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

Actual Data for Fiscal Year 2023

November 2024

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

FOREWORD

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

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

The Organization published the actual data for electricity supply–demand and network system utilization ahead of the annual report because of the compilation of actual data collection up to the 2023 fiscal year.

SUMMARY

This report reviews the outlook for electricity supply–demand and cross-regional interconnection lines in the 2023 fiscal year according to the provisions of Article 181 of the Operational Rules the Organization for Cross-regional Coordination of Transmission Operators, Japan (hereinafter, the Organization).

This report comprises two parts the electricity supply and demand situation and, the interconnection lines situation.

Regarding supply and demand, the peak demand nationwide (16,090 $\times 10^4$ kW) was recorded in July, and the monthly peak electric energy requirement nationwide (83,695 GWh) was recorded in August.

The reserve margin against the summer and winter peak demands was 13.5% and 14.3%, respectively.

Power exchange instructions were issued by the Organization 8 times, with 5 of them being issued for insufficient ability to reduce power supply caused by unexpected demand decrease and solar output increase.
In Addition, long-cycle frequency control was implemented 377 times in the year.

Instructions for output shedding of the renewable-energy generating facilities were issued 305 times in FY 2023, increasing from 136 times of issuance in the previous year. The actual output shed in a day totaled 431,961 MW in FY 2023.

The total volume of utilization of the interconnection lines was 116,723 GWh, which was a slight decrease from the 124,975 GWh in FY 2023.

In FY 2023, 339 interconnection line maintenance events occurred, requiring 776 days-worth of work in FY 2023.

We hope that this report will be useful.

CONTENTS

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

CHAPTER I: ACTUAL ELECTRICITY SUPPLY AND DEMAND

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

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

A regional service area is a specific area to which a GT&D company supplies electricity through cross-regional interconnection lines. Japan is divided into 10 regional service areas, as depicted 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.

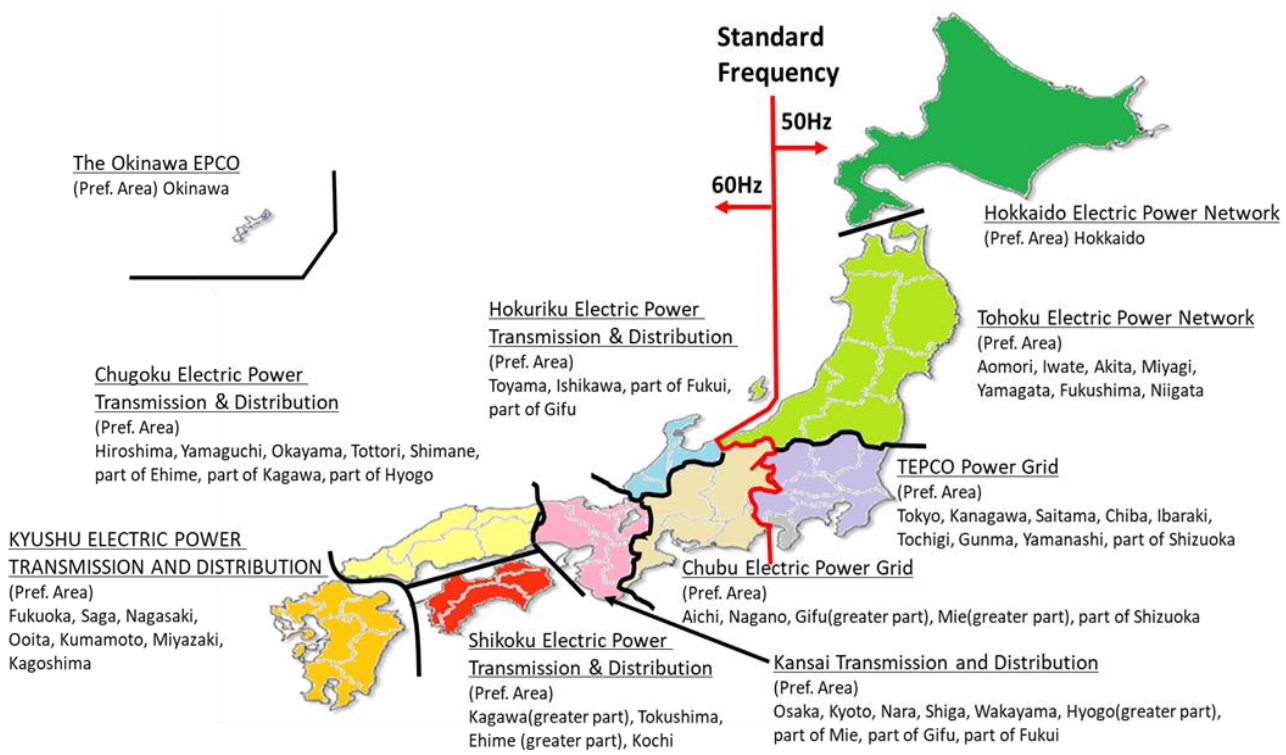


Figure 1-1: The 10 Regional Service Areas in Japan and their Prefectural Distribution

(2) Definition of Seasons

This report divides the seasons into summer and winter. Summer is from July to September, and winter is from December to February. This report compares the outlook of actual weather for the previous year to the Seasonal Climate Report of Japan prepared by the Japan Meteorological Agency (JMA). JMA defines the summer and winter periods as June–August and December–February, respectively. The definitions of the summer period by this report and the JMA differ.

2. Outlook for Actual Weather Nationwide

(1) Weather During the Summer Period (from June to August 2023)

The characteristics of the actual weather from June to August 2023 were published on the website of the JMA. Table 1-1 presents the anomalies in the temperature and precipitation ratios of the period.

- Seasonal mean temperatures were significantly above normal in northern/eastern/western Japan because the regions were covered by warm-air and affected by southerly warm air advection. The regional average of seasonal mean temperature anomalies was the highest on record for summer since 1946 in northern/eastern Japan, and tied with 2013, 2018 and 2022 as the highest on record for summer since 1946 in western Japan. The seasonal anomaly of the average temperature over Japan was +1.76℃ (the warmest for the season since 1898).
- Seasonal sunshine durations were significantly above normal in northern/eastern Japan, and seasonal precipitation amounts were below normal in the Pacific side of northern Japan, because the regions were frequently covered by high-pressure systems.
- Meanwhile, seasonal precipitation amounts were significantly above normal on the Pacific side of eastern/western Japan and in Okinawa/Amami, and seasonal sunshine durations were below normal in Okinawa/Amami, because the regions were affected by the Baiu rainy season front in June and two Typhoons KHANUN (T2306) and LAN (T2307) in August.

Table 1-1: Anomalies in temperature, precipitation, and sunshine duration by weather region from June to August 2023

Weather Region	Mean Temperature Anomaly[°C]	Precipitation Ratio[%]	Sunshine Duration Ratio[%]
Northern	+3.0	94	120
Eastern	+1.7	112	126
Western	+0.9	109	101
Okinawa/Amami	+0.1	137	93

Source: Japan Meteorological Agency (JMA), Tokyo Climate Center.
Seasonal Climate Report over Japan for Summer (FY 2023).
https://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=8&year=2023
https://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=8&year=2023

(2) Weather During the Winter Period (from December 2023 to February 2024)

The characteristics of the actual weather from December 2023 to February 2024 were published on the website of the JMA. Table 1-2 presents the anomalies in temperature and the ratios of rainfall and snowfall during the period.

- Seasonal temperatures were significantly above normal nationwide due to weaker-than-normal winter monsoon, and warm air inflow mainly in February. The seasonal anomaly of the average temperature over Japan was +1.27 **℃** (the second highest for the season since 1898).
- Seasonal precipitation amounts were above normal on the Sea of Japan side of eastern Japan due to stronger influences of winter monsoon and low-pressure systems mainly in December, and on the Sea of Japan side and on the Pacific side of western Japan due to stronger influences of low-pressure systems and fronts in February. On the other hand, they were below normal in Okinawa/Amami due to weaker influences of low-pressure systems and fronts.
- Seasonal sunshine durations were above normal on the Sea of Japan side of northern/eastern Japan, on the Pacific side of northern Japan, and Okinawa/Amami, due to weaker-than-normal winter monsoon and so on.

Table 1-2: Anomalies in temperature, precipitation, sunshine duration and snowfall by weather region from December 2023 to February 2024

Weather Region	Mean Temperature Anomaly[°C]	Precipitation Ratio[%]	Sunshine Duration Ratio[%]	Snowfall Ratio[%]
Northern	+1.1	106	109	82
Eastern	+1.6	109	103	53
Western	+1.5	117	100	36
Okinawa/Amami	+1.0	86	124	-

Source：Japan Meteorological Agency, Tokyo Climate Center.
Seasonal Climate Report over Japan for Winter (FY 2024).
https://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=2&year=2024
https://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=2&year=2024

3. Actual Nationwide Peak Demand

Peak demand refers to the highest consumption of electricity in a period, and it is expressed hourly in this report.[1] Table 1-3 presents the monthly peak demand for regional service areas in FY 2023. Figures 1-2 and 1-3 depict the nationwide monthly peak demand for FY 2023 and the actual annual peak demand from FY 2016 to FY 2023, respectively. Table 1-4 presents the actual nationwide peak demand since FY 2016 at the sending end. In this report, peak demand refers to the maximum hourly value of the electric energy requirement.

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

The maximum monthly peak demand nationwide for FY 2023 was 16,090 × 10^4 kW in July, which was only lower than that of the previous year by 518 × 10^4 kW or 3.1% and lower than the FY 2020's peak demand by 3.3% during the 8 years since they were recorded at the sending end. This decrease is attributable to factors such as falling residential demand accompanied by a decrease in remote work, as well as energy conservation and savings, despite the record-breaking highest summer mean temperature.

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	385	355	376	455	488	406	363	454	500	522	488	459
Tohoku	1,002	1,040	1,115	1,367	1,449	1,376	947	1,216	1,328	1,423	1,337	1,278
Tokyo	3,393	3,805	4,658	5,525	5,475	5,238	3,730	3,791	4,335	4,675	4,990	4,789
Chubu	1,674	1,804	2,151	2,465	2,433	2,357	1,760	1,862	2,153	2,311	2,172	2,084
Hokuriku	353	361	422	491	507	465	348	397	501	497	478	447
Kansai	1,725	1,831	2,262	2,708	2,671	2,522	1,810	1,885	2,304	2,503	2,345	2,233
Chugoku	720	696	839	1,027	1,026	955	718	794	1,006	1,047	935	881
Shikoku	319	341	424	488	491	464	356	356	450	464	422	392
Kyushu	1,005	1,162	1,294	1,574	1,578	1,504	1,137	1,193	1,500	1,529	1,240	1,183
Okinawa	104	124	143	155	155	151	147	116	98	103	103	101
Nationwide	10,355	11,074	13,490	16,090	15,992	15,032	11,014	11,756	13,940	14,462	14,018	13,389

[1] In this report, the demand includes connection to the network of the GT&D company and excludes connection to the specified transmission and distribution system or consumption of the privately-owned generating facility.

