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

Actual Data for Fiscal Year 2022

December 2023

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 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 before the publication of the Annual Report because of the completion of actual data collection up to fiscal year 2022.

SUMMARY

This report reviews the outlook for electricity supply–demand and cross-regional interconnection lines in fiscal year 2022 (FY 2022), based on the provisions of Article 181 of the Operational Rules of the Organization.

This report comprises of two parts: (i) the electricity supply and demand and (ii) the interconnection line.

Regarding supply and demand, the peak demand nationwide (16,608 × 10^4 kW), was recorded in August, and the monthly peak electric energy requirement nationwide (332,978 GWh) was recorded in January.

The reserve margins against summer and winter peak demands were 11.8% and 10.1%, respectively.

The Organization for Cross-regional Coordination of Transmission Operators, Japan (The Organization) issued power-exchange instructions 24 times, with 18 of them being issued for improvements in supply - demand tightness because of an unusual early summer heatwave in June 2022.
In addition, long-cycle frequency control was implemented 174 times during the year.

Instructions for output shedding of renewable-energy generating facilities were issued for 294,151 MW in FY 2022, a value that showed an increase from 252,834 MW reported in the previous year. The actual output shed based on the current day instruction totaled 147,166 MW in FY 2022.

The total volume of utilization of the interconnection lines was 124,975 GWh, which is a significant increase from the 111,076 GWh in FY 2021.

In FY 2022, 423 events were reported for interconnection line maintenance–requiring 605 days of work.

We hope that the information in this report proves useful.

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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 Definition of a Season

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

A regional service area is described as 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.

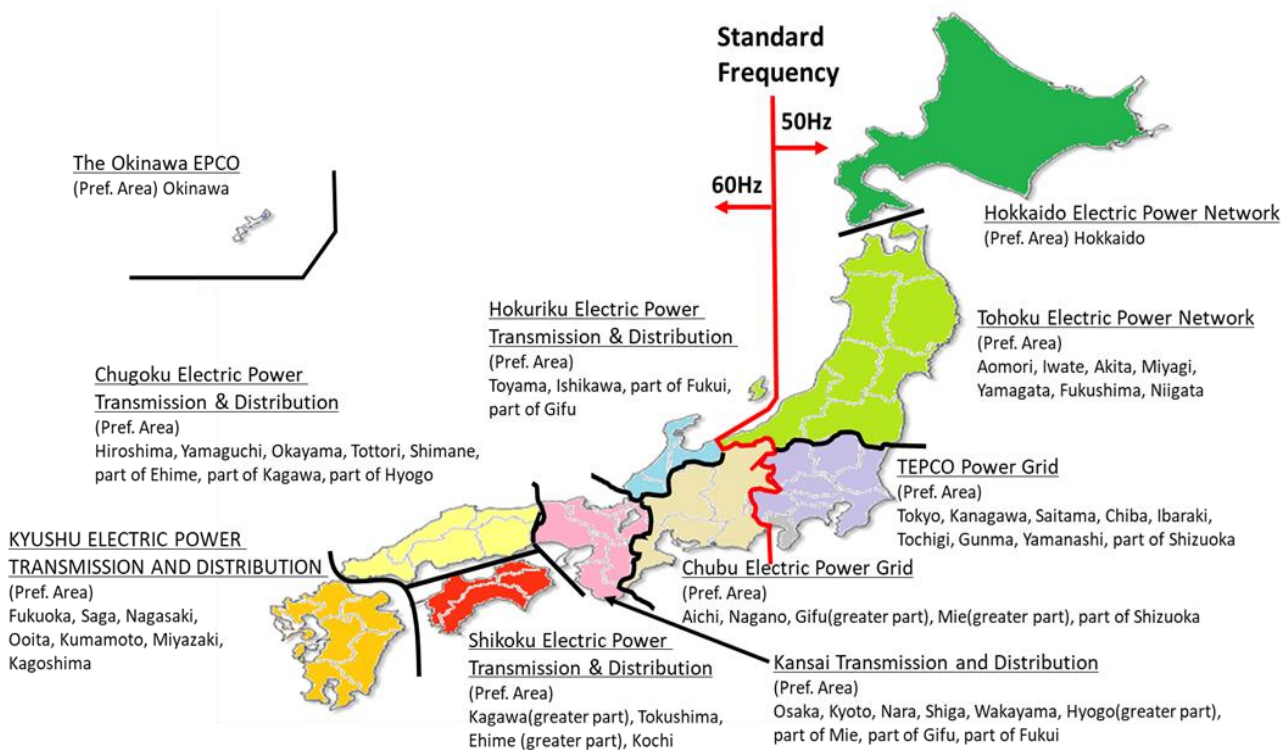


Figure 1-1: The 10 Regional Service Areas in Japan and their Prefectural Distribution

(2) Definition of Seasons

This report divides the seasons into the summer ranging from July to September, and winter ranging from December to February.

This report refers to the outlook of actual weather for the previous year toin the Seasonal Climate Report over Japan prepared by the Japan Meteorological Agency (JMA). JMA defines the summer and winter periods, as June–August, and December–February, respectively, clearly showing a difference in the definition of the summer period differ between this from that defined in the current report and JMA.

2. Outlook for Actual Weather Nationwide

(1) Weather During the Summer Period (from June to August 2022)

Characteristics of the actual weather from June to August 2022 have been published on the JMA website. Table 1-1 shows anomalies in temperature and precipitation ratios during the period.

- Seasonal mean temperatures were significantly above normal in eastern and western Japan, and Okinawa/Amami, because warm-air tended to cover the regions through the summer. In western Japan, the temperature was tied for the highest since 1946.
- Seasonal precipitation amounts were significantly above normal on the Sea of Japan side and the Pacific side of northern Japan, and above normal on the Sea of Japan side of eastern Japan and the Pacific side of eastern Japan, because the regions were repeatedly affected by moist air inflow and stationary fronts. The end of the Baiu was not detected in Tohoku and Hokuriku regions.

Table 1-1: Anomalies in temperature, precipitation, and sunshine duration according to the weather from June to August 2022

Weather Region	Mean Temperature Anomaly[°C]	Precipitation Ratio[%]	Sunshine Duration Ratio[%]
Northern	+0.9	142	96
Eastern	+0.9	111	104
Western	+0.9	83	106
Okinawa/Amami	+0.6	85	107

Source: Japan Meteorological Agency (JMA), Tokyo Climate Center.
Seasonal Climate Report over Japan for Summer (FY 2022).
https://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=8&year=2022
https://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=8&year=2022

(2) Weather During the Winter Period (from December 2022 to February 2023)

Characteristics of the actual weather from December 2022 to February 2023 have been published on the JMA website. Table 1-2 shows the anomalies in temperature and the ratios of rainfall and snowfall during the study period.

- Seasonal temperatures were below normal in northern Japan due to cold air inflow. On the other hand, seasonal temperatures were above normal in Okinawa/Amami, which was easily covered by warm-air.
- Seasonal precipitation amounts were above normal on the Sea of Japan side of eastern Japan due to winter monsoon. Seasonal precipitation amounts were below normal on the Pacific side of northern/eastern/western Japan and the Sea of Japan side of western Japan due to less passage of low-pressure systems and fronts.
- Seasonal sunshine durations were above normal on the Sea of Japan side and the Pacific side of western Japan due to high-pressure systems that frequently covered the regions.

Table 1-2: Anomalies in temperature, precipitation, sunshine duration and snowfall based on the weather from December 2022 to February 2023

Weather Region	Mean Temperature Anomaly[°C]	Precipitation Ratio[%]	Sunshine Duration Ratio[%]	Snowfall Ratio[%]
Northern	-0.3	93	100	101
Eastern	+0.3	70	102	64
Western	+0.0	85	105	202
Okinawa/Amami	+0.3	104	94	-

Source：Japan Meteorological Agency, Tokyo Climate Center.
Seasonal Climate Report over Japan for Winter (FY 2022).
https://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=2&year=2023
https://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=2&year=2023

3. Actual Nationwide Peak Demand

"Peak demand" refers to the highest consumption of electricity during a given period. In the current report, "peak demand" refers to the maximum hourly electric-energy requirement.[1] Tables 1-3 shows the monthly peak demand for regional-service areas in FY 2022. Figures 1-2 and 1-3 show the nationwide monthly peak demand for FY 2022 and the actual annual peak demand from FY 2016 to 2022, respectively. Table 1-4 presents the actual nationwide peak demand at the sending-end data since FY 2016.

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

The maximum monthly peak demand nationwide for FY 2022 was registered as 16,608 × 10^4 kW in August, which was higher than that recorded in the previous year by 0.9%, and lower than that recorded in FY 2020 by 0.2%; the data for FY 2020 comprised the peak data for 7 years as they were recorded as the sending-end data.

Table 1-3: Monthly peak demand for regional service-areas[2]

[10^4kW]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	396	346	357	400	395	374	395	444	494	569	514	433
Tohoku	1,087	1,020	1,259	1,326	1,377	1,240	1,043	1,092	1,374	1,524	1,359	1,188
Tokyo	4,161	3,821	5,487	5,546	5,930	4,884	4,174	3,692	4,685	5,137	5,179	3,814
Chubu	1,780	1,843	2,450	2,471	2,550	2,405	1,947	1,749	2,229	2,464	2,269	1,937
Hokuriku	381	365	491	497	522	491	390	363	520	542	505	405
Kansai	1,798	1,844	2,578	2,695	2,721	2,562	2,070	1,769	2,431	2,559	2,378	2,000
Chugoku	739	726	965	994	1,060	1,002	824	763	1,050	1,030	971	826
Shikoku	326	348	473	501	518	483	419	345	502	505	448	388
Kyushu	1,016	1,083	1,490	1,553	1,569	1,498	1,248	1,083	1,506	1,574	1,309	1,174
Okinawa	120	135	151	161	163	150	139	110	97	100	92	105
Nationwide	11,400	11,216	15,651	15,875	16,608	14,749	12,549	10,970	14,337	15,967	14,601	12,076

[1] Demand in this report includes the demand which connects to the network of general transmission and distribution company, and excludes the one which connects to specified transmission and distribution system, or consumption of privately-owned generating facility.

[2] "Nationwide peak demand" refers to 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.

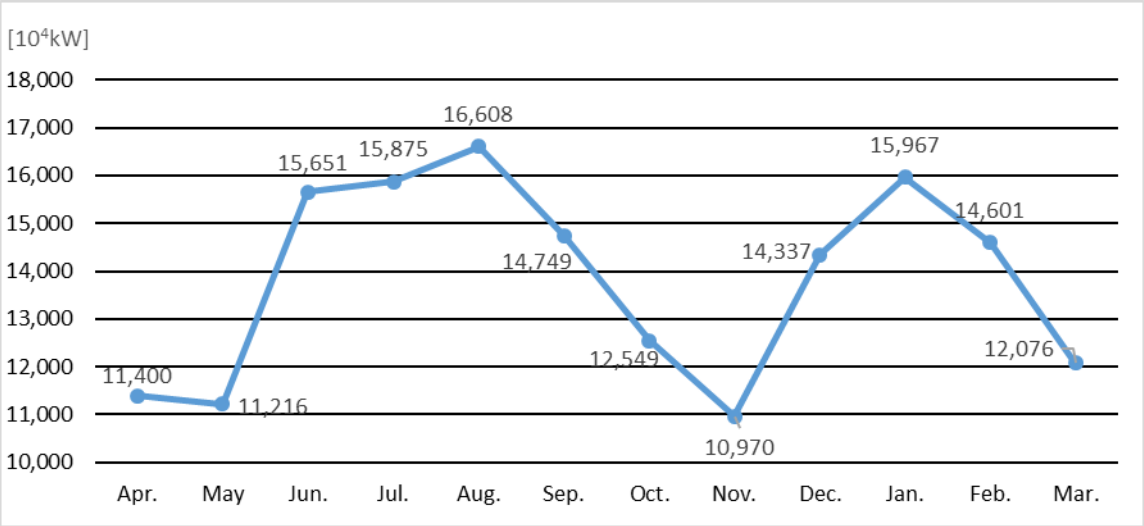


Figure 1-2: Nationwide monthly peak demand

Table 1-4: Actual annual peak demand (FY 2016–2022, at the sending-end)

[10^4 kW]

FY	2016	2017	2018	2019	2020	2021	2022
Nationwide	15,589	15,577	16,482	16,461	16,645	16,460	16,608

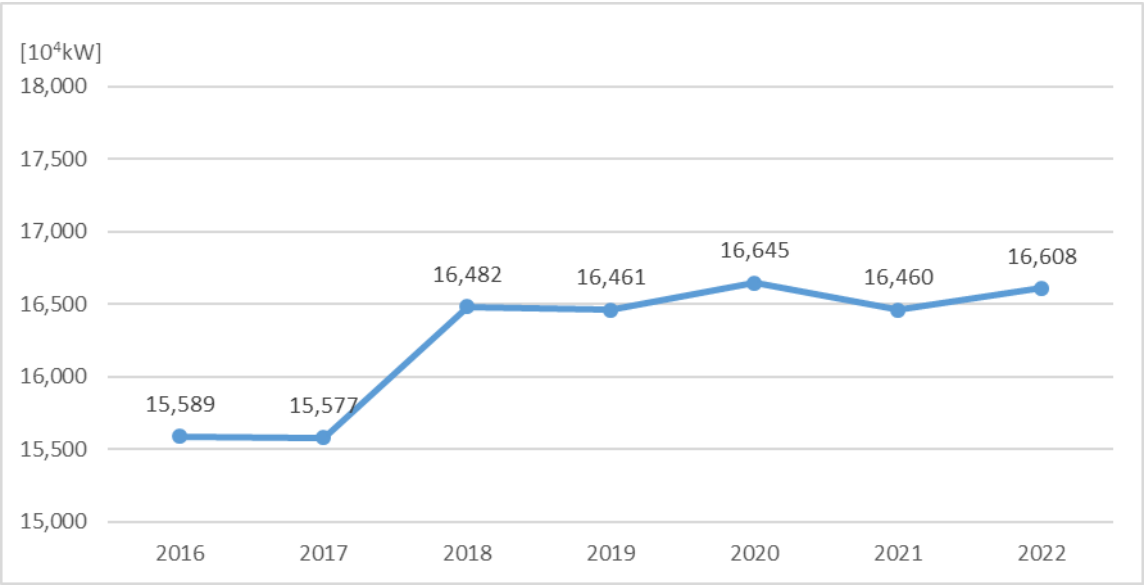


Figure 1-3: Actual annual peak demand (Nationwide)

4. Actual Nationwide Electric Energy Requirements

Table 1-5 shows the monthly electric-energy requirements for regional-service areas in FY 2022. Figures 1-4 and 1-5 show the nationwide monthly electric-energy requirements and the actual annual electric-energy requirements from FY 2016 to 2022, respectively. Table 1-6 presents the actual annual electric-energy requirement recorded in the sending-end data since FY 2016.
The values in red and blue represent the maximum and minimum monthly energy requirements for each regional-service area, respectively.
The actual annual nationwide electric-energy requirement for FY 2022 was 870,049 GWh, which was lower than that for the previous year by 1.7%, and lower than that for FY 2017 by 3.4%, which was the highest during 7 years since they were recorded at the sending-end data.

