of electricity at most to TEPCO PG from 16:00 to 24:00 on March 22. ・Shikoku T&D shall supply 200 MW of electricity at most to TEPCO PG from 16:00 to 24:00 on March 22. ・Kyushu T&D shall supply 200 MW of electricity at most to TEPCO PG from 16:30 to 24:00 on March 22. ・TEPCO PG shall be supplied 927.4 MW of electricity at most by Hokkaido NW, Chubu PG, Chugoku NW, Shikoku T&D, and Kyushu T&D from 16:00 to 24:00 on March 22. (The transmission margin of an interconnection line was utilized to the power exchange for TEPCO PG, and the available transfer capacity of the line was utilized to its upper limit.)
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply–demand balance due to unexpected demand growth caused by cold weather. An upper reservoir pond of pumped storage hydropower plant, which has an ultimate supply–demand balancing function, may dry up due to further demand growth; further supply–demand tightness is likely to occur. The Organization shall intermittently issue additional instructions for power exchange for tight supply–demand to restore the water level of the upper reservoir pond.

21	Issued at	23:19 on March 22, 2022
	Instruction	・Hokkaido NW shall supply 200 MW of electricity at most to TEPCO PG from 0:00 to 7:30 on March 23. ・Tohoku NW shall supply 200 MW of electricity at most to TEPCO PG from 0:00 to 9:30 on March 23. (Supply from Tohoku NW shall be implemented after securing a 3% reserve margin as its criteria of stable supply.) ・Chubu PG shall supply 300 MW of electricity to TEPCO PG from 0:00 to 11:00 on March 23. ・Kansai T&D shall supply 300 MW of electricity to TEPCO PG from 0:00 to 11:00 on March 23. ・TEPCO PG shall be supplied 1000 MW of electricity at most by Hokkaido NW, Tohoku NW, Chubu PG, and Kansai T&D from 0:00 to 11:00 on March 23. (The transmission margin of an interconnection line was utilized to the power exchange for TEPCO PG, and the available transfer capacity of the line was utilized to its upper limit.)
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity for balancing generators in the regional service area of TEPCO PG, which is necessary for supply–demand balance due to unexpected demand growth caused by cold weather. An upper reservoir pond of pumped storage hydropower plant, which has an ultimate supply–demand balancing function, may dry up due to further demand growth; further supply–demand tightness is likely to occur. The Organization shall intermittently issue additional instructions for power exchange for tight supply–demand to restore the water level of the upper reservoir pond.

Actual requests for additional supply capcity, and demand reduction by the Organization

[1]	Issued on	March 21, 2022
	Background	Due to the Fukushima Earthquake that occurred on March 16, some generators sited in the regional service areas of Tohoku EPCO NW and TEPCO PG were shut down. Furthermore, a cold wave and bad weather were forecasted in Eastern Japan on March 22. It is estimated that the supply–demand will be tight, particularly in the TEPCO PG area. In the TEPCO PG area, increasing measures for supply capacity, such as power exchange instruction by the Organization or additional generation by the GT&D companies, shall be implemented. However, due to the condition of supply capacity, temperature, and weather, further supply–demand tightness will be possible. To cope with the aforementioned condition, the Organization requests the members to implement measures for improving the supply–demand condition stated below.
	Period	March 22 (on expiry of the period, it shall be informed later).
	Requested Items	(1) For Generator III or private power installation, which is owned by the member or procured power from other entity by power purchase contract (including demand reduction [DR]), it shall generate electricity in increased capacity as possible in the regional service area with a tight supply–demand. However, if the generator has other power purchase contracts with other retail companies, such contracts will be prioritized, and generation increase will be implemented to the extent possible. (2) Each retail company must reduce its demand to the extent possible by the agreed economic DR contract or power-saving request to its customer. However, if there is a bilateral contract with other electric power suppliers, such a contract will be prioritized, and demand reduction will be implemented to the extent possible. (3) Surplus power provided by the additional generation or DR shall be traded in the day-ahead or 1-h ahead market. If such power has a bilateral contract with retail company (including economic DR contract), delivery or demand reduction shall be implemented by such a contract. Clearing shall be implemented according to the market rule or the bilateral contract.
	Additional Notice	・The corresponding area is the TEPCO Power Grid area. ・For correspondence to the aforementioned request, life safety shall be prioritized, particularly operational safety and compliance with laws and ordinances. ・Please comply with the corresponding regulatory direction for operating generators, which is deemed an environmental regulation. ・The Organization shall not be liable to the cost (including imbalance cost) or loss incurred by responding to the aforementioned request.
[2]	Issued on	March 22, 2022
	Request	The Organization newly requested the measures for coping with the tight supply-demand adding Tohoku EPCO Network for the corresponding area.
[3]	Issued on	March 22, 2022 at 14:30
	Request	The Organization newly requested the measures for coping with the tight supply-demand based on the additional about 5% (2000 MW/h) saving needed from 15:00 to 20:00 on March 22 in the TEPCO PG area.
[4]	Issued on	March 22, 2022 at 23:30
	Request	The Organization newly requested the measures for coping with the tight supply-demand based on the estimation of continuous tight supply-demand condition on March 23 in the TEPCO PG area.
	Issued on	March 23, 2022 at 11:30
	Termination Notice	The Organization has continuously issued request based on the estimate that it is likely to be tight supply-demand situation in TEPCO PG area on March 23 based on the condition which partly suspended operation of thermal power plants in Tohoku and Tokyo area due to Fukushima Earthquake occurred on March 16. Following improvement in the supply–demand condition, the Organization has announced the termination of the requests at 11:00 on March 23, according to the release of warning for tight supply-demand condition. The Organization express sincere thanks to the members who cooperated to cope with the condition, and also express our deep thanks to the electric power suppliers other than our members. The Organization shall continuously strive to ensure stable supply, coping with the government and GT&D companies.

Organization for Cross-regional
Coordination of Transmission Operators,
Japan
http://www.occto.or.jp/en/index.html