[2] "Nationwide peak demand" refers the maximum aggregated demand in a period for the regional service areas of the 10 GT&D companies but not the addition of each regional peak demand.

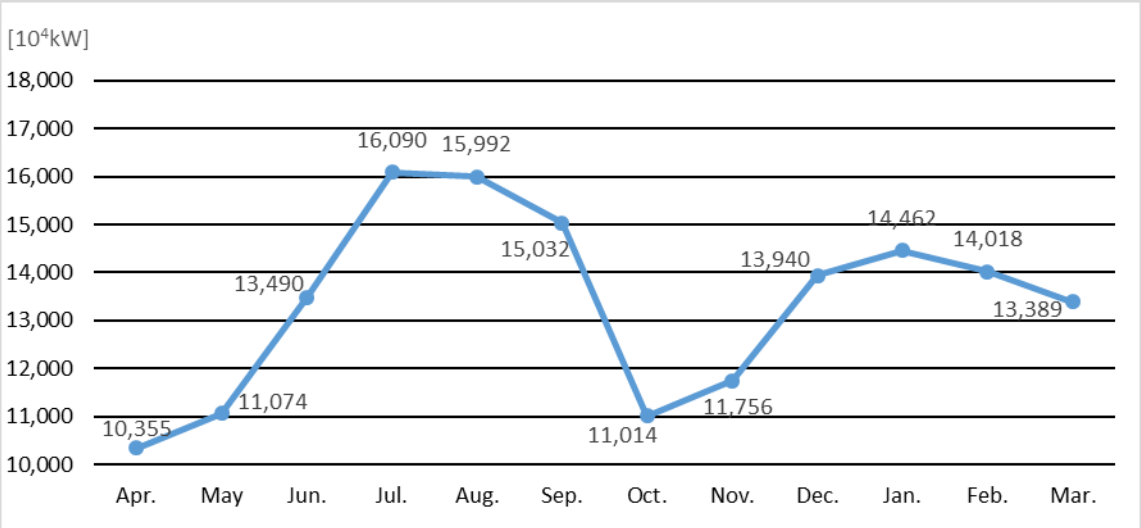


Figure 1-2: Nationwide monthly peak demand

Table 1-4: Actual annual peak demand (FY 2016–2023, sending-end data)

[10⁴kW]

FY	2016	2017	2018	2019	2020	2021	2022	2023
Nationwide	15,589	15,577	16,482	16,461	16,645	16,460	16,608	16,090

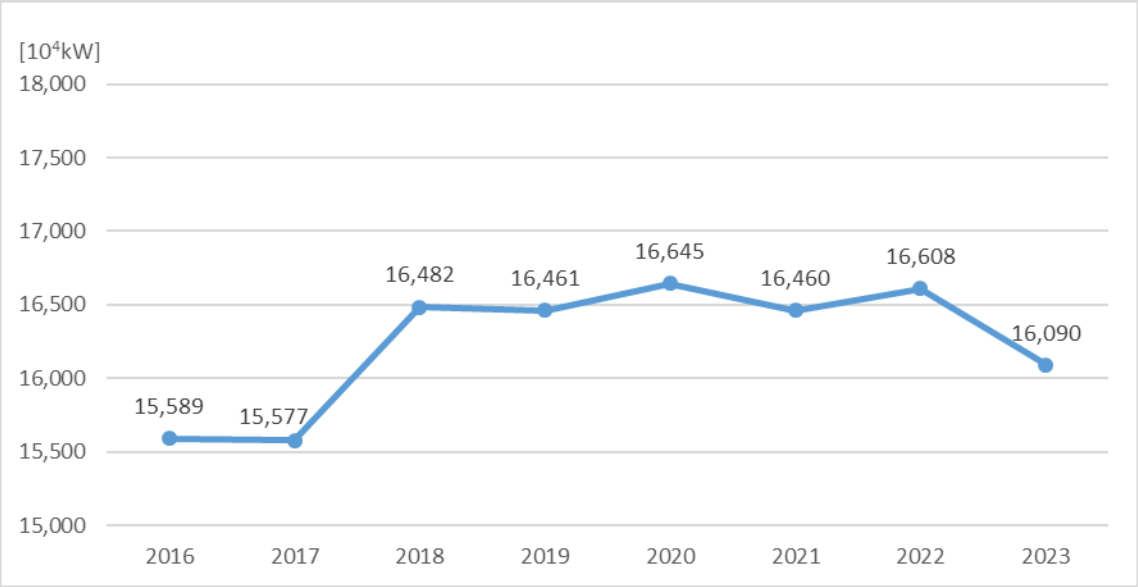


Figure 1-3: Actual annual peak demand (Nationwide)

4. Actual Nationwide Electric Energy Requirements

Table 1-5 presents the monthly electric energy requirements for the regional service areas in FY 2023. Figures 1-4 and 1-5 depict the nationwide monthly and actual annual electric energy requirements from FY 2016 to 2023, respectively. Table 1-6 presents the actual annual electric energy requirement since FY 2016 at the sending end.

The values in red are the maximum monthly energy requirement, and those in blue are the minimum monthly energy requirement for each regional service area.

The actual annual nationwide electric energy requirement for FY 2023 was 862,572 GWh, which was lower than that for the previous year by 7,477 GWh or 0.9% and the FY 2017's electric energy requirement by 4.3% (the highest in the 8 years since they were recorded at the sending end). This decrease is attributable to factors such as falling residential demand accompanied by a decrease in remote work, as well as energy conservation and savings, despite the record-breaking highest summer mean temperature.

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	2,254	2,140	2,088	2,340	2,520	2,224	2,198	2,448	3,015	3,115	2,878	2,832	30,052
Tohoku	5,827	5,741	5,844	6,768	7,520	6,444	5,741	6,219	7,435	7,657	7,149	7,314	79,658
Tokyo	19,335	19,473	21,240	27,194	28,083	24,971	20,321	20,866	24,159	25,518	23,953	24,193	279,308
Chubu	9,322	9,320	10,157	12,193	12,189	11,491	9,775	10,092	11,286	11,724	10,985	11,392	129,925
Hokuriku	2,056	1,959	2,083	2,449	2,612	2,286	2,011	2,155	2,553	2,602	2,457	2,535	27,758
Kansai	9,852	9,982	10,732	13,274	13,727	12,353	10,090	10,504	12,219	12,899	11,938	12,301	139,871
Chugoku	4,127	4,028	4,287	5,159	5,379	4,848	4,253	4,376	5,215	5,396	4,940	4,942	56,950
Shikoku	1,884	1,892	1,995	2,408	2,473	2,273	1,915	1,987	2,330	2,415	2,225	2,245	26,041
Kyushu	5,971	6,153	6,634	8,071	8,354	7,513	6,270	6,388	7,647	7,824	7,005	7,034	84,864
Okinawa	573	636	760	903	838	840	714	584	583	585	549	579	8,144
Nationwide	61,201	61,323	65,819	80,760	83,695	75,242	63,288	65,620	76,443	79,735	74,080	75,366	862,572

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

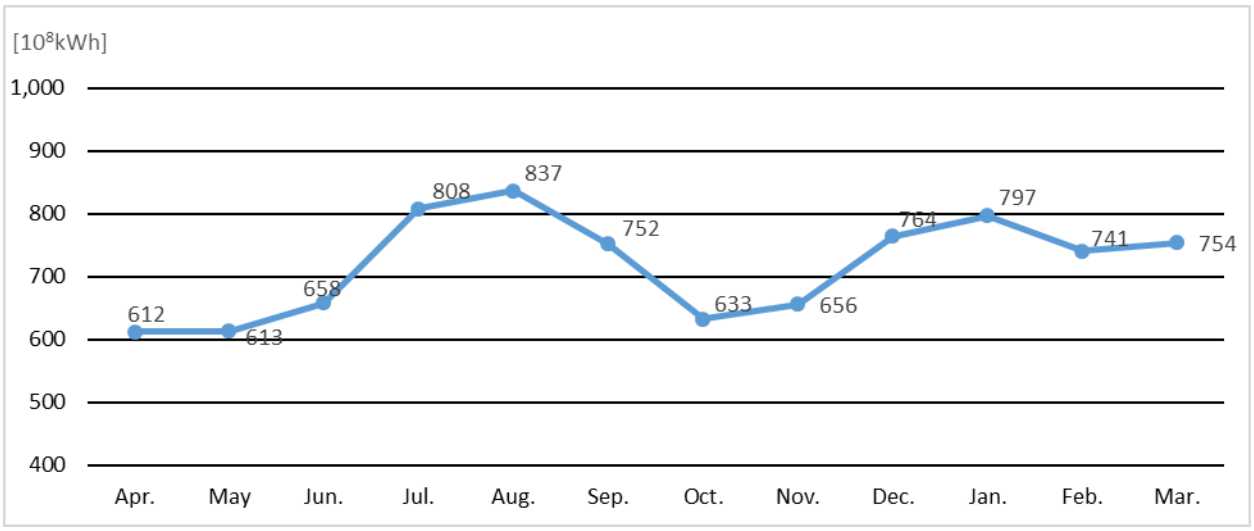


Figure 1-4: Nationwide monthly electric energy requirements

Table 1-6: Actual annual electric energy requirement (FY 2016–2023, sending-end data)

[GWh]

FY	2016	2017	2018	2019	2020	2021	2022	2023
Nationwide	890,451	900,902	896,473	878,383	867,842	885,171	870,849	862,572

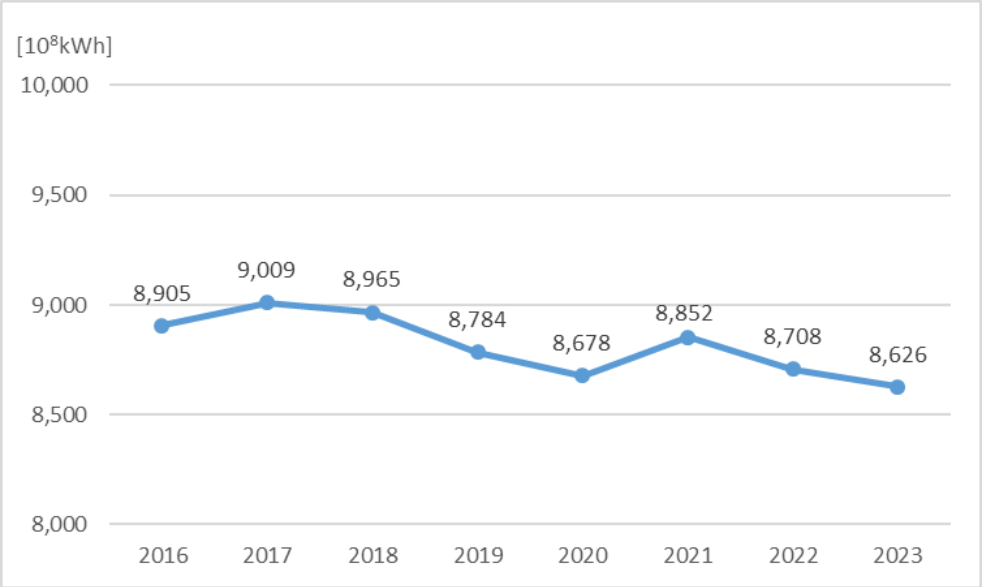


Figure 1-5: Actual annual electric energy requirements (Nationwide)

5. Nationwide Load Factor

The load factor is the ratio of average demand to peak demand for a period. Table 1-7 presents the monthly load factor for the regional service areas in FY 2023, while Figures 1-6 and 1-7 depict the nationwide monthly and annual load factors, respectively. Table 1-8 presents the actual annual load factor since FY 2016 at the sending end.