Table 1-5: Monthly and annual electric energy requirements for the regional service-areas[3]

[GWh]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido	2,325	2,170	2,113	2,348	2,330	2,176	2,288	2,471	3,105	3,259	2,873	2,621	30,078
Tohoku	6,169	5,925	6,175	6,971	6,798	6,277	6,198	6,377	7,967	8,313	7,393	6,750	81,315
Tokyo	20,693	20,358	22,623	27,104	26,746	23,162	21,047	20,896	25,386	26,709	23,492	21,429	279,645
Chubu	9,777	9,508	10,702	12,077	12,108	11,388	10,002	10,014	11,850	12,072	11,045	10,395	130,938
Hokuriku	2,178	2,054	2,259	2,539	2,497	2,282	2,119	2,175	2,748	2,801	2,549	2,342	28,543
Kansai	10,166	10,141	11,340	13,435	13,736	12,006	10,473	10,331	12,809	13,252	12,083	11,055	140,827
Chugoku	4,353	4,238	4,638	5,331	5,528	4,868	4,424	4,409	5,580	5,614	4,974	4,643	58,600
Shikoku	1,968	1,923	2,200	2,540	2,644	2,266	2,081	2,043	2,550	2,620	2,332	2,166	27,331
Kyushu	6,066	6,095	6,896	8,251	8,389	7,079	6,275	6,087	7,919	8,022	6,862	6,592	84,533
Okinawa	594	648	775	921	929	809	708	610	587	583	508	566	8,238
Nationwide	64,289	63,060	69,721	81,517	81,705	72,313	65,616	65,415	80,500	83,245	74,110	68,558	870,049

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

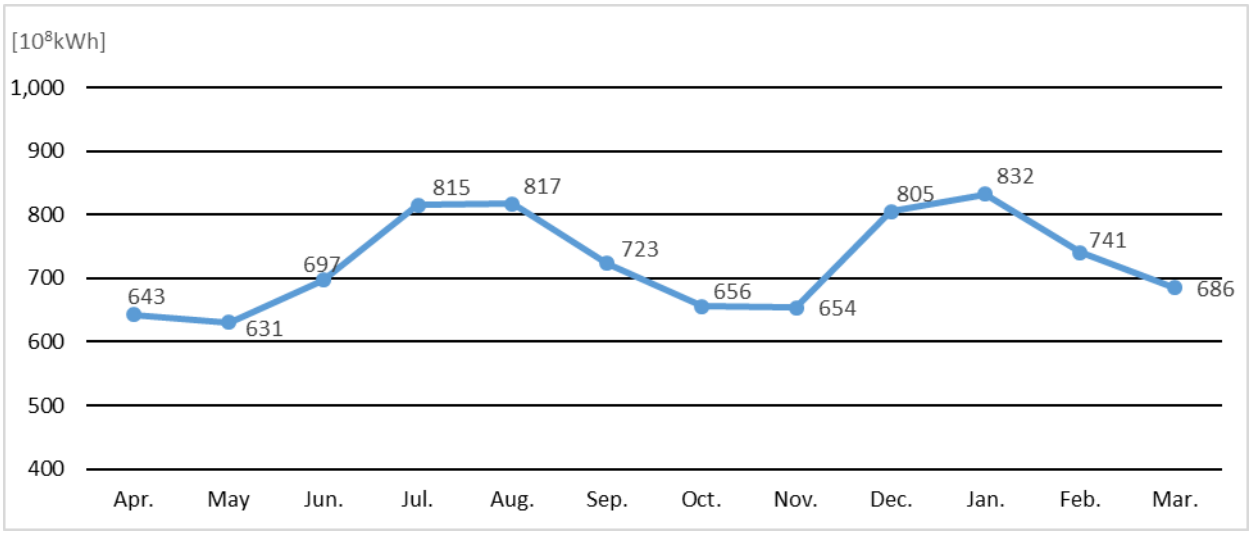


Figure 1-4: Nationwide monthly electric energy requirements

Table 1-6: Actual annual electric energy requirement (FY 2016–2022, at the sending-end)

[GWh]

FY	2016	2017	2018	2019	2020	2021	2022
Nationwide	890,451	900,902	896,473	878,383	867,842	885,171	870,049

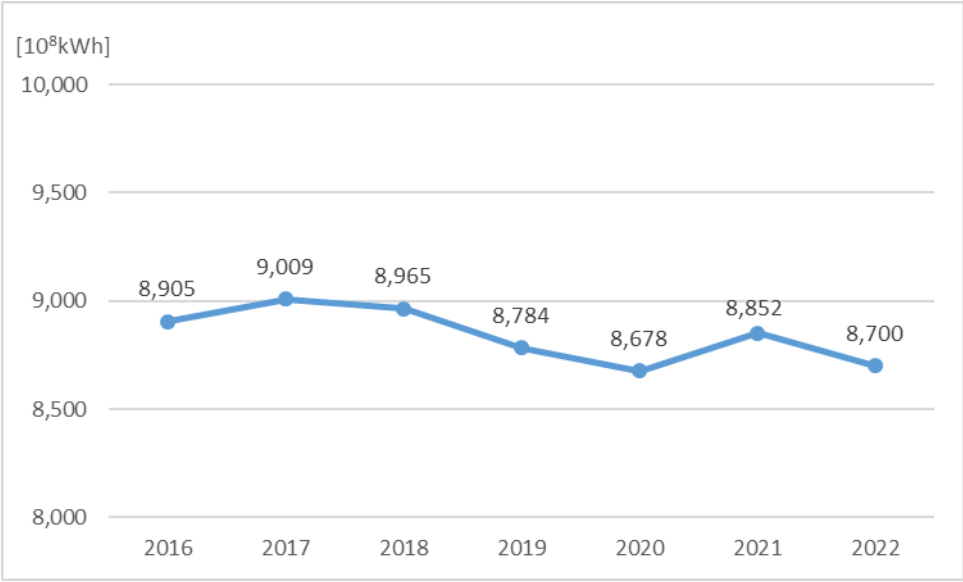


Figure 1-5: Actual annual electric energy requirements (Nationwide)

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 2022, and 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 represent the highest and lowest load factors, respectively, for each regional-service area.

The nationwide annual load factor for FY 2022 was 59.8%, which is lower than that for the previous year by 2.6% and lower than that for FY 2017 by 9.4%, thus showing the maximum figure over a period of 7 years since the sending-end data was begun to be recorded. This fall could be attributable to an increase in the peak demand owing to the heat wave, despite the decrease in the electric-energy requirement due to the delayed recovery of economic activities and mild winter conditions.

Table 1-7: Monthly and annual load factors for the regional service-areas[4]

[%]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido	81.6	84.3	82.3	78.9	79.3	80.7	77.9	77.3	84.6	77.0	83.1	81.4	60.3
Tohoku	78.8	78.1	68.1	70.7	66.4	70.3	79.9	81.1	78.0	73.3	81.0	76.4	60.9
Tokyo	69.1	71.6	57.3	65.7	60.6	65.9	67.8	78.6	72.8	69.9	67.5	75.5	53.8
Chubu	76.3	69.4	60.7	65.7	63.8	65.8	69.0	79.5	71.5	65.8	72.4	72.1	58.6
Hokuriku	79.5	75.6	63.8	68.6	64.3	64.6	73.0	83.3	71.0	69.5	75.2	77.6	60.1
Kansai	78.5	73.9	61.1	67.0	67.8	65.1	68.0	81.1	70.8	69.6	75.6	74.3	59.1
Chugoku	81.8	78.5	66.8	72.1	70.1	67.5	72.2	80.2	71.4	73.3	76.3	75.6	63.1
Shikoku	83.7	74.2	64.7	68.2	68.6	65.1	66.8	82.4	68.3	69.8	77.4	75.1	60.2
Kyushu	82.9	75.7	64.3	71.4	71.9	65.6	67.6	78.1	70.7	68.5	78.0	75.4	61.3
Okinawa	68.8	64.7	71.5	76.8	76.9	74.8	68.3	76.9	81.6	78.1	82.2	72.4	57.9
Nationwide	78.3	75.6	61.9	69.0	66.1	68.1	70.3	82.8	75.5	70.1	75.5	76.3	59.8

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

$$\text{Monthly Load Factor (\%)} = \frac{\text{Monthly Energy Requirement}}{\text{Monthly Peak Demand} \times \text{Calendar Hours (24h * monthly days)}}$$

$$\text{Annual Load Factor (\%)} = \frac{\text{Annual Energy Requirement}}{\text{Annual Peak Demand} \times \text{Calendar Hours (24h * Annual days)}}$$

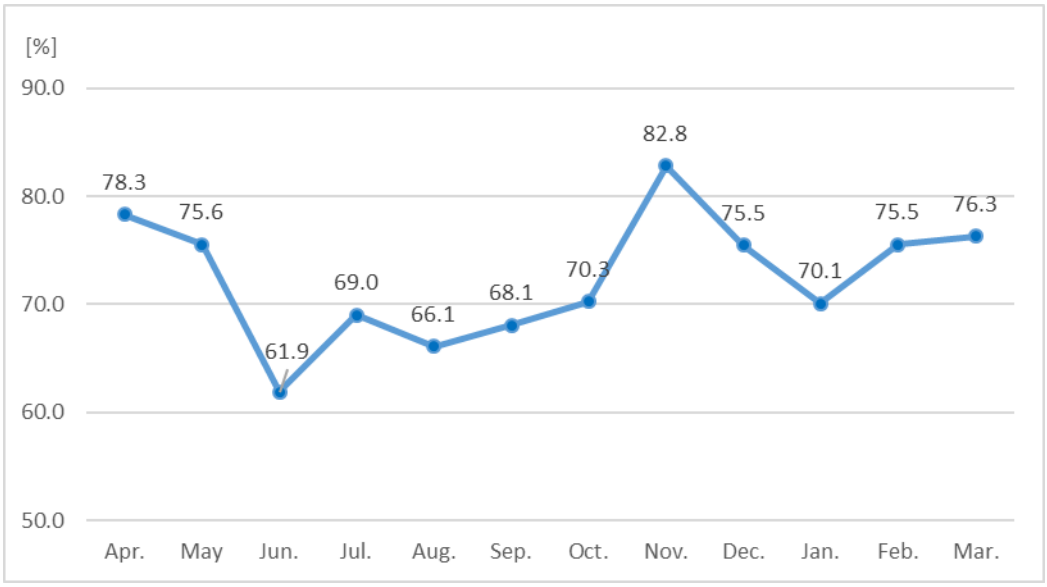


Figure 1-6: Nationwide monthly load factor

Table 1-8: Actual annual load factor (FY 2016–2022)

[%]

FY	2016	2017	2018	2019	2020	2021	2022
Nationwide	65.8	66.0	62.1	60.7	59.5	61.4	59.8

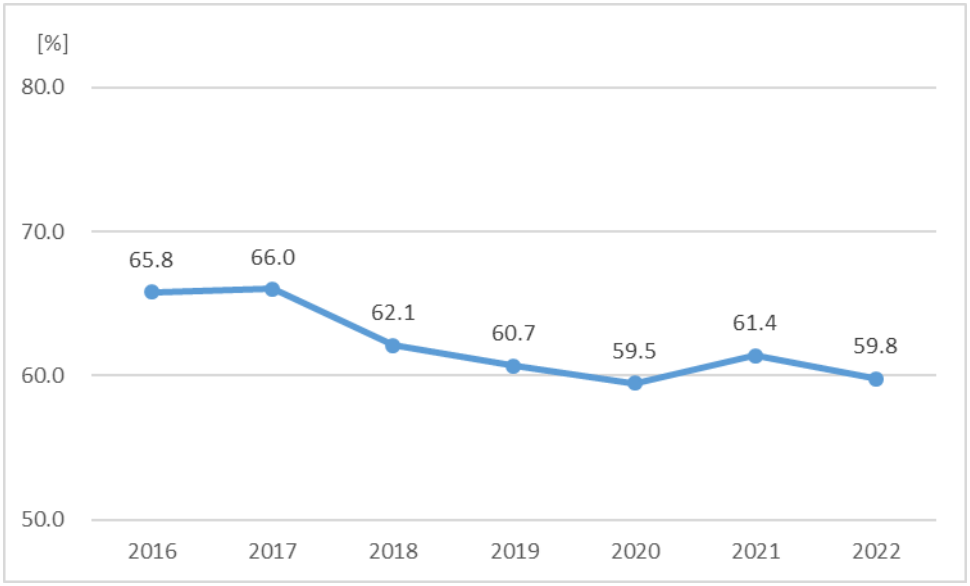


Figure 1-7: Actual annual load factor (Nationwide)

6. Nationwide Supply–Demand Status During 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 2022.

The actual nationwide summer peak demand for FY 2022 was 16,608 × 10^4 kW, which was registered at 14:00 on August 2, against the supply capacity of 18,561 × 10^4 kW with a reserve margin of 11.8%. This was the lowest figure logged for the past 7 years since data were recorded at the sending-end. The lowest reserve margin for the areal-summer peak demand was 5.7%, which was registered at 15:00 on August 1 in the Hokuriku area. 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 at the nationwide and regional-service areas[5]

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	400	7/29	Fri.	16:00~17:00	28.9	440	39	9.8	8,178	85.2
Tohoku	1,377	8/1	Mon.	11:00~12:00	33.4	1,586	209	15.2	26,530	80.3
Tokyo	5,930	8/2	Tue.	13:00~14:00	35.9	6,469	539	9.1	109,898	77.2
Chubu	2,550	8/2	Tue.	14:00~15:00	37.5	2,739	189	7.4	47,700	77.9
Hokuriku	522	8/1	Mon.	14:00~15:00	35.8	552	30	5.7	9,594	76.6
Kansai	2,721	8/3	Wed.	14:00~15:00	35.8	3,107	385	14.2	50,713	77.7
Chugoku	1,060	8/3	Wed.	14:00~15:00	35.2	1,135	75	7.0	20,486	80.5
Shikoku	518	8/3	Wed.	13:00~14:00	36.9	611	93	18.0	9,741	78.4
Kyushu	1,569	8/2	Tue.	13:00~14:00	36.9	1,810	241	15.4	30,216	80.3
Okinawa	163	8/26	Fri.	13:00~14:00	33.3	208	46	28.0	3,257	83.5
Nationwide	16,608	8/2	Tue.	13:00~14:00	-	18,561	1,956	11.8	314,861	79.0

[5] The daily maximum and mean temperatures were provided by the JMA on the basis of 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 2016–2022)

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
2022	16,608	8/2	Tue.	13:00～14:00	-	18,561	1,956	11.8	314,861	79.0

(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 2022. Table 1-12 presents the winter peak supply–demand status data since FY 2016.

The actual nationwide winter peak demand for FY 2022 was 15,967 × 10^4 kW, which was recorded at 10:00 on January 25, against a supply capacity of 17,587 × 10^4 kW, with a reserve margin of 10.1%.

The lowest reserve margin for the areal-winter peak demand was 4.7%, which was registered at 10:00 on January 25 in the Kyushu area.

Table 1-11: Supply–demand status during the winter peak demand period for regional service areas[6]

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	569	1/25	Wed.	09:00~10:00	-11.0	613	44	7.7	12,448	91.1
Tohoku	1,524	1/25	Wed.	09:00~10:00	-5.4	1,621	97	6.4	33,196	90.8
Tokyo	5,179	2/10	Fri.	11:00~12:00	1.9	5,683	504	9.7	102,152	82.2
Chubu	2,464	1/25	Wed.	09:00~10:00	-1.1	2,668	203	8.3	49,824	84.2
Hokuriku	542	1/25	Wed.	10:00~11:00	-4.1	582	40	7.4	11,557	88.9
Kansai	2,559	1/27	Fri.	11:00~12:00	3.3	2,871	312	12.2	51,082	83.2
Chugoku	1,050	12/23	Fri.	09:00~10:00	-0.6	1,136	86	8.2	22,188	88.0
Shikoku	505	1/25	Wed.	09:00~10:00	0.4	562	58	11.4	10,604	87.6
Kyushu	1,574	1/25	Wed.	09:00~10:00	-0.3	1,648	74	4.7	32,351	85.6
Okinawa	100	1/28	Sat.	19:00~20:00	12.4	136	36	35.7	2,074	86.2
Nationwide	15,967	1/25	Wed.	09:00~10:00	-	17,587	1,620	10.1	332,978	86.9

[6] See footnote 5.

Table 1-12: Actual supply–demand status of the winter peak demand (FY 2016–2022)

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
2022	15,967	1/25	Wed.	09:00～10:00	-	17,587	1,620	10.1	332,978	86.9

7. Supply–Demand Status During the Actual Least Cross-regiional Reserve Margin Period

The cross-regional reserve margin is calculated to level the reserve margin within the total transfer capacity of the interconnection line around adjacent areas. In this calculation, the supply capacity of a certain area within the volume of available transfer capacity (ATC) of the interconnection line is transferred to another area at the same level. If the ATC of the interconnection line reaches zero and a constraint is introduced in the line, the cross-regional reserve margin varies from that of the adjacent area.

Based on the review of the imbalance-clearing scheme implemented from FY 2022, the Organization started publishing data on the cross-regional reserve margin from March 24, 2023 on the cross-regional network system and cross-regional reserve margin system.[7]

Tables 1-13 and 1-14 show the supply-demand status at the actual least cross-reserve margin,[8] and the cross-reserve margin of 3% under in the summer and winter peaking periods, respectively. In addition, record did not show any occurences below 3% of cross-reserve margin in the winter peaking period.

Table 1-13 Supply–demand status at the actual least cross-regional reserve margin in the summer peaking period

FY	Occurrence Date & Time		Block	Block			Cross-regional
				Demand(MW)	Supply capacity(MW)	Reserve capacity(MW)	Reserve margin(%)
2022	2022/6/29	09:00～9:30	Tokyo	47,456	48,650	1,194	2.52
2022	2022/7/1	09:00～9:30	Tokyo	50,346	51,776	1,430	2.84
2022	2022/7/1	08:30～9:00	Tokyo	47,416	48,824	1,408	2.97

Table 1-14 Supply–demand status at the actual least cross-regional reserve margin in the winter peaking period

FY	Occurrence Date & Time		Block	Block			Cross-regional
				Demand(MW)	Supply capacity(MW)	Reserve capacity(MW)	Reserve margin(%)
2022	2022/12/12	01:30～2:00	Hokkaido	3,972	4,167	195	4.91

[7] https://web-kohyo.occto.or.jp/kks-web-public/ (written only in Japanese)

[8] The actual least cross-regional reserve margin is the figure of gate closure (one hour before actual supply–demand), and not the actual supply–demand figure.