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

The nationwide annual load factor for FY 2023 was 61.0%, which was higher than that for the previous year by 1.2 points but lower than the FY 2017's load factor by 5.0 points (the maximum figure for 8 years since they were recorded at the sending end).

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	81.4	81.0	77.2	69.2	69.4	76.0	81.5	75.0	81.1	80.3	84.7	83.0	65.6
Tohoku	80.7	74.2	72.8	66.5	69.7	65.0	81.5	71.1	75.3	72.3	76.8	76.9	62.6
Tokyo	79.1	68.8	63.3	66.2	68.9	66.2	73.2	76.4	74.9	73.4	69.0	67.9	57.6
Chubu	77.4	69.5	65.6	66.5	67.3	67.7	74.7	75.3	70.5	68.2	72.7	73.5	60.0
Hokuriku	80.9	72.9	68.5	67.1	69.2	68.2	77.6	75.4	68.5	70.3	73.8	76.2	62.3
Kansai	79.3	73.3	65.9	65.9	69.1	68.0	74.9	77.4	71.3	69.3	73.1	74.0	58.8
Chugoku	80.3	78.2	71.4	67.6	71.5	70.3	79.8	76.6	69.4	69.1	76.2	76.3	62.1
Shikoku	82.0	74.5	65.3	66.3	67.7	68.0	72.2	77.5	69.6	69.9	75.7	76.9	60.4
Kyushu	82.5	71.2	71.2	68.9	71.1	69.4	74.2	74.4	68.5	68.8	81.2	79.9	61.2
Okinawa	76.7	68.9	74.0	78.2	72.8	77.2	65.1	69.9	80.2	76.6	76.6	77.0	59.8
Nationwide	82.1	74.4	67.8	67.5	70.3	69.5	77.2	77.5	73.7	74.1	75.9	75.7	61.0

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

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

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

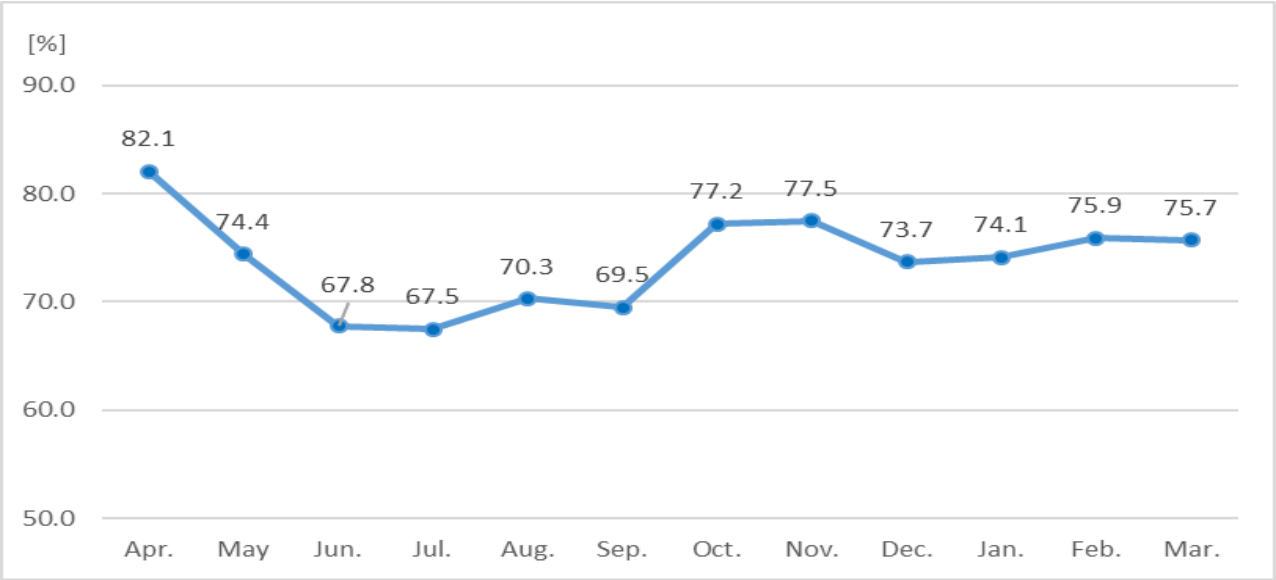


Figure 1-6: Nationwide monthly load factor

Table 1-8: Actual annual load factor (FY 2016–2023)

[%]

FY	2016	2017	2018	2019	2020	2021	2022	2023
Nationwide	65.8	66.0	62.1	60.7	59.5	61.4	59.8	61.0

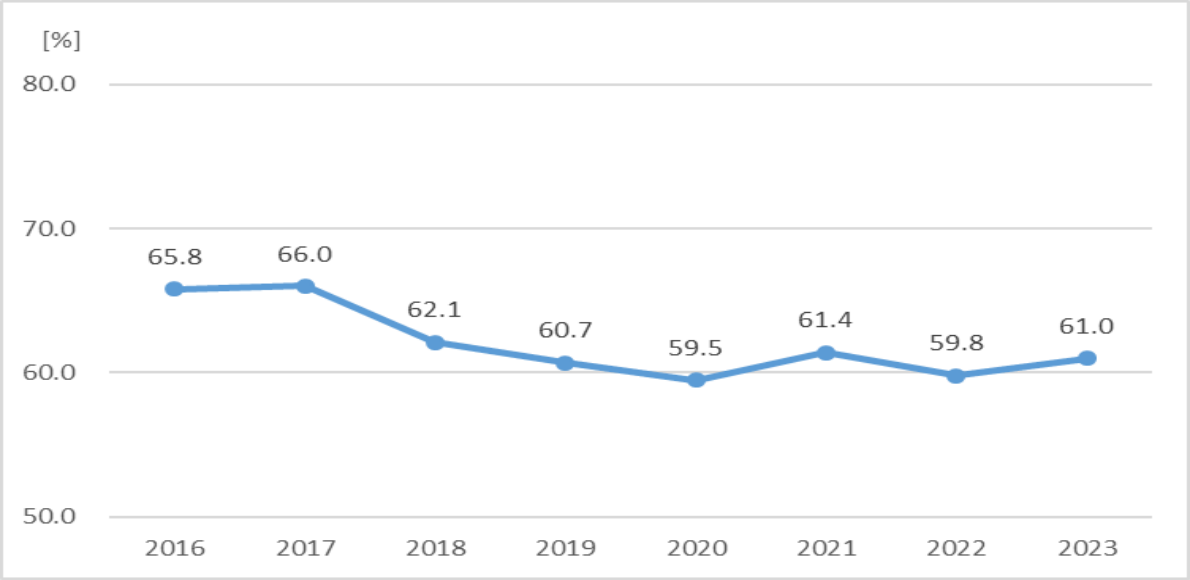


Figure 1-7: Actual annual load factor (Nationwide)

6. Nationwide Supply–Demand Status During the Peak Demand

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

Table 1-9 presents the supply–demand status during the summer peak demand period for regional service areas in FY 2023. Table 1-10 presents the summer peak supply–demand status data since FY 2016.

The actual nationwide summer peak demand for FY 2023 was 16,090 × 10^4 kW, which was registered at 15:00 on July 27, against the supply capacity of 18,267 × 10^4 kW, having a reserve margin of 13.5%.

The least reserve margin for the summer peak demand was 6.8%, which was registered at 15:00 on August 3 in the Hokuriku area.

Table 1-9: Supply–demand status during the summer peak demand period for 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	488	8/25	Fri.	11:00～12:00	34.7	543	55	11.3	9,385	80.2
Tohoku	1,448	8/23	Wed.	14:00～15:00	33.6	1,692	244	16.8	27,200	78.3
Tokyo	5,525	7/18	Tue.	14:00～15:00	37.5	6,188	663	12.0	101,456	76.5
Chubu	2,465	7/18	Tue.	14:00～15:00	37.1	2,757	292	11.8	46,116	77.9
Hokuriku	507	8/3	Thur.	14:00～15:00	38.2	542	34	6.8	9,566	78.6
Kansai	2,708	7/27	Thur.	14:00～15:00	38.1	2,999	291	10.7	49,713	76.5
Chugoku	1,027	7/28	Fri.	15:00～16:00	36.1	1,123	96	9.3	19,507	79.1
Shikoku	491	8/21	Mon.	13:00～14:00	35.7	545	54	11.0	9,002	76.4
Kyushu	1,578	8/21	Mon.	14:00～15:00	34.1	1,703	125	7.9	29,291	77.3
Okinawa	155	7/7	Fri.	14:00～15:00	33.3	212	57	36.7	3,087	82.9
Nationwide	16,090	7/27	Thur.	14:00～15:00	-	18,267	2,177	13.5	299,164	77.5

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

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

"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 2016–2023)

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
2023	16,090	7/27	Thur.	14:00～15:00	-	18,267	2,177	13.5	299,164	77.5

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

Table 1-11 presents the supply–demand status during the winter peak demand period for regional service areas in FY 2023. Table 1-12 presents the winter peak supply–demand status data since FY 2016.

The actual nationwide winter peak demand for FY 2023 was 14,462 × 10^4 kW, which occurred at 10:00 on January 24, against a supply capacity of 16,527× 10^4 kW, with a reserve margin of 14.3%. The least reserve margin at the winter peak demand was 8.1%, which was registered at 10:00 on January 24 in the Kyushu area.

Table 1-11: Supply–demand status during the winter peak demand period for the 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	522	1/16	Tue.	09:00～10:00	-5.7	571	49	9.4	11,367	90.8
Tohoku	1,423	1/16	Tue.	09:00～10:00	-1.1	1,627	204	14.3	30,084	88.1
Tokyo	4,990	2/5	Mon.	14:00～15:00	3.0	5,655	665	13.3	99,477	83.1
Chubu	2,311	1/24	Wed.	09:00～10:00	0.1	2,528	217	9.4	47,352	85.4
Hokuriku	501	12/22	Fri.	09:00～10:00	0.4	575	74	14.8	10,869	90.3
Kansai	2,503	1/24	Wed.	09:00～10:00	2.4	2,727	224	8.9	50,281	83.7
Chugoku	1,047	1/24	Wed.	09:00～10:00	0.2	1,153	106	10.1	21,741	86.5
Shikoku	464	1/24	Wed.	09:00～10:00	1.5	504	40	8.6	9,725	87.3
Kyushu	1,529	1/24	Wed.	09:00～10:00	2.9	1,653	124	8.1	31,729	86.5
Okinawa	103	2/22	Thur.	13:00～14:00	23.0	163	60	58.2	2,028	82.0
Nationwide	14,462	1/24	Wed.	09:00～10:00	-	16,527	2,065	14.3	304,378	87.7

[6] See footnote 5.

Table 1-12: Actual supply–demand status for winter peak demand (FY 2016–2023)

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
2023	14,462	1/24	Wed.	09:00～10:00	-	16,527	2,065	14.3	304,378	87.7

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 lines around adjacent areas. During the calculation, within the volume of the available transfer capacity (ATC) of the interconnection lines, the supply capacity of a certain area is transferred to another area for them to be at the same level. If the ATC of an interconnection line becomes zero and the constraint of the line emerges, the cross-regional reserve margin becomes different from the adjacent area.

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

Tables 1-13 and 1-14 present the supply–demand status during occurrences at the actual least cross-reserve margin,[8] and the cross-reserve margin of 3% during the summer and winter peak periods, respectively. Moreover, no case was under 3% of the cross-reserve margin.

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

FY	Occurrence Date & Time	Block	Block			Cross-regional
			Demand(MW)	Supply capacity(MW)	Reserve capacity(MW)	Reserve margin(%)
2023	2023/7/19 11:30~12:00	Tokyo	51,842	54,998	3,156	6.09

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

FY	Occurrence Date & Time	Block	Block			Cross-regional
			Demand(MW)	Supply capacity(MW)	Reserve capacity(MW)	Reserve margin(%)
2023	2024/2/26 4:00~4:30	Hokkaido	4,433	4,829	396	8.93

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

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

8. Nationwide Lowest Demand Period

Tables 1-15 and 1-16 present the status of the lowest demand period for nationwide and regional service areas in FY 2023 and the actual annual lowest demands at the sending end from FY 2016 to FY 2023, respectively. The lowest demand in FY 2023 was 5,944 × 10^4 kW, which was the lowest for the past 8 years since data were recorded at the sending end, and it is lower than the previous year's by 4.7% and lower than FY 2016's highest demand by 8.6%.

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

	Least Demand [10^4kW]	Occurrence Date & Time			Daily Mean Temperature [℃]	Daily Energy Supply [10^4kWh]
Hokkaido	223	9/25	Mon.	01:00~02:00	17.9	7,080
Tohoku	569	5/5	Fri.	00:00~01:00	18.9	15,859
Tokyo	1,888	5/4	Thur.	01:00~02:00	19.7	53,466
Chubu	804	5/5	Fri.	01:00~02:00	20.1	22,316
Hokuriku	178	5/5	Fri.	00:00~01:00	21.0	4,813
Kansai	952	5/4	Thur.	01:00~02:00	20.1	26,476
Chugoku	409	5/5	Fri.	00:00~01:00	20.3	11,050
Shikoku	187	5/5	Fri.	01:00~02:00	19.9	5,124
Kyushu	632	10/16	Mon.	01:00~02:00	20.8	20,304
Okinawa	59	11/20	Mon.	01:00~02:00	20.4	1,814
Nationwide	5,944	5/5	Fri.	01:00~02:00	-	165,990

Table 1-16: Actual annual lowest demand (FY 2016–2023, sending-end data)

[10^4kW]

FY	2016	2017	2018	2019	2020	2021	2022	2023
Nationwide	6,516	6,477	6,496	6,398	6,065	6,332	6,239	5,944

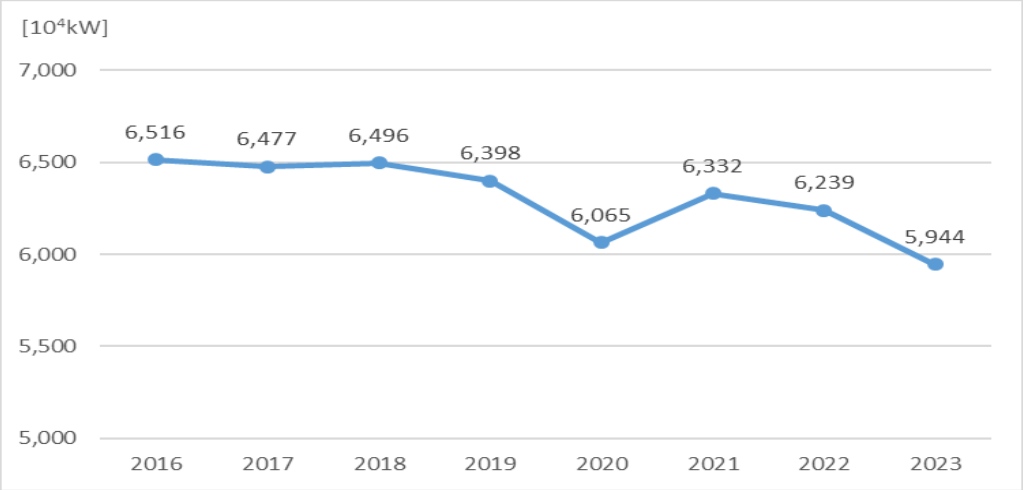


Figure 1-8: Actual annual lowest demand (Nationwide)

[9] See Footnote 5.

9. Nationwide Peak Daily Energy Supply

Tables 1-17 and 1-18 present the summer peak daily energy supply for nationwide and regional service areas in FY 2023 (July–September 2023) and the winter peak daily energy supply for nationwide and regional service areas in FY 2023 (December 2023–February 2024), respectively.[10]

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

Area	Peak Daily Energy Supply [10^4kWh]	Occurrence Date		Daily Mean Temperature [˚C]
Hokkaido	9,385	8/25	Fri.	29.7
Tohoku	27,216	8/24	Thur.	29.3
Tokyo	101,456	7/18	Tue.	31.8
Chubu	46,116	7/18	Tue.	31.9
Hokuriku	9,593	8/4	Fri.	31.9
Kansai	49,918	7/28	Fri.	31.1
Chugoku	19,803	8/3	Thur.	30.9
Shikoku	9,020	7/27	Thur.	31.3
Kyushu	29,933	8/4	Fri.	31.9
Okinawa	3,096	7/6	Thur.	30.1
Nationwide	300,714	8/4	Fri.	-

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

Area	Peak Daily Energy Supply [10^4kWh]	Occurrence Date		Daily Mean Temperature [˚C]
Hokkaido	11,367	1/16	Tue.	-5.7
Tohoku	30,084	1/16	Tue.	-1.1
Tokyo	99,728	2/6	Tue.	3.4
Chubu	47,352	1/24	Wed.	0.1
Hokuriku	10,869	12/22	Fri.	0.4
Kansai	50,281	1/24	Wed.	2.4
Chugoku	21,741	1/24	Wed.	0.2
Shikoku	9,725	1/24	Wed.	1.5
Kyushu	32,114	12/22	Fri.	3.0
Okinawa	2,144	1/24	Wed.	13.3
Nationwide	304,378	1/24	Wed.	-

[10] See 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 (hereinafter, the Act), if the Organization finds it necessary to improve the electricity supply–demand status, the Organization may require members such as EPCOs to undertake certain necessary actions if the status of the electricity supply–demand from an electricity business conducted by a member has worsened or is likely to worsen.

In FY 2023, the Organization issued instructions to GT&D companies on eight occasions for them to exchange power according to the provisions of Items 1–3 of Paragraph 1 of Article 111 of the Operational Rules (Table 1-19). Specifically, the Organization issued instructions to the GT&D companies that the supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of the shortage of supply capacity in a corresponding area, following a decrease in solar power output and unexpected demand growth caused by higher temperatures. However, the instructions for reducing the power supply were also issued due to the unexpected demand decrease and the solar power output increase.

The specific instructions are as follows (for details, please refer to <Reference> Details of Actual Power Exchange Instructions Issued by the Organization):[11]

(1) Instruction for resolving tight supply–demand from Kansai T&D to Hokuriku T&D
January 1, 2024: 600 MW at most following supply capacity shortage caused by the occurrence of the Hokuriku Peninsular Earthquake (three instructions)

(2) Instruction for absorbing excessive energy from Kansai T&D to TEPCO PG and Hokuriku T&D
June 3, 2023: 500 MW at most following unexpected demand decrease and solar power output increase (five instructions)

Table 1-19: Actual instructions to GT&D companies issued by the Organization (FY 2015–2023)

[Instructions]

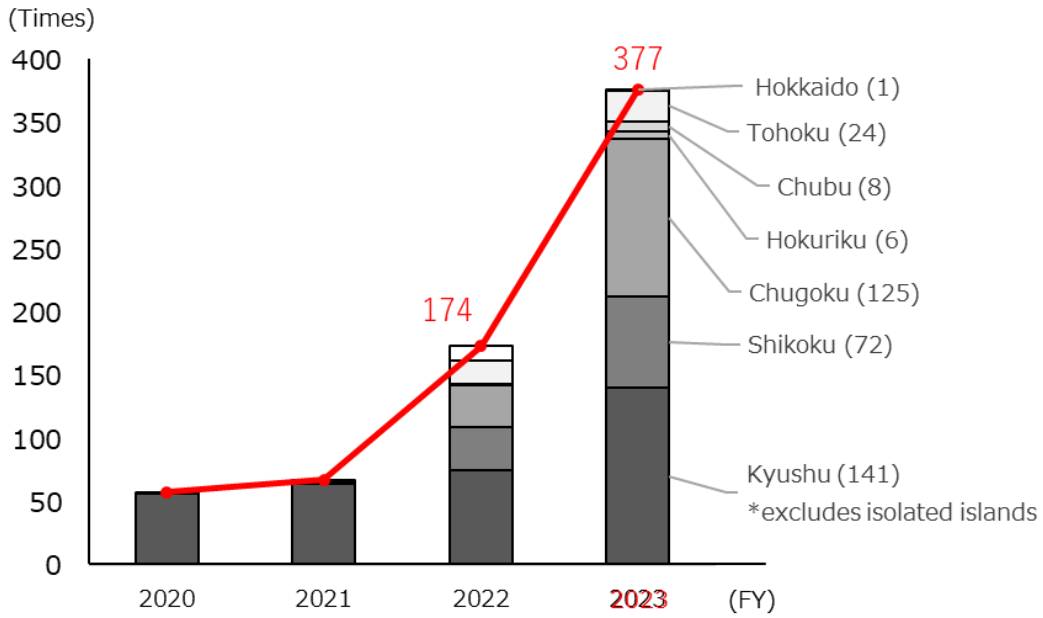
FY	2015	2016	2017	2018	2019	2020	2021	2022	2023
Tight supply-demand	2	2	10	25	6	226	21	24	3
Insufficient ability of reducing power supply	–	–	–	–	–	–	–	–	5

[11] https://www.occto.or.jp/oshirase/shiji/2023.html (in Japanese only)

Long-cycle Cross-regional Frequency 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, Hokuriku T&D, Kansai T&D, Chugoku NW, Shikoku T&D, and Kyushu T&D to other areas through cross-regional interconnection lines by utilizing their ATC, according to the provisions of Article 132 of the Operational Rules. The Organization received the request from each EPCO to control the inability to reduce the power supply.[13] Such controls were implemented on 377 occasions in FY 2023.