8. Nationwide Lowest Demand Period

Table 1-15 shows the status of the lowest demand period for nationwide and regional-service areas in FY 2022 and Table 1-16 shows the actual, annual lowest demands at the sending-end from FY 2016 to FY 2022.
The lowest demand in FY 2022 was recorded as 6,239 × 10^4 kW, which was lower than that of the previous year by 1.5% but higher than that of FY 2020 by 2.9%.

Table 1-15: Lowest demand period for nationwide and regional-service areas[9]

	Least Demand [10^4kW]	Occurrence Date & Time			Daily Mean Temperature [℃]	Daily Energy Supply [10^4kWh]
Hokkaido	234	8/22	Mon.	01:00~02:00	23.1	7,553
Tohoku	596	5/6	Fri.	00:00~01:00	17.4	18,169
Tokyo	1,953	5/5	Thur.	06:00~07:00	19.8	56,229
Chubu	859	5/6	Fri.	01:00~02:00	19.6	26,020
Hokuriku	200	5/5	Thur.	00:00~01:00	18.6	5,419
Kansai	989	5/5	Thur.	01:00~02:00	19.4	27,517
Chugoku	437	5/30	Mon.	01:00~02:00	19.6	14,030
Shikoku	190	5/5	Thur.	00:00~01:00	18.4	5,293
Kyushu	623	5/5	Thur.	01:00~02:00	20.5	17,193
Okinawa	60	3/8	Wed.	01:00~02:00	19.4	1,772
Nationwide	6,239	5/5	Thur.	01:00~02:00	-	172,443

Table 1-16: Actual annual lowest demand (FY 2016–2021, at the sending-end)

[10^4 kW]

FY	2016	2017	2018	2019	2020	2021	2022
Nationwide	6,516	6,477	6,496	6,398	6,065	6,332	6,239

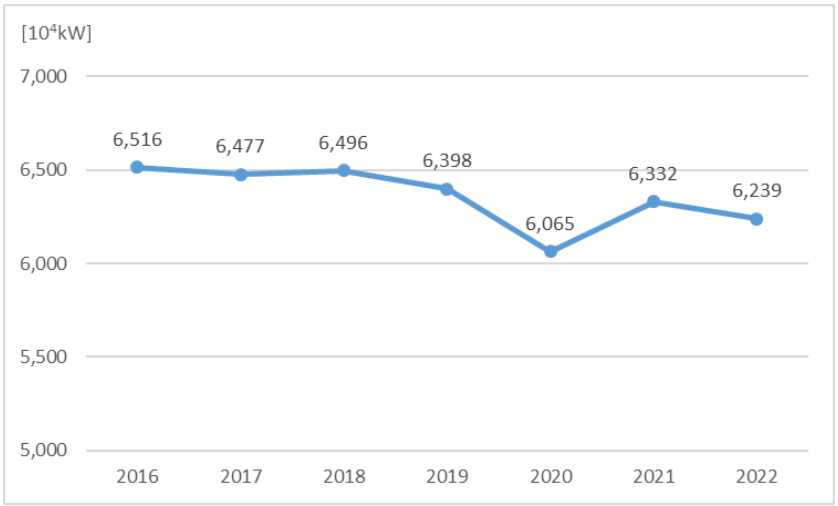


Figure 1-8: Actual annual lowest demand (Nationwide)

[9] See the former half of footnote 5.

9. Nationwide Peak Daily Energy Supply

Table 1-17 shows the peak daily energy supply in summer nationwide and for regional-service areas in FY 2022 (July–September 2022) and Table 1-18 shows the peak daily energy supply in winter nationwide and for regional-service areas in FY 2022 (from December 2022 to February 2023), respectively.[10]

Table 1-17: Summer peak daily energy supply nationwide and for regional-service areas

Area	Peak Daily Energy Supply [10^4kWh]	Occurrence Date		Daily Mean Temperature [˚C]
Hokkaido	8,204	8/9	Tue.	24.9
Tohoku	26,122	8/2	Tue.	29.2
Tokyo	110,259	8/3	Wed.	31.5
Chubu	47,700	8/2	Tue.	32.6
Hokuriku	9,793	8/2	Tue.	30.8
Kansai	50,713	8/3	Wed.	31.0
Chugoku	20,486	8/3	Wed.	30.8
Shikoku	9,741	8/3	Wed.	31.9
Kyushu	30,226	8/3	Wed.	31.5
Okinawa	3,258	8/23	Tue.	30.8
Nationwide	314,861	8/2	Tue.	-

Table 1-18: Winter peak daily energy supply nationwide and for regional-service areas

Area	Peak Daily Energy Supply [10^4kWh]	Occurrence Date		Daily Mean Temperature [˚C]
Hokkaido	12,448	1/25	Wed.	-7.8
Tohoku	33,196	1/25	Wed.	-0.7
Tokyo	107,038	1/25	Wed.	0.7
Chubu	49,824	1/25	Wed.	2.0
Hokuriku	11,557	1/25	Wed.	-0.4
Kansai	51,797	1/25	Wed.	3.4
Chugoku	22,188	12/23	Fri.	0.4
Shikoku	10,604	1/25	Wed.	1.9
Kyushu	32,351	1/25	Wed.	1.7
Okinawa	2,074	1/28	Sat.	14.4
Nationwide	332,978	1/25	Wed.	-

[10] See the former half of footnote 5.

10. 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), the Organization may require members, such as EPCOs, to undertake certain necessary actions for improvement in the status of the electricity supply–demand if it has worsened or is likely to worsen from the point of view of electricity business conducted by a member.

During FY 2022, the Organization issued instructions to GT&D companies on 24 occasions to exchange power according to the provisions of items 1–3, paragraph 1 of Article 111 of the Operational Rules (Table 1-19). The Organization issued instructions to 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.

For detailed instructions, please refer to <Reference> Details of Actual Power Exchange Instructions Issued by the Organization.[11] Some specific instructions are listed as follows.

(1) TEPCO Power Grid, Incorporated (TEPCO PG)

June 27: 1350 MW at most, following unexpected demand growth due to high temperature, recovery of reservoir water level of upper pond for pumped storage hydro generator, four instructions

(2) TEPCO PG

June 28: 1100 MW at most, following unexpected demand growth due to high temperature, recovery of reservoir water level of upper pond for pumped storage hydro generator, two instructions

(3) TEPCO PG

June 29: 880 MW at most, following unexpected demand growth due to high temperature, recovery of reservoir water level of upper pond for pumped storage hydro generator, eight instructions

(4) TEPCO PG

June 30: 650 MW at most, following unexpected demand growth due to high temperature, and recovery of reservoir water level in the upper pond for pumped storage hydro generator, four instructions

(5) TEPCO PG

July 1: 600 MW at most, following unexpected demand growth due to high temperature, and decreasing output of solar power generator due to weather change, two instructions

(6) TEPCO PG

August 2: 1260 MW at most, following unexpected demand growth due to high temperature, recovery of reservoir water level in the upper pond for pumped storage hydro generator, one instruction

(7) TEPCO PG

August 3: 720 MW at most, following the unexpected demand growth due to high temperature, one

[11] https://www.occto.or.jp/oshirase/shiji/jukyu_taiou_2022.html (in Japanese only)

instruction

(8) Kyushu Electric Power Transmission and Distribution (Kyushu T&D)

September 12: 700 MW at most, following the unexpected demand growth due to high temperature, one instruction

(9) Kyushu T&D

September 13: 400 MW at most, following the unexpected demand growth due to high temperature, one instruction

Table 1-19: Actual instructions to GT&D companies issued by the Organization (FY 2015–2022)

[occasions]

FY	2015	2016	2017	2018	2019	2020	2021	2022
Nationwide	2	2	10	25	6	226	21	24

Controls

The Organization implemented long-cycle cross-regional frequency controls[12] to send surplus electric energy generated from renewable-energy-generating facilities in the Hokkaido NW, Tohoku NW, Chubu PG, Chugoku NW, Shikoku T&D, and Kyushu T&D to other areas through cross-regional interconnection lines based on their ATC, according to the provisions of Article 132 of the Operational Rules. The Organization received a request from each EPCO to control the inability to reduce the power supply.[13] Such controls were implemented on 174 occasions during FY 2022.

[12] This refers to frequency control by using 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.

[13] 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. Therefore, 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."

11. Output Shedding of Renewable-Energy-Generating Facilities Operated by Electric Power Companies Other Than GT&D Companies

GT&D companies may instruct renewable-energy-generating facilities owned by other EPCOs to shed their output in the case of an unexpected oversupply of demand for its regional-service areas after shedding the output of generators, other than the renewable-energy-generating facilities of 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 1-20 – 1-26 show the actual output shedding of renewable-energy-generating facilities in FY 2022 from Hokkaido to Okinawa, respectively.[14] Table 1-27 shows the nationwide results. Unlike the data provided in Table 1-25, the "Shedding Instructed" column indicates the total effect of the instructions issued on both the previous day, which implementes the shedding by offline control, and the current day, which implements the shedding by online control. The actual shed capacity for a particular month is expressed within parentheses for that month. The values 0 and 0.0 within parentheses indicates that there was no output shedding for that month. In addition, the number of instructions on the current day does not included those registered for the previous day because certain instruction for a day could have been issued because of the changes in the supply–demand condition compared to that of the previous day. Table 1-25 shows the necessary output shedding conditions for the isolated Kyushu islands. The shedding is calculated by deducting the demand from the supply capacity and was implemented through offline control.

Output shedding of renewable-energy-generating facilities was implemented in cases where the balancing capacity for redundancy may prove insufficient. On the Kyushu mainland, the shedding period ranged from 8:00 to 16:00, except for a few cases.

While increasing the capacity of variable renewable energy sources, such as solar and wind power, instructions for output shedding to the renewable energy generating facilities were issued 429 times, summing up to 294,151 MW of the output shedding in FY 2022, which shows an increase from 252,834 MW of the previous year. The actual output shed on the current day instruction totaled 147,166 MW in FY 2022, which shows an increase from 116,980 MW in FY 2021.

The Organization confirmed and verified that the output shedding of renewable-energy-generating facilities that General T&D companies implemented to facilities of EPCOs was in accordance with the provisions of Article 180 of the Operational Rules.

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

Table 1-20: Instructed and actual output shedding of renewable-energy-generating facilities in Hokkaido

(times, 10^4 kW)

Month	Number of instructions		Instructed capacity		Maximum instructed capacity		
	Issued on the previous day	(Issued on the current day)	Issued on the previous day	(Issued on the current day)	Maximum instruction	(Actual maximum shed)	Maximum shed date
April 2022	1	(0)	17.5	(0.0)	17.5	(0.0)	-
May 2022	3	(2)	40.0	(38.9)	22.3	(20.1)	May 15
Aug. 2022	3	(1)	80.0	(12.6)	35.0	(12.6)	August 21
Sep. 2022	1	(2)	37.0	(24.0)	37.0	(13.0)	September 25
FY 2022	8	(5)	174.5	(75.5)			

Table 1-21: Instructed and actual output shedding of renewable-energy-generating facilities in Tohoku

(times, 10^4 kW)

Month	Number of instructions		Instructed capacity		Maximum instructed capacity		
	Issued on the previous day	(Issued on the current day)	Issued on the previous day	(Issued on the current day)	Maximum instruction	(Actual maximum shed)	Maximum shed date
April 2022	5	(5)	403.2	(303.4)	140.6	(132.4)	April 17
May 2022	8	(9)	671.2	(552.4)	130.2	(123.6)	May 8
Mar.2023	4	(4)	241.9	(344.0)	115.6	(139.0)	March 19
FY 2022	17	(18)	1316.3	(1,199.8)			

Table 1-22: Instructed and actual output shedding of renewable-energy-generating facilities in Chugoku

(times, 10^4 kW)

Month	Number of instructions		Instructed capacity		Maximum instructed capacity		
	Issued on the previous day	(Issued on the current day)	Issued on the previous day	(Issued on the current day)	Maximum instruction	(Actual maximum shed)	Maximum shed date
April 2022	3	(2)	153.9	(95.7)	72.5	(49.1)	April 30
May 2022	7	(5)	375.3	(183.7)	86.9	(55.3)	May 22
Sep. 2022	1	(0)	61.0	(0.0)	61.0	(0.0)	-
Oct. 2022	2	(2)	191.5	(96.2)	147.0	(69.8)	October 2
Nov. 2022	1	(0)	40.0	(0.0)	40.0	(0.0)	-
Mar.2023	9	(8)	789.5	(608.0)	215.1	(195.0)	March 19
FY 2022	23	(17)	1611.2	(983.6)			

Table 1-23: Instructed and actual output shedding of renewable-energy-generating facilitiesin Shikoku

(times, 10^4 kW)

Month	Number of instructions		Instructed capacity		Maximum instructed capacity		
	Issued on the previous day	(Issued on the current day)	Issued on the previous day	(Issued on the current day)	Maximum instruction	(Actual maximum shed)	Maximum shed date
April 2022	4	(4)	180.7	(96.1)	61.1	(54.1)	April 30
May 2022	7	(6)	259.3	(196.4)	55.9	(49.2)	May 3
Mar.2023	12	(3)	278.1	(149.0)	82.3	(57.0)	March 12
FY 2022	23	(13)	718.1	(441.5)			

Table 1-24: Instructed and actual output shedding of renewable-energy-generating facilities in Kyushu mainland

(times, 10^4 kW)

Month	Number of instructions		Instructed capacity		Maximum instructed capacity		
	Issued on the previous day	(Issued on the current day)	Issued on the previous day	(Issued on the current day)	Maximum instruction	(Actual maximum shed)	Maximum shed date
April 2022	18	(17)	4,363.8	(2,130.2)	332.2	(229.9)	April 17
May 2022	10	(7)	1,312.8	(510.4)	264.1	(147.0)	May 3
June 2022	1	(0)	47.0	(0.0)	47.0	(0.0)	-
July 2022	1	(0)	27.0	(0.0)	27.0	(0.0)	-
Aug. 2022	1	(1)	95.2	(34.5)	95.2	(34.5)	August 28
Sep. 2022	5	(1)	508.0	(67.0)	249.0	(67.0)	September 25
Oct. 2022	20	(7)	2,083.4	(284.3)	247.4	(122.0)	October 30
Nov. 2022	14	(4)	938.9	(347.0)	177.9	(125.1)	November 27
Dec. 2022	6	(1)	481.4	(55.8)	212.4	(55.8)	December 31
Jan. 2023	13	(6)	2,181.8	(717.4)	380.1	(173.5)	January 1
Feb. 2023	20	(13)	4,104.2	(1,512.2)	426.3	(278.9)	February 26
Mar.2023	26	(23)	9,350.1	(6,351.4)	648.9	(549.6)	March 19
FY 2022	135	(80)	25,493.6	(12,010.2)			

Table 1-25: Output shedding needed for FY 2022 in Isolated islands of Kyushu (times, 10^4 kW)

Month	Number of instructions issued on the previous day	Instructed capacity issued on the previous day	Maximum instructed capacity	Maximum shed date
April 2022	42	12.3	0.6	April 10
May 2022	28	8.4	0.7	May 3
June 2022	9	2.1	0.4	June 12
July 2022	1	0.1	0.1	July 10
Sep. 2022	3	0.3	0.1	September 24
Oct. 2022	25	5.2	0.4	October 19
Nov. 2022	20	4.4	0.4	November 24
Dec. 2022	9	1.2	0.2	December 29
Jan. 2023	14	3.0	0.3	January 8
Feb. 2023	17	4.6	0.5	February 17
Mar.2023	36	12.9	0.6	March 15
FY 2022	204	54.6		

Table 1-26: Instructed and actual output shedding of renewable-energy-generating facilities in Okinawa

(times, 10^4 kW)

Month	Number of instructions		Instructed capacity		Maximum instructed capacity		
	Issued on the previous day	(Issued on the current day)	Issued on the previous day	(Issued on the current day)	Maximum instruction	(Actual maximum shed)	Maximum shed date
Jan. 2023	3	(1)	8.6	(2.5)	6.9	(2.5)	January 1
Feb. 2023	4	(0)	5.4	(0.0)	2.6	(0.0)	-
Mar.2023	12	(2)	32.8	(3.5)	5.7	(1.8)	March 12
FY 2022	19	(3)	46.8	(6.0)			

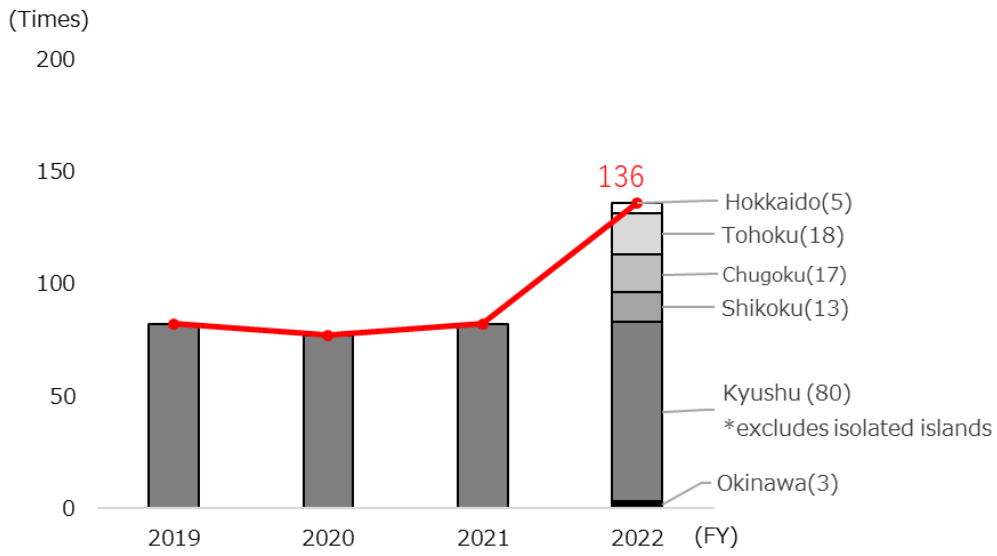
Table 1-27: Instructed and actual output shedding of renewable-energy-generating facilities Nationwide

(times, 10^4 kW)

Month	Number of instructions		Instructed capacity	
	Issued on the previous day	(Issued on the current day)	Issued on the previous day	(Issued on the current day)
Hokkaido	8	(5)	174.5	(75.5)
Tohoku	17	(18)	1,316.3	(1,199.8)
Chugoku	23	(17)	1,611.2	(983.6)
Shikoku	23	(13)	718.1	(441.5)
Kyushu	135	(80)	25,493.6	(12,010.2)
isolated islands	204	(*)	54.6	(*)
Okinawa	19	(3)	46.8	(6.0)
Nationwide	429	(136)	29,415.1	(14,716.6)

*The isolated islands of Kyushu do not consider the actual instruction issuance and shed capacity.