<Reference> Transition of Long-cycle Cross-regional Frequency Controls



[12] This refers to frequency control through the utilization of the balancing capacity of other regional service areas of member GT&D companies via 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. Thus, controlling the output of the thermal power generators according to such fluctuations is essential. Among such output controls, the capacity to vary the output of the generators is generally called the "balancing capacity for redundancy."

11. Output Shedding of Renewable Energy Generating Facilities Operated by EPCOs Other than GT&D Companies

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

Tables 1-20 to 1-28 present the actual output shedding of the renewable energy generating facilities in FY 2023 from the Hokkaido to Okinawa areas.[14] Table 1-29 presents the nationwide results.

Output shedding of renewable energy generating facilities was implemented in each regional service area of Hokkaido, Tohoku, Chugoku, Shikoku, Kyushu, and Okinawa in FY 2022. In FY 2023, the regional service areas of Chubu, Hokuriku, and Kansai were added.

Output shedding of renewable energy generating facilities was implemented when the balancing capacity for redundancy might become insufficient. The shedding period was from 8:00 to 16:00 in each area, except for a few cases.

Amid the increasing capacity of variable renewable energy, such as solar and wind power, output shedding of renewable energy generating facilities was implemented 305 times in FY 2023, increasing from 136 times in the previous year. The actual output shed on a day totaled 431,961 MW in FY 2023, increasing from 147,166 MW in FY 2022.

The Organization confirms and verifies whether the output shedding of the renewable energy generating facilities by GT&D company to facilities of EPCOs is according to the provisions of Article 180 of the Operational Rules. The confirmation and verification revealed that it was appropriate.

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

Table 1-20: Actual output shedding of the renewable energy generating facilities (Hokkaido, times, 10^4 kW)

Hokkaido				
Month	Numbers of shedding [times]	Shed capacity [MW]	Maximum of shed capacty [MW]	Implemented on
Apr. 2023	0	0.0	0.0	
May 2023	0	0.0	0.0	
Jun. 2023	0	0.0	0.0	
Jul. 2023	0	0.0	0.0	
Aug. 2023	0	0.0	0.0	
Sep. 2023	0	0.0	0.0	
Oct. 2023	2	24.5	12.6	Oct. 13
Nov. 2023	0	0.0	0.0	
Dec. 2023	0	0.0	0.0	
Jan. 2024	0	0.0	0.0	
Feb. 2024	0	0.0	0.0	
Mar. 2024	0	0.0	0.0	
FY 2023 total	2	24.5		

Table 1-21: Actual output shedding of the renewable energy generating facilities (Tohoku, times, 10^4 kW)

Tohoku				
Month	Numbers of shedding	Shed capacity	Maximum of shed capacty	Implemented on
Apr. 2023	5	916.1	246.5	Apr. 22
May 2023	4	522.4	215.2	May 4
Jun. 2023	2	289.3	252.1	Jun. 4
Jul. 2023	0	0.0	0.0	
Aug. 2023	0	0.0	0.0	
Sep. 2023	0	0.0	0.0	
Oct. 2023	0	0.0	0.0	
Nov. 2023	0	0.0	0.0	
Dec. 2023	0	0.0	0.0	
Jan. 2024	0	0.0	0.0	
Feb. 2024	0	0.0	0.0	
Mar. 2024	3	515.2	240.2	Mar. 30
FY 2023 total	14	2,243.0		

Table 1-22: Actual output shedding of the renewable energy generating facilities (Chubu, times, 10^4 kW)

Chubu				
Month	Numbers of shedding	Shed capacity	Maximum of shed capacty	Implemented on
Apr. 2023	5	235.7	90.8	Apr. 23
May 2023	5	344.6	100.9	May 21
Jun. 2023	2	418.5	223.3	Jun. 4
Jul. 2023	0	0.0	0.0	
Aug. 2023	0	0.0	0.0	
Sep. 2023	0	0.0	0.0	
Oct. 2023	0	0.0	0.0	
Nov. 2023	0	0.0	0.0	
Dec. 2023	0	0.0	0.0	
Jan. 2024	0	0.0	0.0	
Feb. 2024	0	0.0	0.0	
Mar. 2024	2	134.2	109.0	Mar. 31
FY 2023 total	14	1,133.0		

Table 1-23: Actual output shedding of the renewable energy generating facilities (Hokuriku, times, 10^4 kW)

Hokuriku				
Month	Numbers of shedding	Shed capacity	Maximum of shed capacty	Implemented on
Apr. 2023	5	103.2	33.7	Apr. 9
May 2023	5	68.2	24.9	May 4
Jun. 2023	2	51.0	32.5	Jun. 3
Jul. 2023	0	0.0	0.0	
Aug. 2023	0	0.0	0.0	
Sep. 2023	0	0.0	0.0	
Oct. 2023	0	0.0	0.0	
Nov. 2023	0	0.0	0.0	
Dec. 2023	0	0.0	0.0	
Jan. 2024	0	0.0	0.0	
Feb. 2024	0	0.0	0.0	
Mar. 2024	1	0.4	0.4	Mar. 31
FY 2023 total	13	222.8		

Table 1-24: Actual output shedding of the renewable energy generating facilities (Kansai, times, 10^4 kW)

Kansai				
Month	Numbers of shedding	Shed capacity	Maximum of shed capacty	Implemented on
Apr. 2023	0	0.0	0.0	
May 2023	0	0.0	0.0	
Jun. 2023	1	57.6	57.6	Jun. 4
Jul. 2023	0	0.0	0.0	
Aug. 2023	0	0.0	0.0	
Sep. 2023	0	0.0	0.0	
Oct. 2023	0	0.0	0.0	
Nov. 2023	0	0.0	0.0	
Dec. 2023	0	0.0	0.0	
Jan. 2024	0	0.0	0.0	
Feb. 2024	0	0.0	0.0	
Mar. 2024	2	190.3	143.9	Mar. 31
FY 2023 total	3	247.9		

Table 1-25: Actual output shedding of the renewable energy generating facilities (Chugoku, times, 10^4 kW)

Chugoku				
Month	Numbers of shedding	Shed capacity	Maximum of shed capacty	Implemented on
Apr. 2023	18	3,086.6	346.7	Apr. 23
May 2023	18	2,275.6	254.4	May 4
Jun. 2023	5	562.6	221.3	Jun. 3
Jul. 2023	0	0.0	0.0	
Aug. 2023	0	0.0	0.0	
Sep. 2023	0	0.0	0.0	
Oct. 2023	4	202.2	120.9	Oct. 22
Nov. 2023	1	35.8	35.8	Nov. 5
Dec. 2023	1	41.2	41.2	Dec. 10
Jan. 2024	2	49.7	33.1	Jan. 1
Feb. 2024	5	371.6	189.8	Feb. 18
Mar. 2024	8	946.3	237.5	Mar. 30
FY 2023 total	62	7,571.6		

Table 1-26: Actual output shedding of the renewable energy generating facilities (Shikoku, times, 10^4 kW)

Shikoku				
Month	Numbers of shedding	Shed capacity	Maximum of shed capacty	Implemented on
Apr. 2023	15	756.6	86.3	Apr. 9
May 2023	13	501.0	64.8	May 21
Jun. 2023	4	341.5	158.2	Jun. 3
Jul. 2023	1	42.1	42.1	Jul. 2
Aug. 2023	0	0.0	0.0	
Sep. 2023	0	0.0	0.0	
Oct. 2023	2	74.7	42.4	Oct. 29
Nov. 2023	0	0.0	0.0	
Dec. 2023	1	15.1	15.1	Dec. 10
Jan. 2024	1	28.4	28.4	Jan. 1
Feb. 2024	0	0.0	0.0	
Mar. 2024	5	412.6	146.7	Mar. 30
FY 2023 total	42	2,172.0		

Table 1-27: Actual output shedding of the renewable energy generating facilities (Kyushu mainland, times, 10^4kW)

Kyushu				
Month	Numbers of shedding	Shed capacity	Maximum of shed capacty	Implemented on
Apr. 2023	20	7,607.0	588.0	Apr. 9
May 2023	24	7,617.0	583.0	May 3
Jun. 2023	9	1,310.0	389.0	Jun. 3
Jul. 2023	0	0.0	0.0	
Aug. 2023	1	132.0	132.0	Aug. 13
Sep. 2023	6	537.0	319.0	Sep. 24
Oct. 2023	24	4,010.0	370.0	Oct. 22
Nov. 2023	15	2,057.0	249.0	Nov. 3
Dec. 2023	3	158.0	128.0	Dec. 10
Jan. 2024	4	351.0	144.0	Jan. 2
Feb. 2024	8	1,070.0	328.0	Feb. 18
Mar. 2024	22	4,698.0	409.0	Mar. 16
FY 2023 total	136	29,547.0		

Table 1-28: Actual output shedding of the renewable energy generating facilities (Okinawa, times, 10^4 kW)

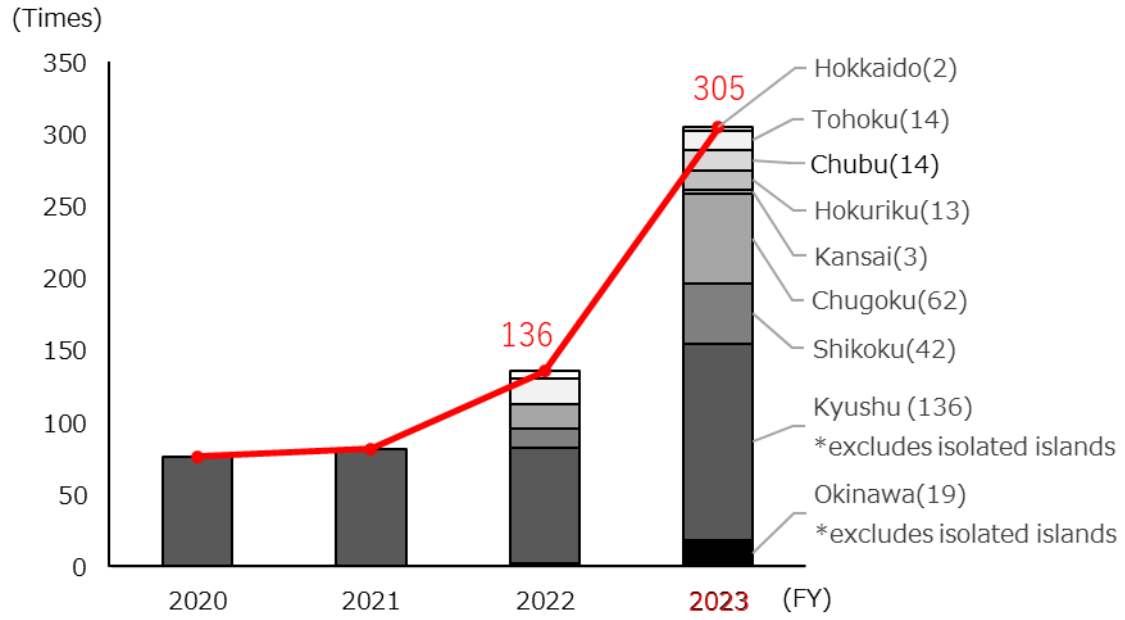
Okinawa				
Month	Numbers of shedding	Shed capacity	Maximum of shed capacty	Implemented on
Apr. 2023	3	6.9	3.4	Apr. 9
May 2023	0	0.0	0.0	
Jun. 2023	0	0.0	0.0	
Jul. 2023	0	0.0	0.0	
Aug. 2023	0	0.0	0.0	
Sep. 2023	0	0.0	0.0	
Oct. 2023	0	0.0	0.0	
Nov. 2023	1	1.3	1.3	Nov. 19
Dec. 2023	2	3.1	1.6	Dec. 17
Jan. 2024	4	7.5	3.3	Jan. 14
Feb. 2024	7	12.5	4.0	Feb. 11
Mar. 2024	2	3.0	1.9	Mar. 17
FY 2023 total	19	34.3		

Table 1-29: Actual output shedding of the renewable energy generating facilities (Nationwide, times, 10^4 kW)

Service area	Numbers of shedding [times]	Shed capacity [MW]
Hokkaido	2	24.5
Tohoku	14	2,243.0
Tokyo	0	0.0
Chubu	14	1,133.0
Hokuriku	13	222.8
Kansai	3	247.9
Chugoku	62	7,571.6
Shikoku	42	2,172.0
Kyushu	136	29,547.0
(isolated isilands)	(*)	(*)
Okinawa	19	34.3
(isolated islands)	(*)	(*)
Nationwide	305	43,196.1

*Isolated islands of Kyushu and Okinawa do not count actual shedding times 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 represent transmission lines with 250 kV or more and AC/DC converters that regularly connect the regional service areas of members that are GT&D companies. The electric power supply outside each service area is made available through the interconnection lines. The Organization directs members to supply electricity through the cross-regional interconnection lines and secures the supply–demand balance in case of insufficient supply capacity for each regional service area. Figure 2-1 and Table 2-1 present the cross-regional interconnection lines in Japan.

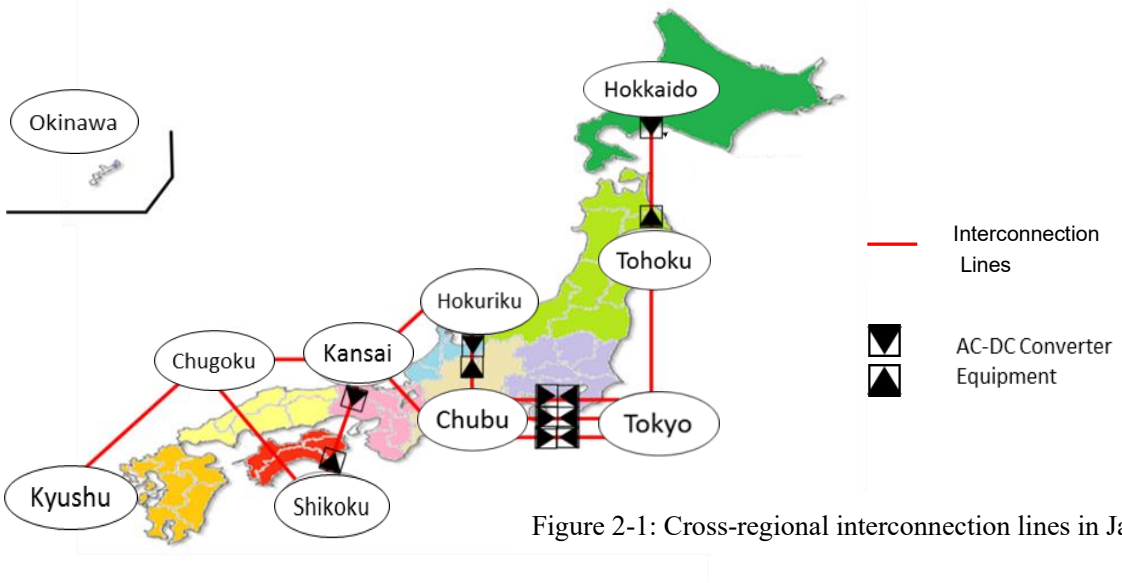


Figure 2-1: Cross-regional interconnection lines in Japan

Table 2-1: Summary of cross-regional interconnection lines (at the end of FY 2023)

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 the Cross-regional Interconnection Lines

The Organization manages the interconnection lines according to the Operational Rules. Regarding the effective utilization of interconnection lines, the security of fairness and transparency among interconnection line users, and the environmental development of the energy trading market, the Organization has currently revised the cross-regional interconnection utilization rules from those based on a "first-come, first-served" principle to those based on the "implicit auction scheme."[15] The implicit auction scheme entirely allocates the capabilities of the interconnection lines through the energy trading market but 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 of timing at capability registration

Figure 2-2 depicts the before and after of introducing the implicit auction scheme. Before its introduction, capability allocation implemented on a "first-come, first-served" basis piled up, and the resulting ATC at 10:00 on the day before was used for day-ahead spot trading of the energy market. After its introduction, principally, the whole capability is traded in the day-ahead spot market.

Thus, there are no capability allocation plans, and the capability is registered after the day-ahead spot market according to the revision of cross-regional interconnection lines from a "first-come, first-served" basis to the implicit auction scheme.

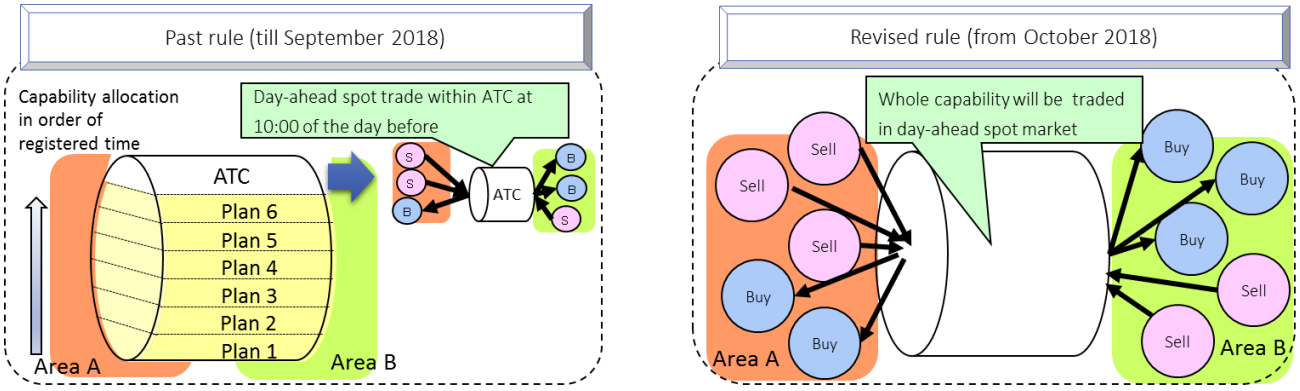

Figure 2-2: Management of the interconnection lines

[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 reports the actual utilization of cross-regional interconnection lines that are managed according to the provisions of Article 124 of the Operational Rules.

(1) Actual Utilization of Cross-regional Interconnection Lines in FY 2023

Table 2-2 and Figure 2-3 present the monthly and annual utilization of the cross-regional interconnection lines for the regional service areas in FY 2023. The annual actual utilization in FY 2023 is described in decreasing order as follows; 1) Tohoku to Tokyo: 35,535 GWh; 2) Kansai to Chubu: 18,008 GWh; 3) Chugoku to Kansai: 16,485 GWh; 4) Kyushu to Chugoku: 15,440 GWh; 5) Shikoku to Kansai: 9,765 GWh; and 6) Chubu to Tokyo: 6,568 GWh. After January 2024, the utilization from Hokuriku to Kansai decreased, but that from Kansai to Hokuriku increased. This was due to the capacity shortage in the Hokuriku area triggered by the Noto Peninsular Earthquake.

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

[GWh]

		Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido - Honshu	→Tohoku (Forward)	188	150	99	72	86	75	115	170	103	88	103	74	1,322
	→Hokkaido (Counter)	38	78	82	91	69	59	49	47	103	82	99	171	969
Tohoku-Tokyo	→Tokyo (Forward)	2,440	2,225	2,324	3,232	3,492	2,832	2,562	2,751	3,588	3,823	3,797	2,471	35,535
	→Tohoku (Counter)	17	21	19	66	75	64	31	12	35	35	28	57	459
Tokyo-Chubu	→Chubu (Forward)	230	122	107	197	245	130	66	68	266	210	193	252	2,086
	→Tokyo (Counter)	317	429	497	478	463	561	694	762	578	737	579	472	6,568
Chubu-Kansai	→Kansai (Forward)	70	36	18	15	31	25	37	31	136	108	33	59	599
	→Chubu (Counter)	1,509	1,527	1,583	1,655	1,533	1,497	1,578	1,482	1,337	1,423	1,484	1,399	18,008
Chubu-Hokuriku	→Hokuriku (Forward)	0	0	6	0	0	3	1	0	1	2	4	2	19
	→Chubu (Counter)	115	140	133	199	158	154	172	134	116	106	138	88	1,653
Hokuriku - Kanasai	→Kansai (Forward)	115	62	60	61	62	74	80	199	140	24	12	33	921
	→Hokuriku (Counter)	77	164	136	148	140	83	82	49	76	491	577	547	2,570
Kansai-Chugoku	→Chugoku (Forward)	99	51	48	37	44	23	39	49	111	77	48	41	666
	→Kansai (Counter)	827	1,041	1,415	2,014	2,003	1,656	1,269	1,018	1,299	1,570	1,230	1,143	16,485
Kansai-Shikoku	→Shikoku (Forward)	0	0	1	1	0	0	0	0	19	0	0	16	36
	→Kansai (Counter)	205	385	879	936	1,009	942	857	996	868	978	858	853	9,765
Chugoku - Shikoku	→Shikoku (Forward)	61	36	8	9	3	4	2	8	5	22	7	10	174
	→Chugoku (Counter)	43	45	146	295	611	397	293	303	202	312	185	199	3,032
Chugoku - Kyushu	→Kyushu (Forward)	19	28	55	32	14	12	30	17	108	65	13	20	414
	→Chugoku (Counter)	1,173	1,073	1,010	1,275	1,590	1,561	1,271	1,138	1,255	1,300	1,459	1,334	15,440

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

[16] Figures were rounded off to the first decimal place, and the minimum figure in blue was determined before rounding off.