<Reference> Transition of the Annual Output Shedding of Renewable Energy Sources



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 and AC/DC convertors that regularly connect the regional-service areas of GT&D member 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 the 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.

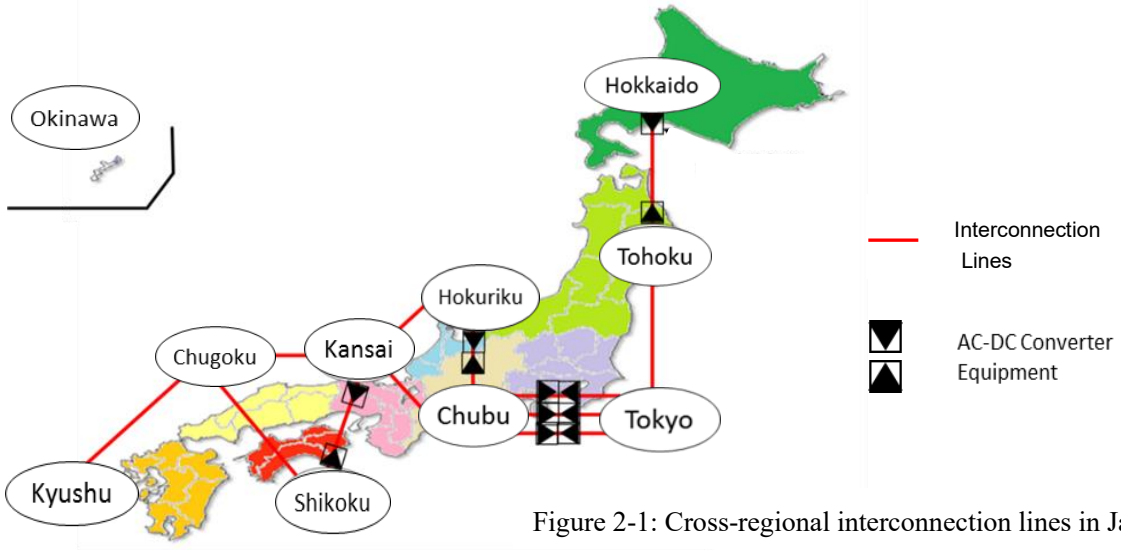


Figure 2-1: Cross-regional interconnection lines in Japan

Table 2-1: Summary of cross-regional interconnection lines (at the end of FY 2022)

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. At present, the Organization has revised the cross-regional interconnection utilization rules according to the "implicit auction scheme"[15] (earlier, they were based on the first-come, first-served principle) 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. The implicit auction scheme allocates the capabilities of the interconnection lines through the energy trading market, and does not directly allocate the position or right of utilization through auctions. The rule revision is described in Figure 2-2.

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Termination of capability allocation plans and changes in timing for capability registration

Figure 2-2 describes the senarios before and after the introduction of the implicit auction scheme. Before the introduction of the scheme, 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 introduction, capability was principally traded in the day-ahead spot market.

Thus, no capability-allocation plans were devised, and capability was registered after the day-ahead spot market trading, according to the revision of the cross-regional interconnection lines to the implicit auction scheme.

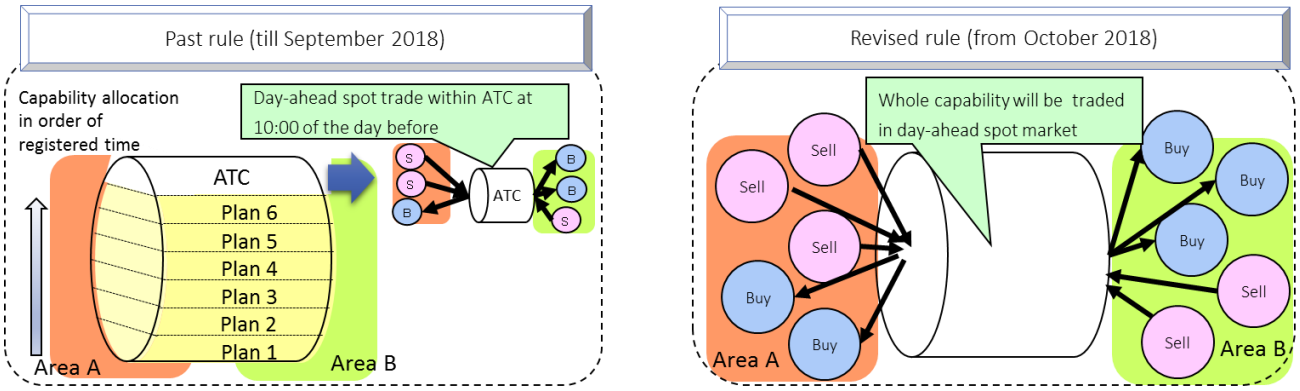

Figure 2-2: Management of interconnection lines

[15] 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 2022

Table 2-2 and Figure 2-3 show the monthly and annual utilization of cross-regional interconnection lines for regional service areas in FY 2022. Annual actual utilization in FY 2022 describing in decreasing order is; 1) Kansai to Chubu: 28,458 GWh, 2) Tohoku to Tokyo: 25,481 GWh, 3) Chugoku to Kansai: 20,302 GWh, 4) Kyushu to Chugoku: 18,536 GWh, 5) Shikoku to Kansai: 9,831 GWh, and 6) Chubu to Tokyo: 7,079 GWh.

Table 2-2: Monthly and annual utilization of cross-regional interconnection lines for regional-service areas[16]

[GWh]

		Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido - Honshu	→Tohoku (Forward)	207	186	113	155	188	87	129	55	137	60	62	241	1,620
	→Hokkaido (Counter)	65	70	107	76	75	128	48	85	78	161	132	32	1,058
Tohoku-Tokyo	→Tokyo (Forward)	1,356	1,640	1,361	2,200	2,685	2,043	1,951	1,731	2,483	3,240	2,576	2,577	25,841
	→Tohoku (Counter)	61	44	69	96	96	88	68	45	45	23	55	17	708
Tokyo-Chubu	→Chubu (Forward)	52	65	37	68	172	69	25	13	322	391	332	467	2,012
	→Tokyo (Counter)	703	674	759	688	701	638	816	798	345	392	358	206	7,079
Chubu-Kansai	→Kansai (Forward)	49	107	73	72	195	116	94	25	58	211	129	169	1,300
	→Chubu (Counter)	1,144	1,686	2,618	2,741	2,438	2,022	2,342	3,103	3,024	2,400	2,150	2,790	28,458
Chubu-Hokuriku	→Hokuriku (Forward)	0	7	0	1	5	5	9	0	0	0	1	0	29
	→Chubu (Counter)	32	188	25	57	49	157	279	82	132	49	58	70	1,177
Hokuriku - Kanasai	→Kansai (Forward)	515	97	283	322	762	396	195	201	108	175	139	273	3,467
	→Hokuriku (Counter)	14	25	26	40	30	61	9	24	125	77	32	14	477
Kansai-Chugoku	→Chugoku (Forward)	26	25	22	31	41	28	28	20	31	83	32	69	435
	→Kansai (Counter)	1,360	1,401	1,714	1,969	1,900	2,023	1,791	1,947	1,532	1,629	1,496	1,542	20,302
Kansai-Shikoku	→Shikoku (Forward)	0	0	0	0	0	0	0	0	7	0	0	0	7
	→Kansai (Counter)	639	685	839	1,034	978	993	1,004	866	922	843	729	298	9,831
Chugoku - Shikoku	→Shikoku (Forward)	6	4	13	6	7	3	2	2	4	7	8	61	123
	→Chugoku (Counter)	89	27	218	539	332	478	242	77	106	87	149	55	2,398
Chugoku - Kyushu	→Kyushu (Forward)	7	5	6	4	3	11	6	9	6	35	4	22	117
	→Chugoku (Counter)	1,387	1,325	1,467	1,723	1,780	1,610	1,502	1,572	1,592	1,591	1,506	1,480	18,536

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

[16] Figures are rounded off to the first decimal place, and the minimum figure in blue is estimated before being rounding off.

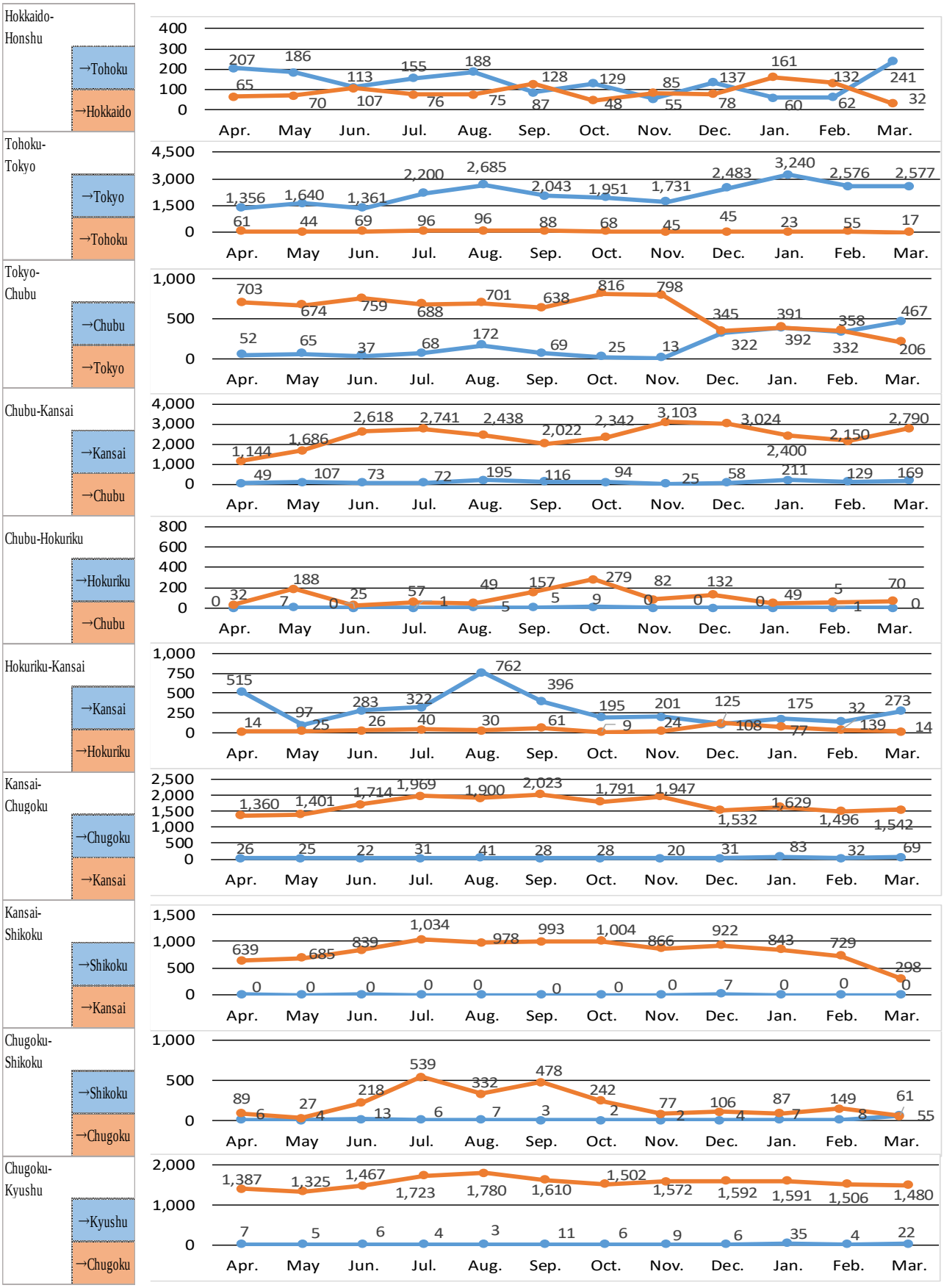

Figure 2-3: Monthly utilization of cross-regional interconnection lines for regional-service areas

(2) Actual Utilization of Cross-regional Interconnection Lines from FY 2013 to FY 2022

Table 2-3 and Figure 2-4 show the annual utilization of cross-regional interconnection lines for regional service areas from FY 2013 to FY 2022. In FY 2022, actual utilization of Chubu to Tokyo, Kansai to Chubu, Hokuriku to Kansai, Chugoku to Kansai, and Kyushu to Chugoku registered their records.

Table 2-3 Annual utilization of cross-regional interconnection lines for regional-service areas (FY 2013 –2022)

[GWh]

		FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
Hokkaido-Honshu	→Tohoku (Forward)	182	143	146	237	340	130	279	947	2,607	1,620
	→Hokkaido (Counter)	505	617	804	1,033	1,270	1,005	2,117	1,154	382	1,058
Tohoku-Tokyo	→Tokyo (Forward)	22,450	21,273	22,587	23,097	28,238	27,298	27,575	31,396	29,092	25,841
	→Tohoku (Counter)	3,891	4,029	3,714	4,660	7,071	3,139	252	541	897	708
Tokyo-Chubu	→Chubu (Forward)	2,829	2,702	693	2,729	3,954	1,711	354	1,497	6,200	2,012
	→Tokyo (Counter)	536	2,755	4,513	5,144	5,328	5,116	4,147	3,016	3,043	7,079
Chubu-Kansai	→Kansai (Forward)	7,049	7,131	3,412	5,538	8,106	3,675	980	4,413	2,964	1,300
	→Chubu (Counter)	4,928	6,342	7,577	6,544	9,889	9,980	7,175	13,285	17,251	28,458
Chubu-Hokuriku	→Hokuriku (Forward)	170	231	108	241	353	134	7	91	96	29
	→Chubu (Counter)	310	296	172	59	108	76	40	458	2,063	1,177
Hokuriku-Kanasai	→Kansai (Forward)	1,406	2,265	2,047	2,033	2,949	2,033	2,918	3,223	3,005	3,467
	→Hokuriku (Counter)	587	491	502	640	1,260	2,540	547	620	376	477
Kansai-Chugoku	→Chugoku (Forward)	2,326	2,252	948	716	4,493	4,734	578	584	564	435
	→Kansai (Counter)	5,468	5,994	9,138	13,179	16,727	13,388	9,793	12,416	15,056	20,302
Kansai-Shikoku	→Shikoku (Forward)	0	1	2	2	1	82	31	10	28	7
	→Kansai (Counter)	9,073	9,362	9,611	8,856	9,510	8,840	9,956	8,623	8,343	9,831
Chugoku-Shikoku	→Shikoku (Forward)	3,583	2,677	3,423	3,294	4,061	2,579	131	245	113	123
	→Chugoku (Counter)	3,694	3,912	4,631	7,638	7,540	4,023	4,143	1,445	1,756	2,398
Chugoku-Kyushu	→Kyushu (Forward)	3,838	3,596	2,174	1,935	3,014	1,998	138	177	142	117
	→Chugoku (Counter)	13,847	11,218	14,947	15,476	18,183	18,280	16,311	15,864	17,098	18,536

* Based on the scheduled power flows of the cross-regional interconnection lines
* Figures in red and blue represent the annual maximum and minimum capabilities in each line and direction between FY 2013 and FY 2022, respectively.
* Figures are rounded off to the first decimal place.