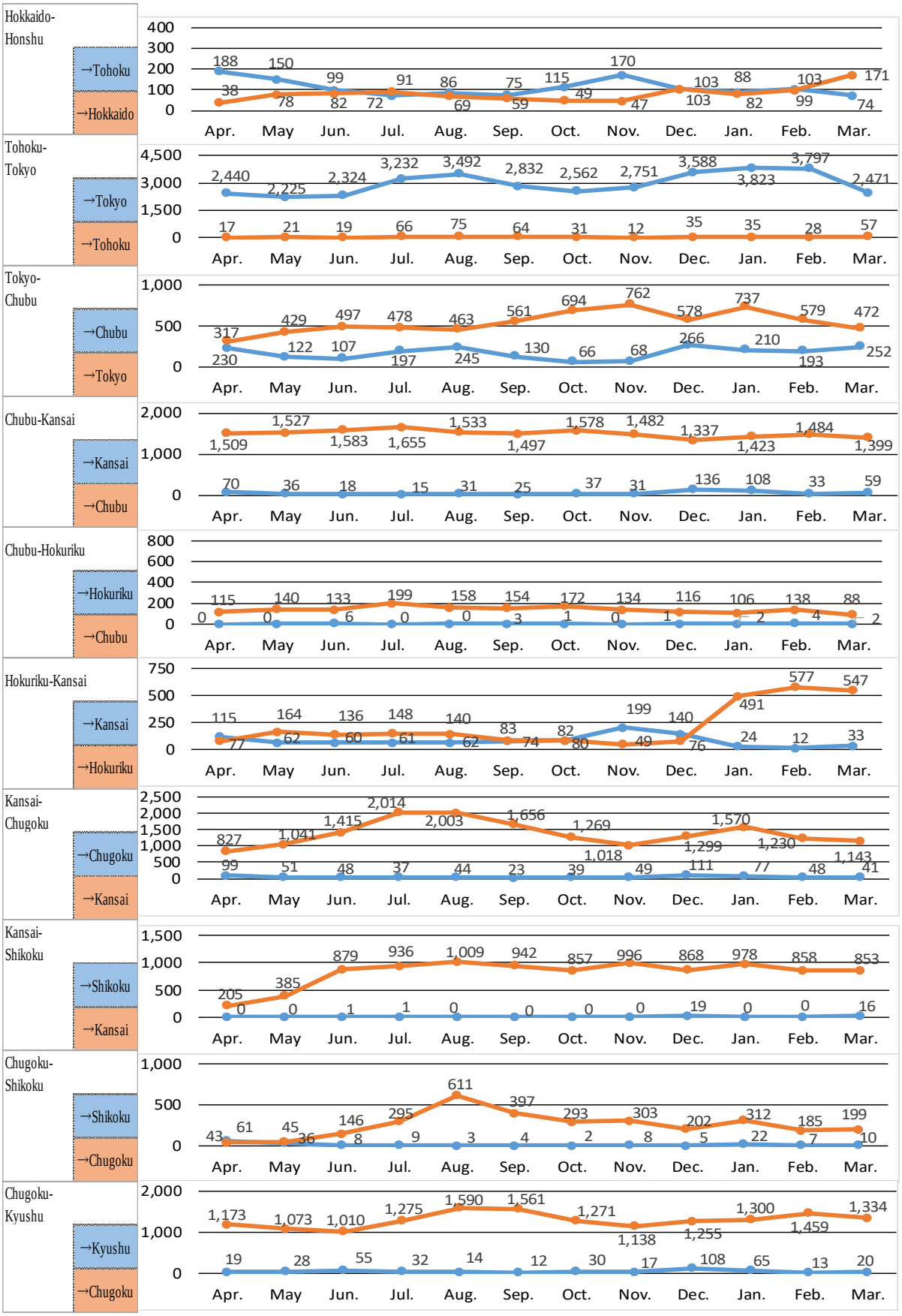

Figure 2-3: Monthly utilization of cross-regional interconnection lines for the regional service areas

(2) Actual Utilization of Cross-Regional Interconnection Lines from FY 2014 to FY 2023

Table 2-3 and Figure 2-4 depict the annual utilization of cross-regional interconnection lines for regional service areas from FY 2014 to FY 2023. In FY 2023, the actual utilization of Tohoku to Tokyo and Kansai to Hokuriku registered their maximum records; however, Chubu to Kansai and Hokuriku to Kansai registered their minimum records.

Table 2-3 Annual utilization of cross-regional interconnection lines for regional service areas (FY 2014 –2023)

[GWh]

		FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Hokkaido-Honshu	→Tohoku (Forward)	143	146	237	340	130	279	947	2,607	1,620	1,322
	→Hokkaido (Counter)	617	804	1,033	1,270	1,005	2,117	1,154	382	1,058	969
Tohoku-Tokyo	→Tokyo (Forward)	21,273	22,587	23,097	28,238	27,298	27,575	31,396	29,092	25,841	35,535
	→Tohoku (Counter)	4,029	3,714	4,660	7,071	3,139	252	541	897	708	459
Tokyo-Chubu	→Chubu (Forward)	2,702	693	2,729	3,954	1,711	354	1,497	6,200	2,012	2,086
	→Tokyo (Counter)	2,755	4,513	5,144	5,328	5,116	4,147	3,016	3,043	7,079	6,568
Chubu-Kansai	→Kansai (Forward)	7,131	3,412	5,538	8,106	3,675	980	4,413	2,964	1,300	599
	→Chubu (Counter)	6,342	7,577	6,544	9,889	9,980	7,175	13,285	17,251	28,458	18,008
Chubu-Hokuriku	→Hokuriku (Forward)	231	108	241	353	134	7	91	96	29	19
	→Chubu (Counter)	296	172	59	108	76	40	458	2,063	1,177	1,653
Hokuriku-Kanasai	→Kansai (Forward)	2,265	2,047	2,033	2,949	2,033	2,918	3,223	3,005	3,467	921
	→Hokuriku (Counter)	491	502	640	1,260	2,540	547	620	376	477	2,570
Kansai-Chugoku	→Chugoku (Forward)	2,252	948	716	4,493	4,734	578	584	564	435	666
	→Kansai (Counter)	5,994	9,138	13,179	16,727	13,388	9,793	12,416	15,056	20,302	16,485
Kansai-Shikoku	→Shikoku (Forward)	1	2	2	1	82	31	10	28	7	36
	→Kansai (Counter)	9,362	9,611	8,856	9,510	8,840	9,956	8,623	8,343	9,831	9,765
Chugoku-Shikoku	→Shikoku (Forward)	2,677	3,423	3,294	4,061	2,579	131	245	113	123	174
	→Chugoku (Counter)	3,912	4,631	7,638	7,540	4,023	4,143	1,445	1,756	2,398	3,032
Chugoku-Kyushu	→Kyushu (Forward)	3,596	2,174	1,935	3,014	1,998	138	177	142	117	414
	→Chugoku (Counter)	11,218	14,947	15,476	18,183	18,280	16,311	15,864	17,098	18,536	15,440

* Based on the scheduled power flows of cross-regional interconnection lines
* The figures in red and blue represent the annual maximum and the minimum capabilities in each line and direction between FY 2014 and FY 2023, respectively.
* Figures were rounded off to the first decimal place.

Figure 2-4: Annual utilization of cross-regional interconnection lines for regional service areas (FY 2014–2023)

(3) Monthly Utilization of Cross-Regional Interconnection Lines by Transaction in FY 2023

Table 2-4 presents the monthly and annual utilization of cross-regional interconnection lines by transaction in FY 2022. Bilateral contracts include transactions at the balancing market that started in 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	143	167	61	54	46	12	48	24	36	61	40	89	782
Day-ahead	6,626	6,738	7,885	10,023	10,838	9,477	8,616	8,686	9,311	10,389	10,080	8,235	106,904
1 Hour-ahead	774	707	681	736	746	662	564	524	998	1,001	726	919	9,037

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

(4) Annual Utilization of Cross-Regional Interconnection Lines by Transaction from FY 2014 to FY 2023

Table 2-5 and Figures 2-5, 2-6, and 2-7 depict the annual utilization of cross-regional interconnection lines by transaction for FY 2014–FY 2023. Day-ahead and hour-ahead transactions were included in the records for the decade (FY 2014–FY 2023), which was due to the introduction of the implicit auction scheme in October 2018, making the entire utilization of cross-regional interconnection lines available through the spot market and activating the spot market.