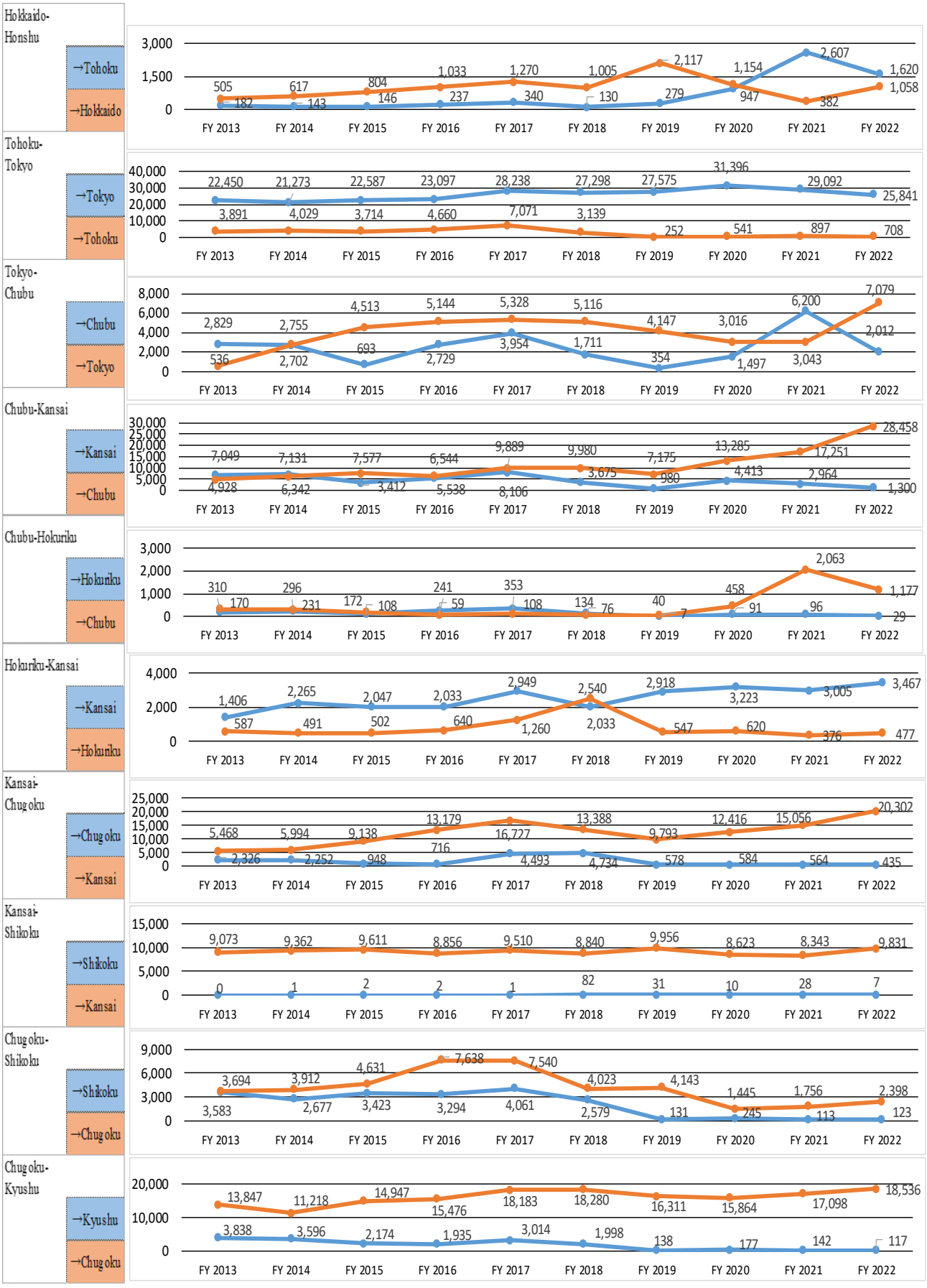

Figure 2-4: Annual utilization of cross-regional interconnection lines for regional-service areas (FY 2013–2022)

(3) Monthly Utilization of Cross-regional Interconnection Lines According to Transaction in FY 2022

Table 2-4 shows the monthly and annual utilization of cross-regional interconnection lines according to transaction processed in FY 2022. Bilateral contract includes the transactions done in the balancing market starting 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	34	63	96	45	68	9	36	9	12	18	5	73	468
Day-ahead	7,213	7,689	9,153	11,092	11,362	10,112	9,947	10,338	10,316	10,290	9,139	9,450	116,101
1 Hour-ahead	464	507	500	686	1,007	833	556	309	728	1,148	805	862	8,406

* 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 According to Transaction in FY 2013 – FY 2022

Table 2-5 and Figures 2-5– 2-7 show the annual utilization of cross-regional interconnection lines according to transaction processed from FY 2013 to FY 2022. The day- and hour-ahead transactions were recorded over a 10-year period (from FY 2013 to FY 2022), and they were attributable to the introduction of an implicit auction scheme from October 2018, allowing for the activation of the spot market as well as the availability of the utilization of all the cross-regional interconnection lines through the spot market.

Table 2-5: Annual utilization of cross-regional interconnection lines by transaction (FY 2013–2022)

[GWh]

	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
Bilateral	73,289	71,558	75,947	84,843	109,842	56,710	255	1,103	366	468
Day-ahead	11,632	14,174	13,152	14,817	18,350	51,120	83,216	91,229	102,328	116,101
1 Hour-ahead	1,750	1,554	2,050	3,392	4,203	2,932	4,000	7,675	8,382	8,406

* In the case of FY 2015, "hour-ahead" refers to transactions that are 4 h ahead of the gate closure. From FY 2016, "hour-ahead" refers to the transactions that are 1 h ahead of the gate closure.

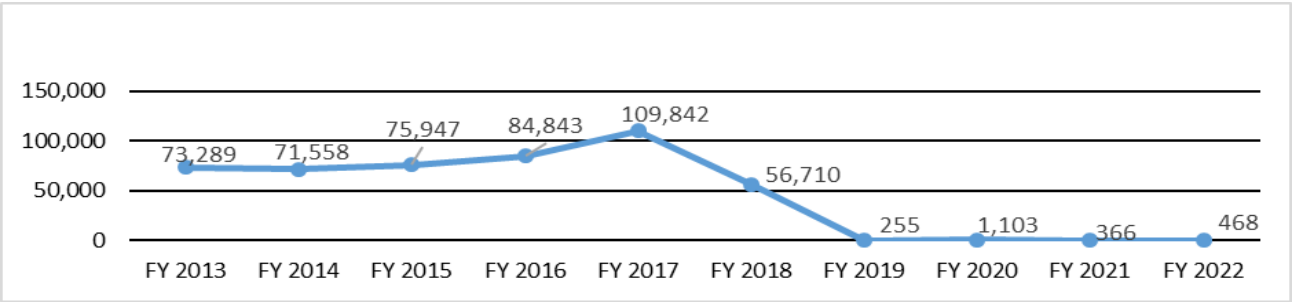

Figure 2-5: Annual utilization of cross-regional interconnection lines by bilateral transaction (FY 2013–2022)

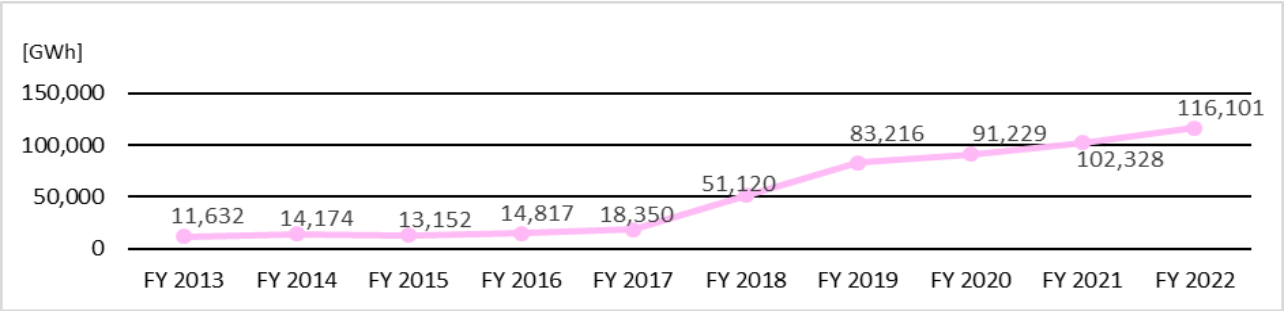

Figure 2-6: Annual utilization of cross-regional interconnection lines by day-ahead transaction (FY 2013–2022)

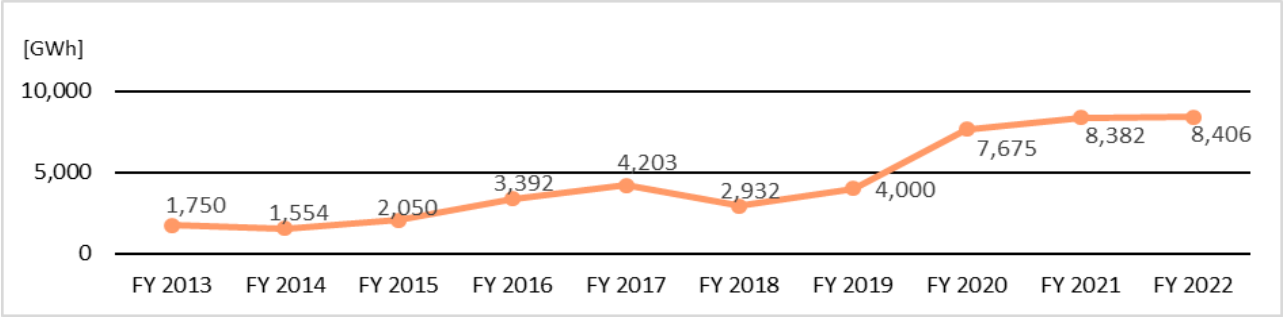

Figure 2-7: Annual utilization of cross-regional interconnection lines by hour-ahead transaction (FY 2013–2022)

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

This section details the actual maintenance work carried out on the cross-regional interconnection lines, as reported by GT&D companies in accordance with the provisions of Article 167 of the Operational Rules.

(1) Actual Monthly Maintenance Work on Cross-regional Interconnection Lines in FY 2022

Table 2-6 lists the monthly and annual maintenance works carried out on cross-regional interconnection lines in FY 2022, and Figure 2-8 shows the nationwide monthly planned outage rate for FY 2022. Maintenance work days for Sakuma FC C.S. and Higashi Shimizu FC C.S. were registered their record for 104 days and 69 days, respectively.

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	0	0	8	7	9	14	21	7	0	0	7	10	6	4	2	5	0	0	0	0	0	0	53	47
Tohoku-Tokyo	Soma-Futaba bulk line, Iwaki bulk line	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	0	0	0	0	0	0	3	19	9	25
Tokyo-Chubu	Sakuma FC C.S.	5	30	4	31	13	30	4	6	0	0	1	6	0	0	0	0	0	0	0	0	1	1	0	0	28	104
	Shin Shinano FC C.S.	2	7	2	1	1	2	9	12	1	1	0	0	9	14	1	12	4	9	0	0	1	1	1	1	31	60
	Higashi Shimizu FC C.S.	0	0	0	0	0	0	4	3	0	0	2	2	7	15	10	18	0	0	0	0	0	0	4	31	27	69
	Hida-Shinano FC	1	2	0	0	2	2	10	10	0	0	16	15	0	0	2	2	0	0	0	0	0	0	2	2	33	33
Chubu-Kansai	Mie-Higashi Omi line	0	0	0	0	0	0	0	0	0	0	22	4	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Chubu-Hokuriku	Minami Fukumitsu HVDC BTB C.S., Minami Fukumitsu Substation	0	0	1	16	0	0	0	0	1	2	2	6	3	16	4	14	0	0	0	0	0	0	0	0	11	54
Hokuriku-Kansai	Echizen-Reinan line	0	0	27	16	0	0	0	0	0	0	4	2	20	16	0	0	0	0	0	0	0	0	0	0	51	34
Kansai-Chugoku	Seiban-Higashi Okayama line, Yamazaki-Chizu line	9	12	0	0	40	18	0	0	0	0	23	11	4	4	1	1	6	6	0	0	0	0	0	0	83	52
Kansai-Shikoku	Kihoku and Anan AC/DC C.S.	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	13	12	18	16
Chugoku-Shikoku	Honshi interconnection line	7	20	18	31	2	30	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	30	83
Chugoku-Kyushu	Kanmon interconnection line	17	12	10	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	24
Nationwide (Cumulative works for the same facilities deducted)		43	84	62	107	66	89	36	45	23	10	70	46	50	75	33	59	15	23	0	0	2	2	23	65	423	605

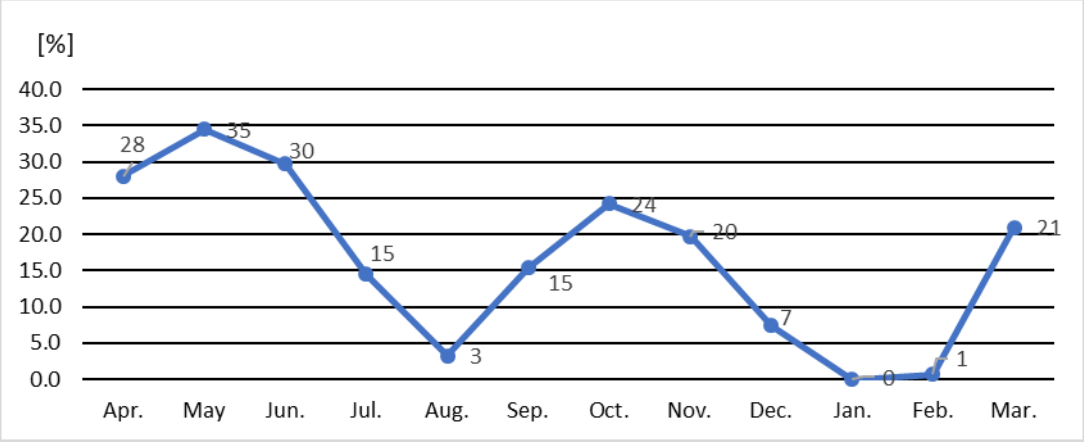

Figure 2-8: Nationwide monthly planned outage rate

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

(2) Annual Maintenance Works on Cross-regional Interconnection Lines from FY 2013 to FY 2022

Table 2-7 shows the annual maintenance work carried out on cross-regional interconnection lines from FY 2013 to FY 2022.

The nationwide annual maintenance work on cross-regional interconnection lines for FY 2022 was carried out on 423 occasions. which was the highest annual total for the past decade.

Table 2-7: Annual maintenance work on cross-regional interconnection lines (FY 2013–2022)

	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	Total	10-years Average
Number	38	63	91	218	267	205	353	385	379	423	2,422	242

* 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 2022

Table 2-8 shows the forced outage of cross-regional interconnection lines in FY 2022.

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

Date	Facility	Background
July 26	Higashi Shimizu FC	Secondary accident of network
July 27	Shin Shinano FC	Secondary accident of network
August 2	Minami Fukumitsu BTB Converter	Substrate failure
August 13	Soma Futaba Trunk Line	Generators shutdown
August 25	Sakuma FC	Secondary accident of network
September 6	Soma Futaba Trunk Line	Generators shutdown
September 8	Higashi Shimizu FC	Secondary accident of network
September 24	Higashi Shimizu FC	Secondary accident of network
November 10	Hokkaido-Honshu HVDC Link	Capacitor failure
December 19	Kihoku and Anan AC/DC C.S.	Control device malfunction
December 23	Kihoku and Anan AC/DC C.S.	Control device malfunction

* Forced outage affecting the TTC is described.

(2) Annual Forced Outage of Cross-regional Interconnection Lines from FY 2013 to FY 2022

Table 2-9 shows the annual forced outage of cross-regional interconnection lines from FY 2013 to FY 2022. In FY 2022, 11 annual forced outages of cross-regional interconnection lines were recorded, which was the same to the previous year, and the highest over 10 years.

Table 2-9: Annual forced outage of cross-regional interconnection lines (FY 2013–2022)

	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	Total	10-years Average
Number	9	1	3	3	3	6	9	8	11	11	64	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 with respect to the interconnection lines, where the supply–demand balance is restricted or insufficient to reduce power supply. Table 2-10 shows the actual employment of the transmission margin for FY 2022 according to the provisions of Article 152 of the Operational Rules.

The actual employment of the transmission margin for FY 2022 was six days. This employment could be fully attributable to the interconnection facilities between Tokyo and Chubu, displaying power flow from Chubu to Tokyo. For four of the six days were allocated to implement countermeasures for the early summer heatwave that occurred from June 27 to July 1, 2022.

Table 2-10: Actual employment of the transmission margin

Date	Facility	Background
From June 27, 2022 to July 1, 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 high temperature (Implemented on June 27, 29, 30, and July 1)
July 1, 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 output decrease of solar power caused by weather change
August 2 & 3, 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 high temperature

Table 2-11: Actual employment of transmission margin (FY 2015–2022)

[days]

FY	2015	2016	2017	2018	2019	2020	2021	2022
Nationwide	1	0	3	15	1	16	7	6

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

Figures 2-10 2-19 shows the actual ATC values calculated and published. Figures 2-9 and Table 2-12 detail the interpretation of the ATC graphs.

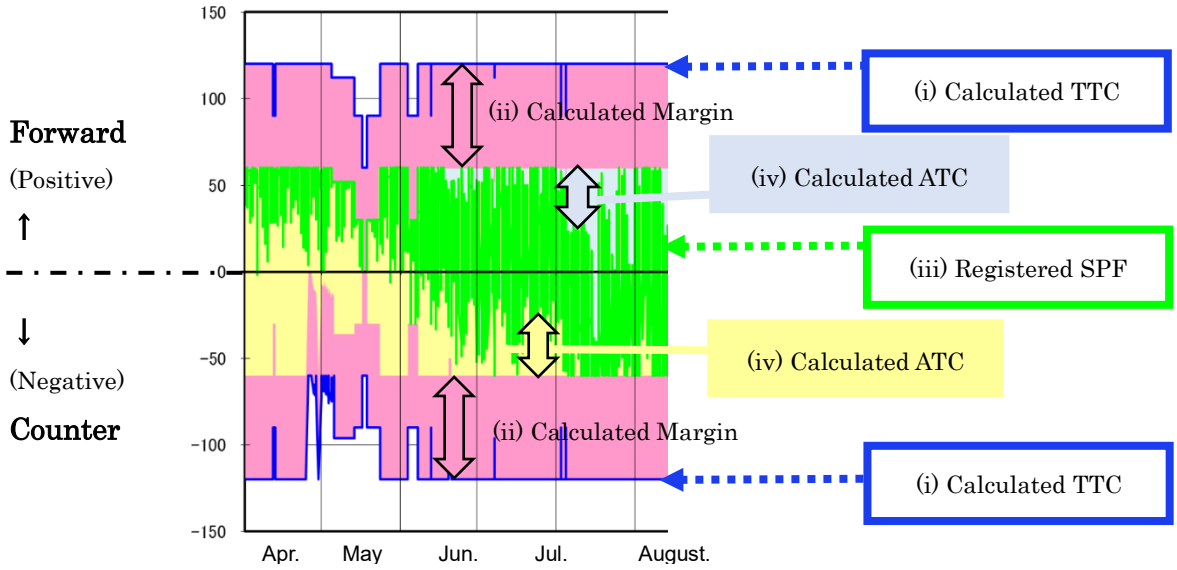

Figure 2-9: How to interpret an ATC graph

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 demonstrates the offset value between the forward and counter flows, and not the simple addition in each direction. In addition, offset figures on the graphs were observed as SPF, and not as 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#

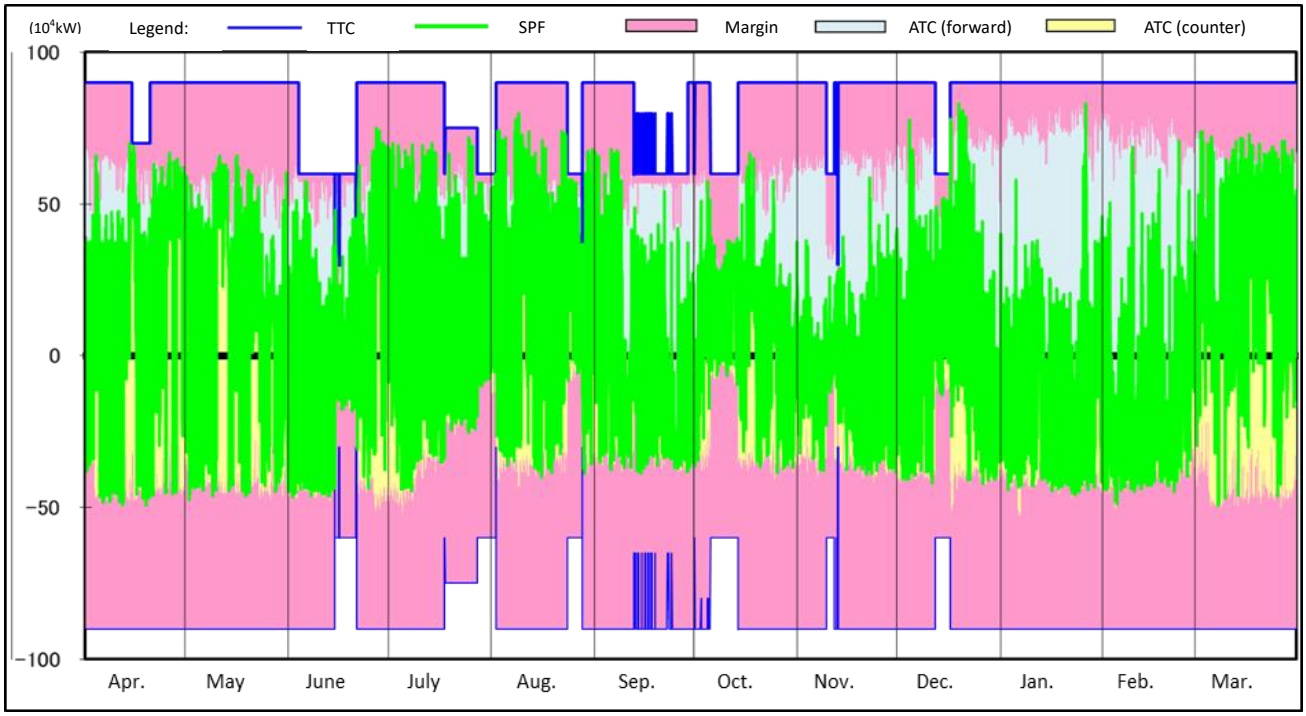

Figure 2-10: Actual ATC for interconnection facilities between Hokkaido and Honshu
(Hokkaido–Honshu HVDC Link, and New Hokkaido–Honshu HVDC Link)

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

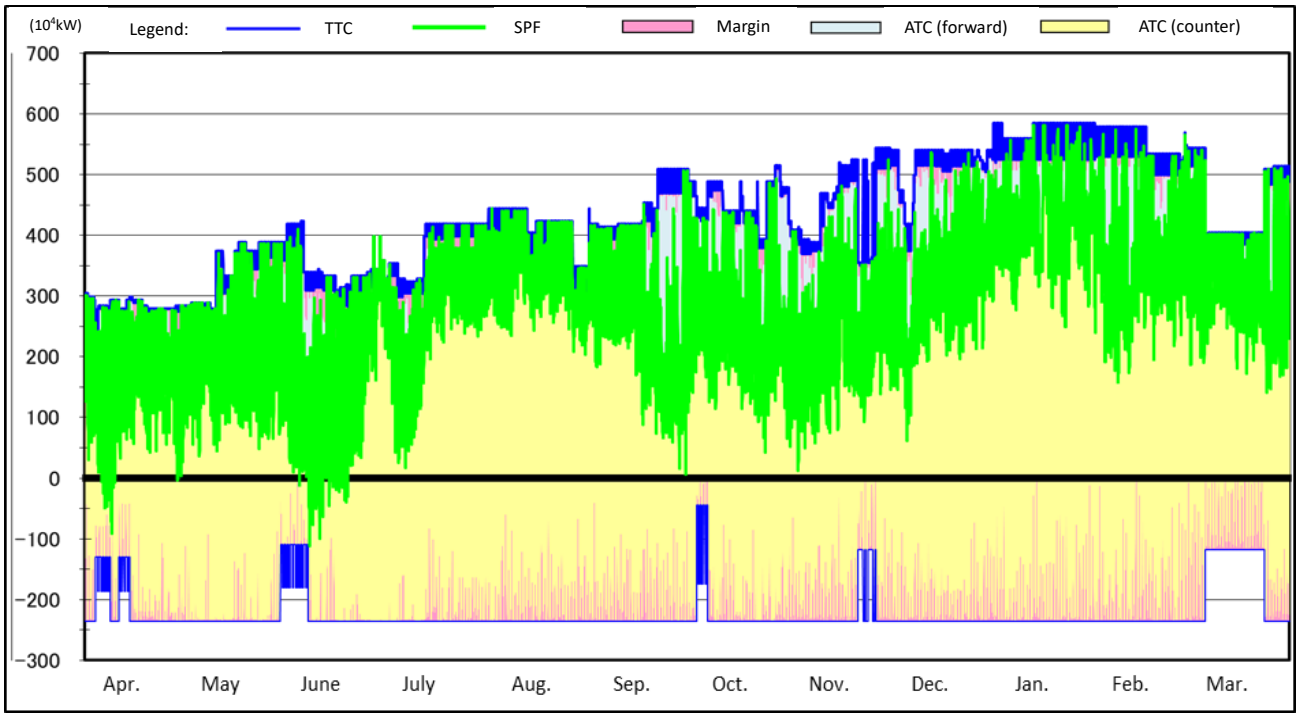

Figure 2-11: Actual ATC for interconnection lines between Tohoku and Tokyo
(Soma–Futaba Bulk Line and Iwaki Bulk Line)

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

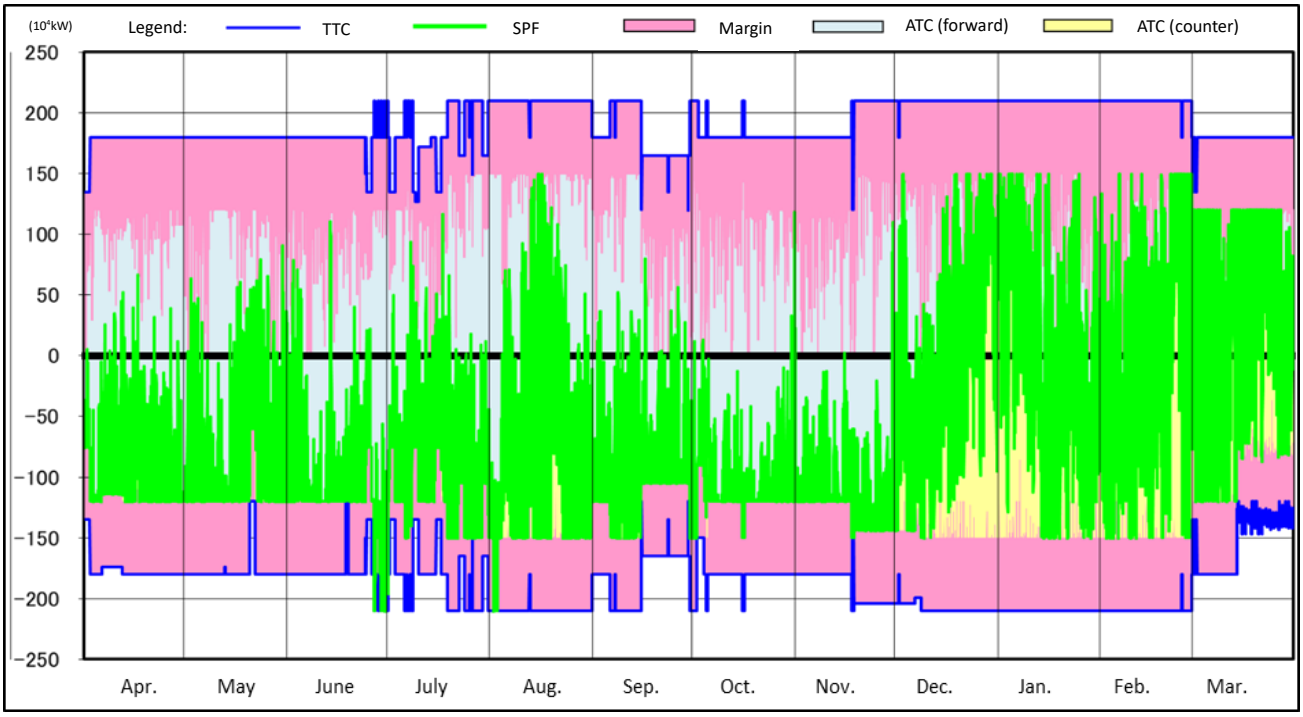

Figure 2-12: Actual ATC for interconnection facilities between Tokyo and Chubu
(Sakuma, Shin Shinano and Higashi Shimizu and Hida–Shinano F.C.)

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

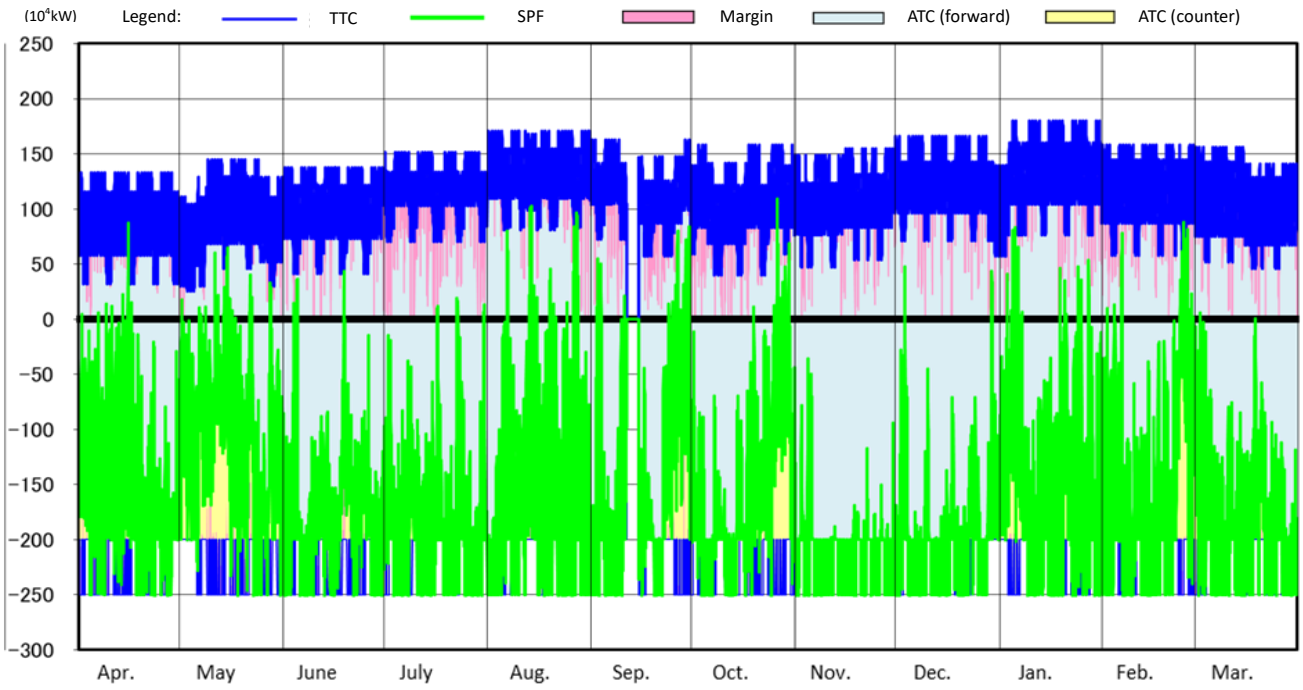

Figure 2-13: Actual ATC for the interconnection line between Chubu and Kansai (Mie–Higashi Omi Line)

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

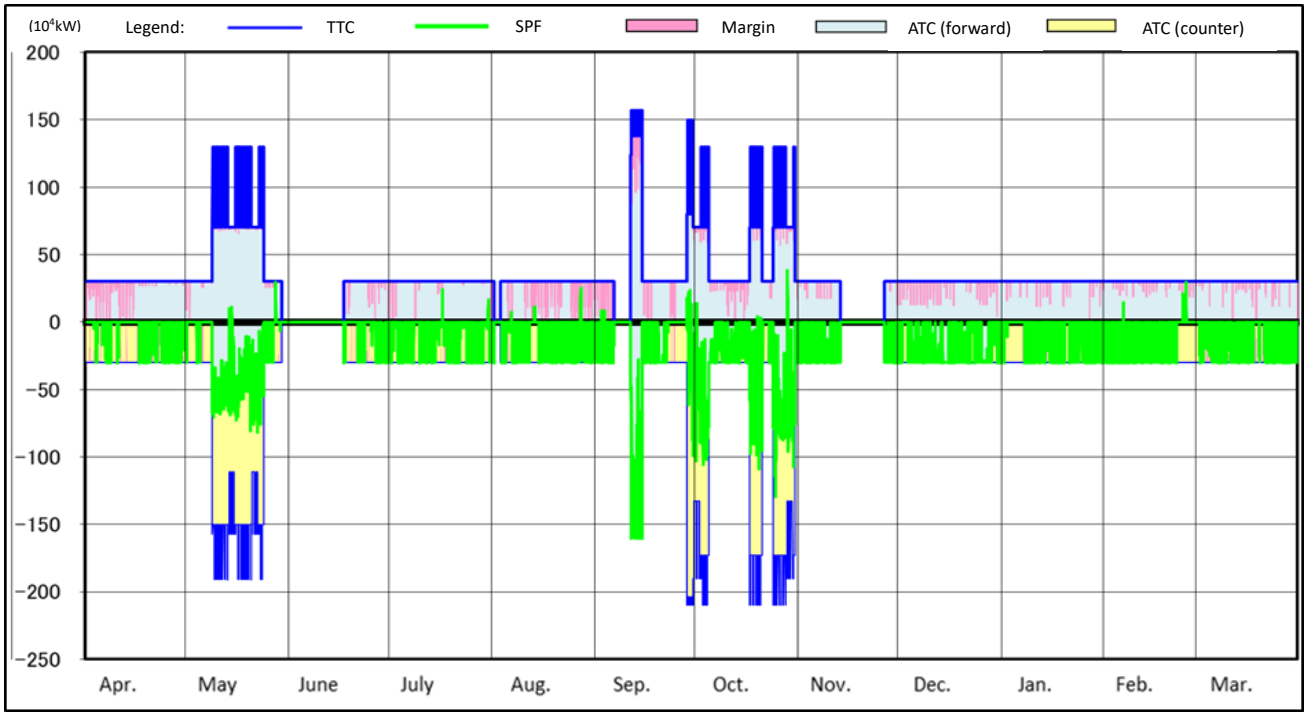

Figure 2-14: Actual ATC for interconnection facilities between Chubu and Hokuriku
(Minami Fukumitsu HVDC BTB Converter Station and Minami Fukumitsu Substation)

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

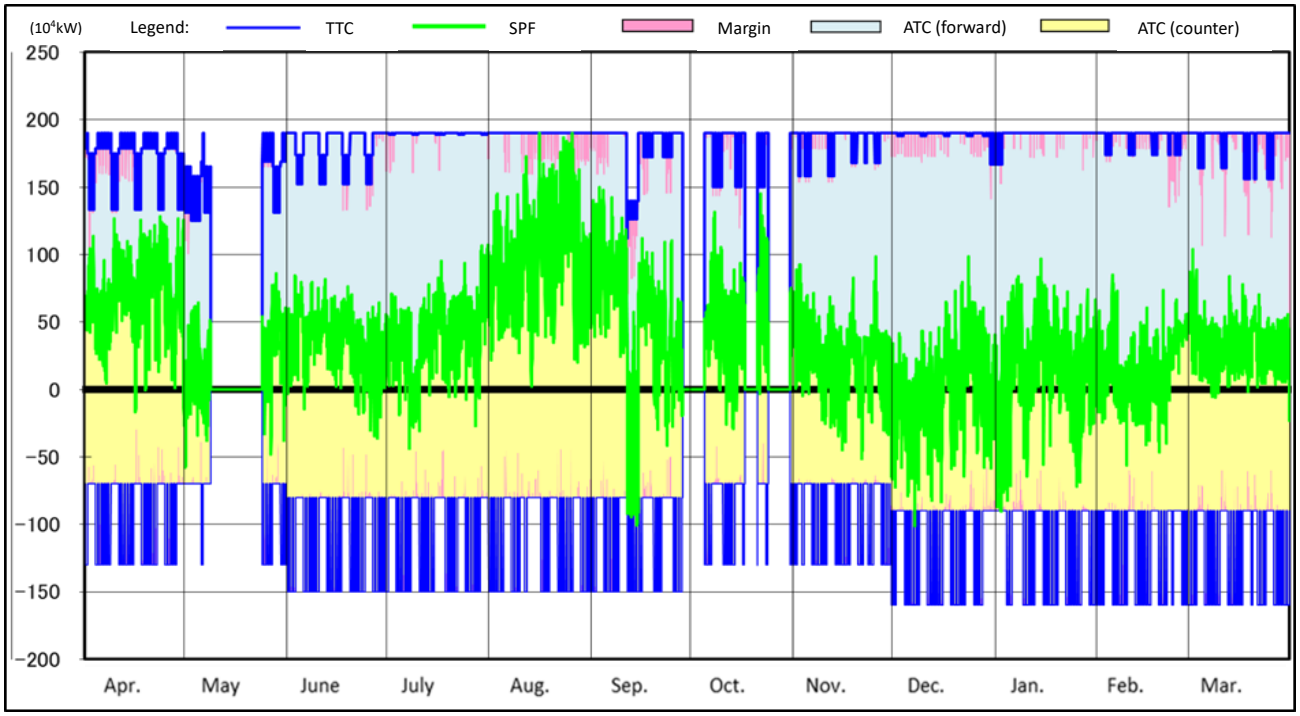

Figure 2-15: Actual ATC for the interconnection line between Hokuriku and Kansai (Echizen–Reinan Line)

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

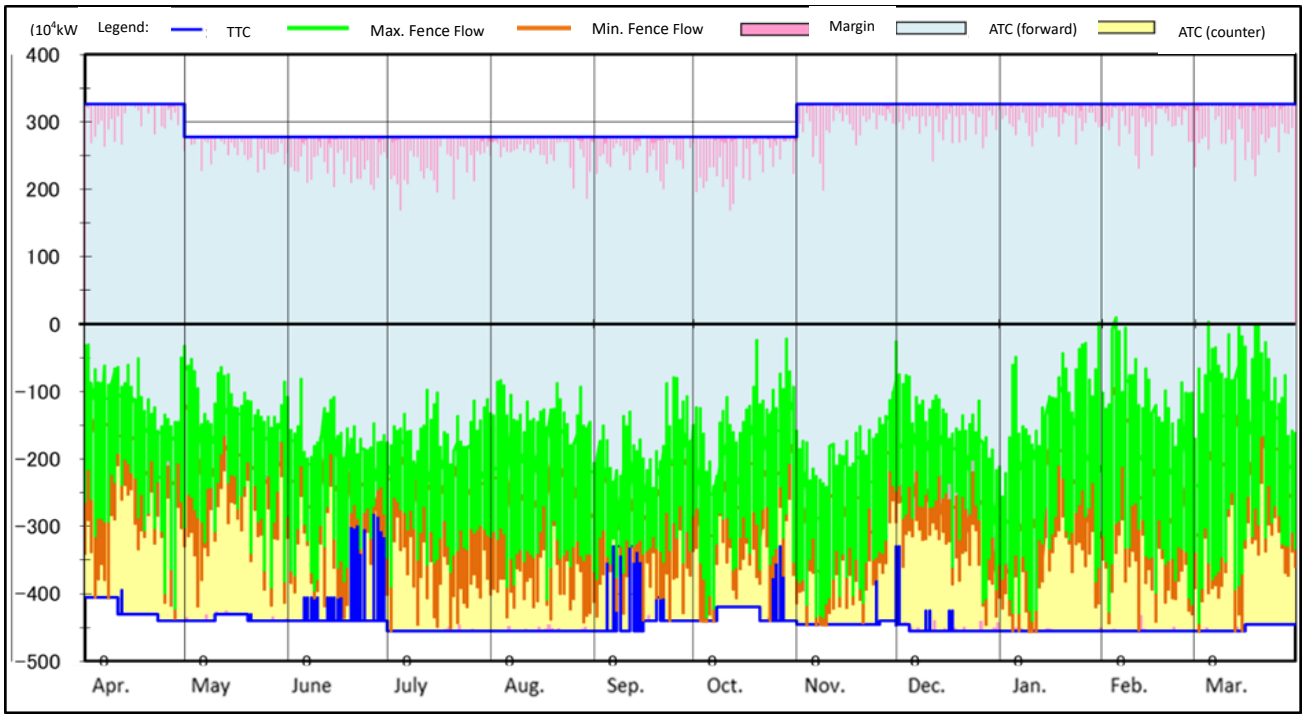

Figure 2-16: Actual ATC for interconnection lines between Kansai and Chugoku
(Seiban–Higashi Okayama Line and Yamazaki–Chizu Line)
Note: Kansai to Chugoku is considered a forward (positive) flow, with Chugoku to Kansai being a counter (negative) flow.

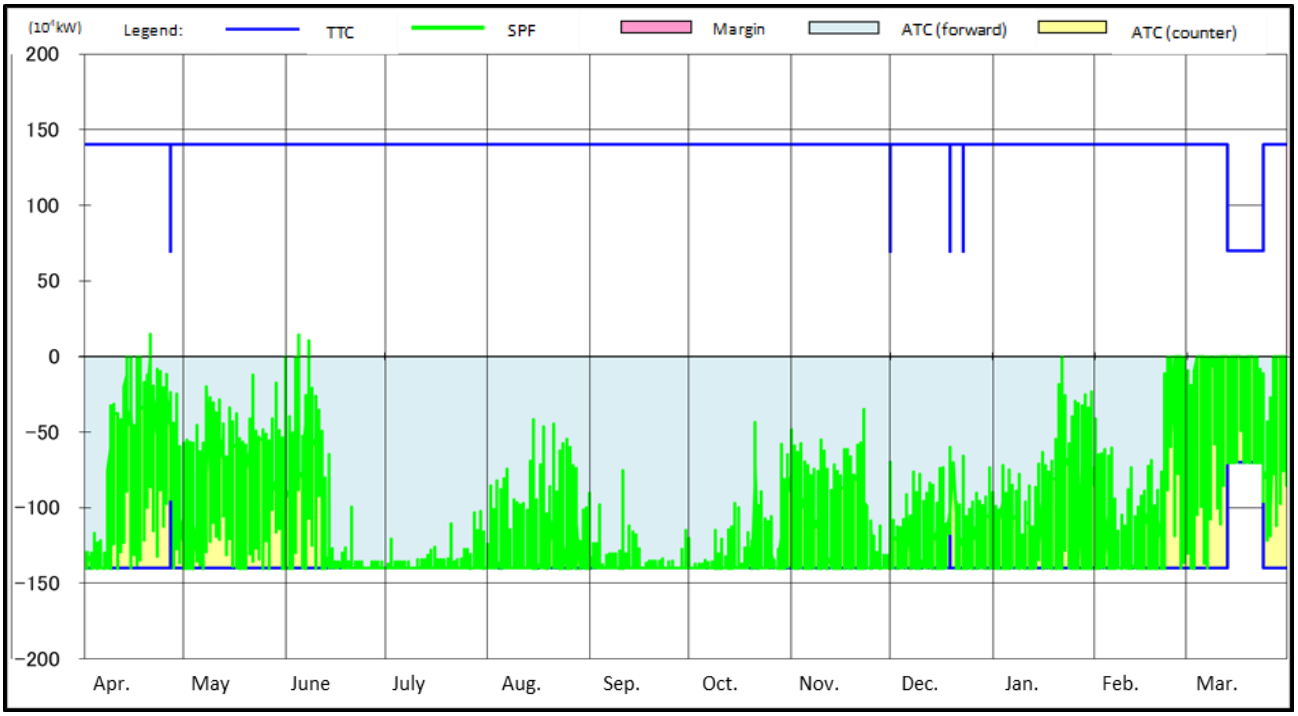

Figure 2-17: Actual ATC for interconnection facilities between Kansai and Shikoku
(Interconnection facilities between Kihoku and Anan AC/DC Converter Station)
Note: Kansai to Shikoku is considered a forward (positive) flow, with Shikoku to Kansai being a counter (negative) flow.
*The ATC for the forward 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).

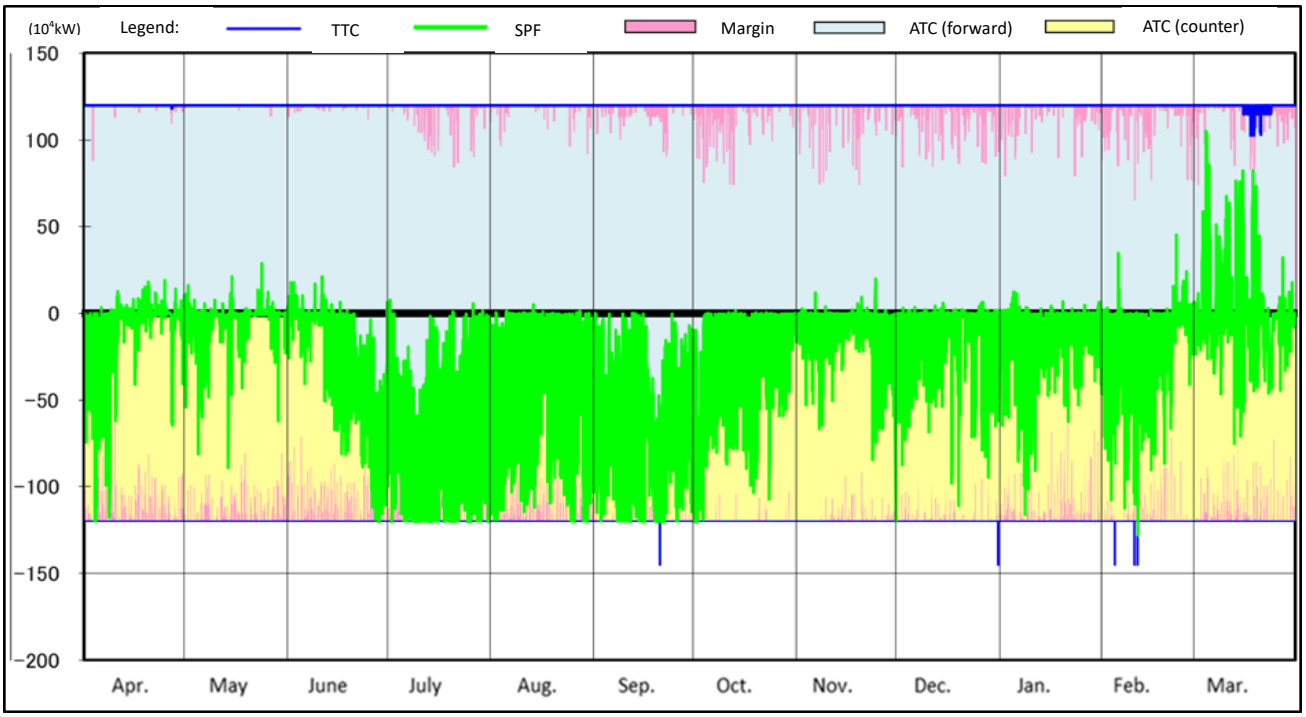

Figure 2-18: Actual ATC for the interconnection line between Chugoku and Shikoku (Honshi Interconnection Line)

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

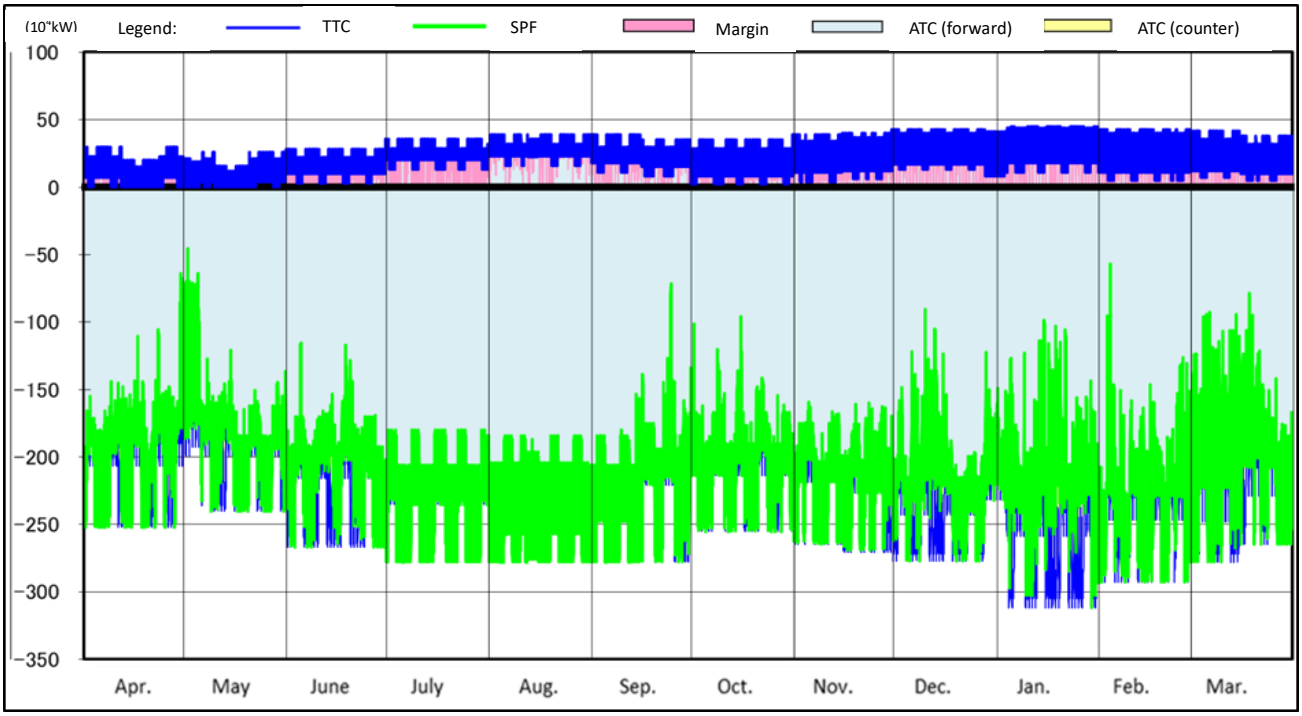

Figure 2-19: Actual ATC for the interconnection line between Chugoku and Kyushu (Kanmon Interconnection Line)

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

7. Actual Constraints on Nationwide Cross-regional Interconnection Lines

For the constraints on each regional service area of the 10 GT&D companies, please refer to the following links.

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* 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:
https://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, electric-energy requirement, load factor, and supply–demand status during the peak and lowest demand periods, and peak daily energy supply were collected. In addition, instructions with respect to power exchanges (according to the provisions of paragraph 1 of Article 28-44 of the 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) were aggregated. Further, instructions regarding the tight supply–demand balance in the summer of 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, maintenance work, forced outages, employment of transmission margin, and ATC were collected.

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

The following table lists the details of the actual power exchange instructions, with instructions and requests to generation and retail companies issued by the Organization in FY 2022. The data include measures for avoiding supply–demand tightness during the unusual early summer heatwave, which occurred in June, 2022.

Actual power exchange instructions by the Organization

1	Issued at	9:58 on June 27, 2022
	Instruction	-Hokkaido NW shall supply 120.4 MW of electricity at most to TEPCO PG from 15:30 to 20:00 on June 27. -Chubu PG shall supply 600 MW of electricity at most to TEPCO PG from 13:30 to 20:00 on June 27. –Hokuriku T&D shall supply 250 MW of electricity at most to TEPCO PG from 10:30 to 20:00 on June 27. –Kansai T&D shall supply 500 MW of electricity at most to TEPCO PG from 10:30 to 20:00 on June 27. –TEPCO PG shall be supplied 912.1 MW of electricity at most by Hokkaido NW, Chubu PG, Hokuriku T&D, and Kansai T&D from 10:30 to 20:00 on June 27. (The maximum transfer capacity of an interconnection line was reviewed and partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.
2	Issued at	13:30 on June 27, 2022
	Instruction	-Tohoku NW shall supply 868.7 MW of electricity at most to TEPCO PG from 15:00 to 20:00 June 27. -TEPCO PG shall be supplied 868.7 MW of electricity at most by Tohoku NW from 15:00 to 20:00 on June 27. (The transmission margin of an interconnection line was partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.
3	Issued at	14:19 on June 27, 2022
	Instruction	-Tohoku NW shall supply 868.7 MW of electricity at most to TEPCO PG from 15:00 to 20:00 June 27. -TEPCO PG shall be supplied 868.7 MW of electricity at most by Tohoku NW from 15:00 to 20:00 on June 27. (The transmission margin of an interconnection line was partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.

4	Issued at	19:27 on June 27, 2022
	Instruction	-Tohoku NW shall supply 746.3 MW of electricity at most to TEPCO PG from 21:00 to 24:00 on June 27. -Chubu PG shall supply 150 MW of electricity to TEPCO PG from 21:00 to 21:30 on June 27. -Hokuriku T&D shall supply 200 MW of electricity at most to TEPCO PG from 20:00 to 22:00 on June 27. -Chugoku NW shall supply 120 MW of electricity at most to TEPCO PG from 21:00 to 24:00 on June 27. -Shikoku T&D shall supply 250 MW of electricity at most to TEPCO PG from 20:00 to 24:00 on June 27. -Kyushu T&D shall supply 600 MW of electricity at most to TEPCO PG from 20:00 to 24:00 on June 27. -TEPCO PG shall be supplied 1346.3 MW of electricity at most by Tohoku NW, Chubu PG, Chugoku NW, Shikoku T&D, and Kyushu T&D from 20:00 to 24:00 on June 27. (The transmission margin of an interconnection line was partly utilized to the power exchange for TEPCO PG.)
	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.
5	Issued at	14:30 on June 28, 2022
	Instruction	-Tohoku NW shall supply 965.9 MW of electricity at most to TEPCO PG from 15:00 to 18:00 on June 28. -Chubu PG shall supply 107.9 MW of electricity at most to TEPCO PG from 15:30 to 16:00 on June 28. -TEPCO PG shall be supplied 965.9 MW of electricity at most by Tohoku NW and Chubu PG from 15:00 to 18:00 on June 28.
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.
6	Issued at	17:31 on June 28, 2022
	Instruction	-Tohoku NW shall supply 1097.3 MW of electricity at most to TEPCO PG from 18:00 to 22:00 on June 28. -TEPCO PG shall be supplied 1097.3 MW of electricity at most by Tohoku NW from 18:00 to 22:00 on June 28.
	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 high temperature. 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.
7	Issued at	0:25 on June 29, 2022
	Instruction	-Tohoku NW shall supply 532.1 MW of electricity at most to TEPCO PG from 2:00 to 6:00 on June 29. -Chubu PG shall supply 576 MW of electricity at most to TEPCO PG from 2:00 to 6:00 on June 29. -TEPCO PG shall be supplied 600 MW of electricity by Tohoku NW and Chubu PG from 2:00 to 6:00 on June 29. (The transmission margin of an interconnection line was partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. 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.

8	Issued at	4:33 on June 29, 2022
	Instruction	-Tohoku NW shall supply 24 MW of electricity at most to TEPCO PG from 6:00 to 7:30 on June 29. -Chubu PG shall supply 576 MW of electricity to TEPCO PG from 2:00 to 6:00 on June 29. -TEPCO PG shall be supplied 600 MW of electricity at most by Tohoku NW, and Chubu PG from 2:00 to 6:00 on June 29. (The transmission margin of an interconnection line was partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. 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	6:29 on June 29, 2022
	Instruction	-Tohoku NW shall supply 24 MW of electricity at most to TEPCO PG from 8:30 to 9:00 on June 29. -Chubu PG shall supply 436 MW of electricity at most to TEPCO PG from 8:00 to 10:00 on June 29. -Hokuriku T&D shall supply 226 MW of electricity to TEPCO PG from 8:00 to 10:00 on June 29. -TEPCO PG shall be supplied 600 MW of electricity at most by Chubu PG, and Hokuriku T&D from 8:00 to 10:00 on June 29. (The transmission margin of an interconnection line was partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.
10	Issued at	7:30 on June 29, 2022
	Instruction	-Tohoku NW shall supply 500 MW of electricity at most to Tohoku NW from 8:00 to 12:00 on June 29. -TEPCO PG shall be supplied 500 MW of electricity at most by Tohoku NW from 8:00 to 12:00 on June 29. (The maximum transfer capacity of an interconnection line was reviewed and partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.
11	Issued at	8:32 on June 29, 2022
	Instruction	-Chubu PG shall supply 600 MW of electricity to TEPCO PG from 10:00 to 18:00 on June 29. -Hokuriku T&D shall supply 300 MW of electricity at most to to TEPCO PG from 10:00 to 18:00 on June 29. -TEPCO PG shall be supplied 600 MW of electricity at most by Hokkaido NW and TEPCO PG from 10:00 to 18:00 on June 29. (The maximum transfer capacity of an interconnection line was reviewed and partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.

12	Issued at	11:04 on June 29, 2022
	Instruction	-Tohoku NW shall supply 558.6 MW of electricity at most to Tohoku NW from 12:00 to 14:00 on June 29. -TEPCO PG shall be supplied 558.6 MW of electricity at most to Tohoku NW from 12:00 to 14:00 on June 29. (The maximum transfer capacity of an interconnection line was reviewed and partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.
13	Issued at	13:23 on June 29, 2022
	Instruction	-Hokkaido NW shall supply 47.5 MW of electricity to TEPCO PG from 14:00 to 17:30 on June 29. -Tohoku NW shall supply 739 MW of electricity at most to TEPCO PG from 14:00 to 18:00 on June 29. -TEPCO PG shall be supplied 7339 MW of electricity at most by Hokkaido NW and Tohoku NW from 14:00 to 18:00 on June 29. (The maximum transfer capacity of an interconnection line was reviewed and partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.
14	Issued at	17:17 on June 29, 2022
	Instruction	-Tohoku NW shall supply 276.4 MW of electricity at most to TEPCO PG from 18:00 to 21:00 on June 29. -Chubu PG shall supply 600 MW of electricity to at most to TEPCO PG from 18:00 to 24:00 on June 29. -Hokuriku T&D shall supply 150 MW of electricity at most to TEPCO PG from 18:00 to 24:00 on June 29. -Shikoku T&D shall supply 300 MW of electricity at most to TEPCO PG from 18:00 to 24:00 on June 29. -Kyushu T&D shall supply 200 MW of electricity at most to TEPCO PG from 18:00 to 24:00 on June 29. -TEPCO PG shall be supplied 876.4 MW of electricity at most by Tohoku NW, Chubu PG, Hokuriku T&D, Shikoku T&D, and Kyushu T&D from 18:00 to 24:00 on June 29. (The transmission margin of an interconnection line was partly utilized to the power exchange for TEPCO PG.)
	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 high temperature. 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.
15	Issued at	6:01 on June 30, 2022
	Instruction	-Chubu PG shall supply 450 MW of electricity to TEPCO PG from 7:00 to 10:00 on June 30. -Hokuriku T&D shall supply 107.3 MW of electricity at most to TEPCO PG from 7:00 to 8:00 on June 30. -Kansai T&D shall supply 250 MW of electricity at most to TEPCO PG from 8:30 to 10:00 on June 30. -TEPCO PG shall be supplied 600 MW of electricity at most by Chubu PG, Hokuriku T&D, and Kansai T&D from 7:00 to 10:00 on June 30. (Transmission margin of interconnection line was partly utilized to the power exchage for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.

16	Issued at	7:56 on June 30, 2022
	Instruction	-Chubu PG shall supply 600 MW of electricity at most to TEPCO PG from 10:00 to 17:30 on June 30. -Hokuriku T&D shall supply 100 MW of electricity to TEPCO PG from 17:00 to 17:30 on June 30. -Kansai T&D shall supply 600 MW of electricity at most to TEPCO PG from 10:00 to 14:00 on June 30. -Chugoku NW shall supply 300 MW of electricity to TEPCO PG from 17:30 to 18:00 on June 30. -Shikoku T&D shall supply 300 MW of electricity to TEPCO PG from 17:30 to 18:00 on June 30. -TEPCO PG shall be supplied 600 MW of electricity by Chubu PG, Hokuriku T&D, Kansai T&D, Chugoku NW, and Shikoku T&D from 10:00 to 18:00 on June 30. (Transmission margin of interconnection line was partly utilized to the power exchage for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.
17	Issued at	9:06 on June 30, 2022
	Instruction	-Hokkaido NW shall supply 153.7 MW of electricity at most to TEPCO PG from 10:00 to 18:00 on June 30. -Tohoku NW shall supply 150 MW of electricity at most to TEPCO PG from 14:00 to 18:00 on June 30. -TEPCO PG shall be supplied 164.5 MW of electricity at most by Hokkaido NW, and Tohoku NW from 10:00 to 18:00 on June 30. (The transmission margin of an interconnection line was utilized to the power exchange for TEPCO PG.)
	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	17:15 on June 30, 2022
	Instruction	-Tohoku NW shall supply 51.6 MW of electricity at most to TEPCO PG from 18:30 to 20:30 on June 30. -Chubu PG shall supply 600 MW of electricity at most to TEPCO PG from 22:00 to 24:00 on June 30. -Hokuriku T&D shall supply 200 MW of electricity at most to TEPCO PG from 18:00 to 22:00 on June 30. -Kansai T&D shall supply 100 MW of electricity at most to TEPCO PG from 18:00 to 23:30 on June 30. -Chugoku NW shall supply 200 MW of electricity to TEPCO PG from 19:30 to 22:00 on June 30. -Shikoku T&D shall supply 200 MW of electricity at most to TEPCO PG from 18:00 to 23:30 on June 30. -TEPCO PG shall be supplied 651.6 MW of electricity at most by Tohoku NW, Chubu PG, Hokuriku T&D, Kansai T&D, Chugoku NW, and Shikoku T&D from 18:00 to 24:00 on June 30. (The transmission margin of an interconnection line was utilized to the power exchange for TEPCO PG.)
	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.

19	Issued at	8:07 on July 1, 2022
	Instruction	-Tohoku NW shall supply 19.1 MW of electricity to TEPCO PG from 9:30 to 10:00 on July 1. -Chubu PG shall supply 150 MW of electricity at most to TEPCO PG from 9:00 to 14:00 on July 1. -Hokuriku T&D shall supply 100 MW of electricity at most to TEPCO PG from 9:00 to 14:00 on July 1. -Kansai T&D shall supply 250 MW of electricity to TEPCO PG from 9:00 to 14:00 on July 1. -Chugoku NW shall supply 150 MW of electricity to TEPCO PG from 9:00 to 14:00 on July 1. -Shikoku T&D shall supply 50 MW of electricity at most to TEPCO PG from 9:00 to 14:00 on July 1. -TEPCO PG shall be supplied 600 MW of electricity by Tohoku NW, Chubu PG, Hokuriku T&D, Kansai T&D, Chugoku NW, and Shikoku T&D from 9:00 to 14:00 on July 1. (The transmission margin of an interconnection line was utilized to the power exchange for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.
20	Issued at	16:04 on July 1, 2022
	Instruction	-Tohoku NW shall supply 143.3 MW of electricity to TEPCO PG from 16:30 to 17:00 on July 1. -Kansai T&D shall supply 300 MW of electricity to TEPCO PG from 16:30 to 17:00 on July 1. -Chugoku NW shall supply 156.7 MW of electricity to TEPCO PG from 16:30 to 17:00 on July 1. -TEPCO PG shall be supplied 600 MW of electricity by Tohoku NW, Kansai T&D, and Chugoku NW from 16:30 to 17:00 on July 1. (The transmission margin of an interconnection line was utilized to the power exchange for TEPCO PG.)
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity by photovoltaic generation due to weather change.
21	Issued at	15:30 on August 2, 2022
	Instruction	-Hokkaido NW shall supply 160.7 MW of electricity at most to TEPCO PG from 16:00 to 19:00 on August 2. -Tohoku NW shall supply 757 MW of electricity at most to TEPCO PG from 16:00 to 24:00 on August 2. -Chubu PG shall supply 300 MW of electricity to TEPCO PG from 16:00 to 24:00 on August 2. -TEPCO PG shall be supplied 1259.5 MW of electricity at most by Hokkaido NW, Tohoku NW, and Chubu PG from 16:00 to 24:00 on August 2. (The transmission margin of an interconnection line was utilized to the power exchange for TEPCO PG.)
	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.
22	Issued at	14:39 on August 3, 2022
	Instruction	-Tohoku NW shall supply 123.8 MW of electricity at most to TEPCO PG from 16:00 to 17:00 on August 3. -Chubu PG shall supply 600 MW of electricity to TEPCO PG from 16:00 to 17:00 on August 3. -TEPCO PG shall be supplied 723.8 MW of electricity at most by Tohoku NW, and Chubu PG from 16:00 to17:00 on August 3. (The transmission margin of an interconnection line was utilized to the power exchange for TEPCO PG.)
	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 high temperature. The Organization tried improvement of supply and demand by issuing instruction to TEPCO PG. *The instructions were issued in the time slot of under 3% area reserve margin as well as in the under 5% time slot considering demand fluctuation.

23	Issued at	15:36 on September 12, 2022
	Instruction	-Kansai T&D shall supply 400 MW of electricity at most to Kyushu T&D from 17:30 to 19:30 on September 12. -Chugoku NW shall supply 300 MW of electricity at most to Kyushu T&D from 16:30 to 20:00 on September 12. -Kyushu T&D shall be supplied 700 MW of electricity at most by Kansai T&D, and Chugoku NW from 16:30 to 20:00 on September 12.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity by unexpected demand growth due to high temperature.
24	Issued at	15:52 on September 13, 2022
	Instruction	-Chubu PG shall supply 100 MW of electricity at most to Kyushu T&D from 18:00 to 18:30 on September 13. -Chugoku NW shall supply 200 MW of electricity at most to Kyushu T&D from 16:30 to 19:00 on September 13. -Shikoku T&D shall supply 100 MW of electricity at most to Kyushu T&D from 17:30 to 19:00 on September 13. -Kyushu T&D shall be supplied 400 MW of electricity at most by Chubu PG, Chugoku NW, and Shikokug T&D from 16:30 to 19:00 on September 13.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of a shortage of supply capacity by unexpected demand growth due to high temperature.

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