Table 2-5: Annual utilization of cross-regional interconnection lines by transaction (FY 2014–2023)

[GWh]

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Bilateral	71,558	75,947	84,843	109,842	56,710	255	1,103	366	468	782
Day-ahead	14,174	13,152	14,817	18,350	51,120	83,216	91,229	102,328	116,101	106,904
1 Hour-ahead	1,554	2,050	3,392	4,203	2,932	4,000	7,675	8,382	8,406	9,037

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

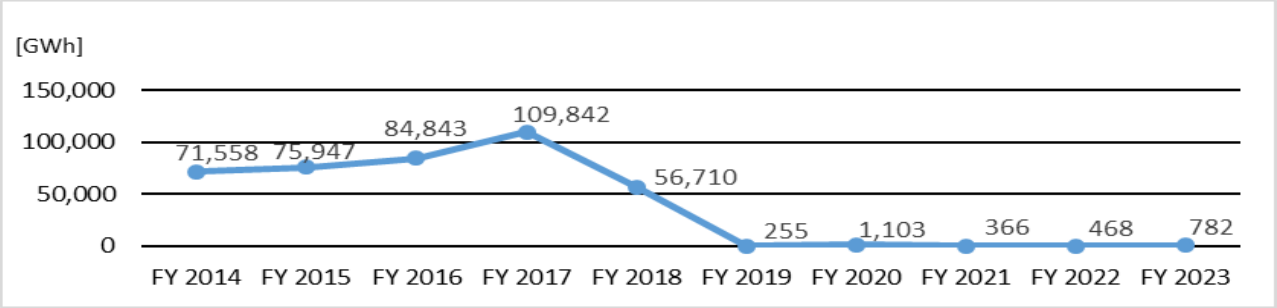

Figure 2-5: Annual utilization of cross-regional interconnection lines by bilateral transaction (FY 2014–2023)

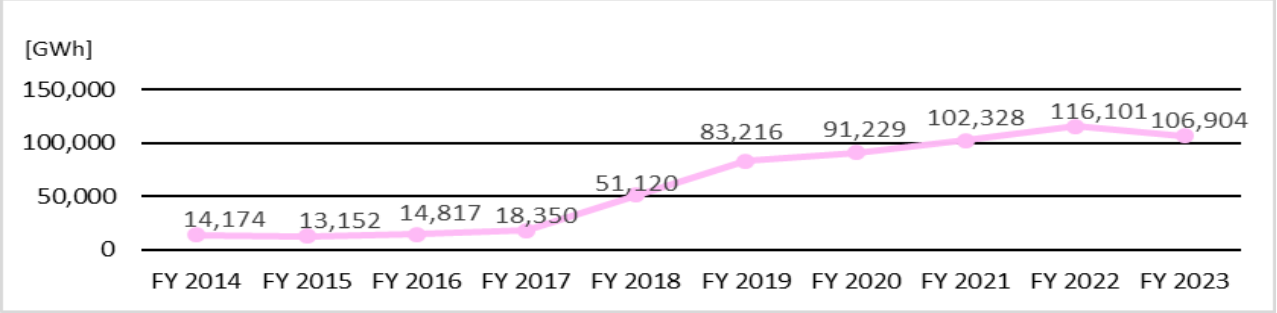

Figure 2-6: Annual utilization of cross-regional interconnection lines by day-ahead transaction (FY 2014–2023)

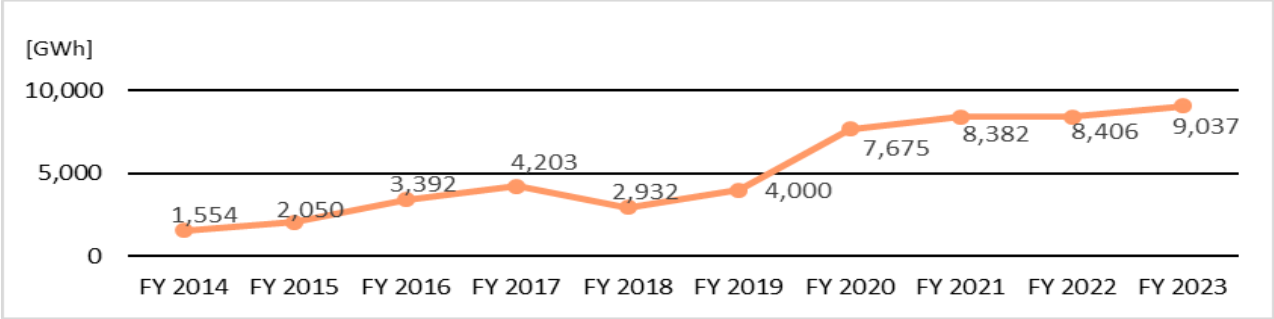

Figure 2-7: Annual utilization of cross-regional interconnection lines by hour-ahead transaction (FY 2014–2023)

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

The following describes the details of the actual maintenance work on the cross-regional interconnection lines, as reported by the 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 2023

Table 2-6 presents the monthly and annual maintenance works on cross-regional interconnection lines in FY 2023, and Figure 2-8 depicts the nationwide monthly planned outage rate for FY 2023. The annual maintenance work on cross-regional interconnection lines for FY 2023 occurred on 339 occasions, with 776 days nationwide. Compared with the previous year, work occasions decreased 84 times, but work days increased by 171 days. Shin Shinano FC C.S. and Higashi Shimizu FC C.S. had much work on both occasions and days.

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	13	8	0	0	8	11	12	10	6	7	0	0	0	0	0	0	4	1	2	3	45	40
Tohoku-Tokyo	Soma-Futaba bulk line, Iwaki bulk line	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	17	0	0	0	0	0	0	0	0	2	17
Tokyo-Chubu	Sakuma FC C.S.	0	0	0	0	1	1	0	0	0	0	0	0	0	0	4	3	7	12	1	1	0	0	0	0	13	17
	Shin Shinano FC C.S.	2	2	3	20	7	22	2	31	1	31	2	30	12	31	23	30	1	31	1	31	2	29	4	16	60	304
	Higashi Shimizu FC C.S.	7	30	11	31	10	30	3	27	0	0	1	1	0	0	0	0	0	0	0	0	0	0	12	28	44	147
	Hida–Shinano FC	0	0	0	0	4	6	0	0	2	2	45	21	18	15	0	0	12	9	0	0	0	0	2	10	83	63
Chubu-Kansai	Mie-Higashi Omi line	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chubu-Hokuriku	Minami Fukumitsu HVDC BTB C.S., Minami Fukumitsu Substation	3	2	0	0	10	13	0	0	0	0	1	6	4	7	0	0	2	1	1	1	0	0	0	0	21	30
Hokuriku-Kansai	Echizen-Reinan line	0	0	0	0	3	4	0	0	0	0	3	6	3	5	0	0	0	0	0	0	0	0	0	0	9	15
Kansai-Chugoku	Seiban-Higashi Okayama line, Yamazaki-Chizu line	0	0	1	1	3	3	0	0	0	0	10	13	2	4	8	6	0	0	0	0	0	0	0	0	24	27
Kansai-Shikoku	Kihoku and Anan AC/DC C.S.	3	2	3	4	1	1	0	0	0	0	0	0	3	2	0	0	1	2	0	0	1	1	1	5	13	17
Chugoku-Shikoku	Honshi interconnection line	5	22	1	22	5	27	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	2	2	15	75
Chugoku-Kyushu	Kanmon interconnection line	6	13	4	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	24
Nationwide (Cumulative works for the same facilities deducted)		26	71	23	89	57	115	5	58	11	44	74	87	49	72	38	57	23	55	3	33	7	31	23	64	339	776

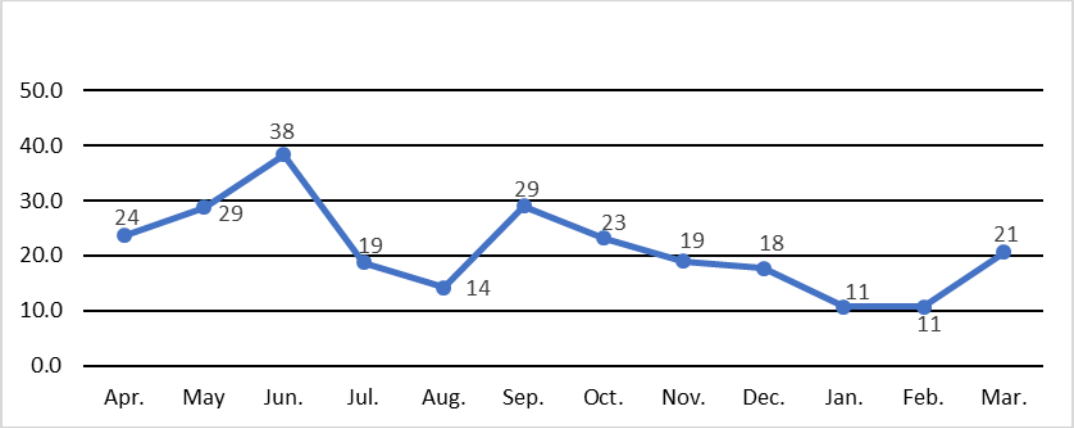

Figure 2-8: Nationwide monthly planned outage rate

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

(2) Annual Maintenance Works on Cross-regional Interconnection Lines from FY 2014 to FY 2023

Table 2-7 presents the annual maintenance work on cross-regional interconnection lines for FY 2014–FY 2023.

Table 2-7: Annual maintenance work on cross-regional interconnection lines (FY 2014–FY 2023)

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Total	10-years Average
Nationwide	63	91	218	267	205	353	385	379	423	339	2,723	272

* 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 the Cross-Regional Interconnection Lines

(1) Forced Outage of Cross-Regional Interconnection Lines in FY 2023

Table 2-8 presents the forced outage of the cross-regional interconnection lines in FY 2023. Five of nine outages were occurred at Sakuma FC Converter Station.

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

Date	Facility	Background
June 3	Hida–Shinano FC	Frequency converter unit failure
July 23	Seiban-Higashi Okayama Trunk Line + Yamazaki-Chizu Line	Shutdown of 500 kV Chugoku Higashi trunk line No.1
July 26	Shin Shinano FC	Frequency converter unit (No.1) failure
August 3	Sakuma FC	Frequency converter unit failure
August 17	Sakuma FC	Frequency converter unit failure
August 19	Sakuma FC	Frequency converter unit failure
August 26	Sakuma FC	Frequency converter unit failure
December 13	Hida–Shinano FC	Frequency converter unit failure
December 30	Anan-Kihoku AC/DC Converter	Bulb group No.1 failure at Anan CS

* The forced outage affecting the TTC is described.

(2) Annual Forced Outage of Cross-regional Interconnection Lines for FY 2014–FY 2023

Table 2-9 presents the annual forced outage of cross-regional interconnection lines from FY 2014 to FY 2023. The number of annual forced outages of cross-regional interconnection lines in FY 2023 was 9, which was lower than the previous year's by 2 outages.

Table 2-9: Annual forced outage of cross-regional interconnection lines (FY 2014–FY 2023)

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Total	10-years Average
Nationwide	1	3	3	3	6	9	8	11	11	9	64	6

5. Actual Employment of the Transmission Margin

"Employment of the transmission margin" refers to the supply of electricity by GT&D companies through their transmission margin to interconnection lines in which the supply–demand balance is restricted or insufficient to reduce power supply. Table 2-10 presents the actual employment of the transmission margin for FY 2023 according to the provisions of Article 152 of the Operational Rules. The actual employment of the transmission margin for FY 2023 was 1 day, which was performed in the interconnection facilities between Tokyo and Chubu, where the flow was from Chubu to Tokyo. This was attributable to the instruction that responded to the insufficient ability to reduce the power supply to Kansai T&D on June 3, 2023.

Table 2-10: Actual employment of the transmission margin

Date	Facility	Background
June 3, 2023	Interconnection facilities between Tokyo and Chubu (Flow from Chubu to Tokyo)	Insufficient ability of reducing power supply which is necessary for keeping the supply-demand balance in Kansai T&D area due to unexpected demand decrease and solar power output increase

Table 2-11: Actual employment of the transmission margin (FY 2015–FY 2023)

[days]

FY	2015	2016	2017	2018	2019	2020	2021	2022	2023
Nationwide	1	0	3	15	1	16	7	6	1

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

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

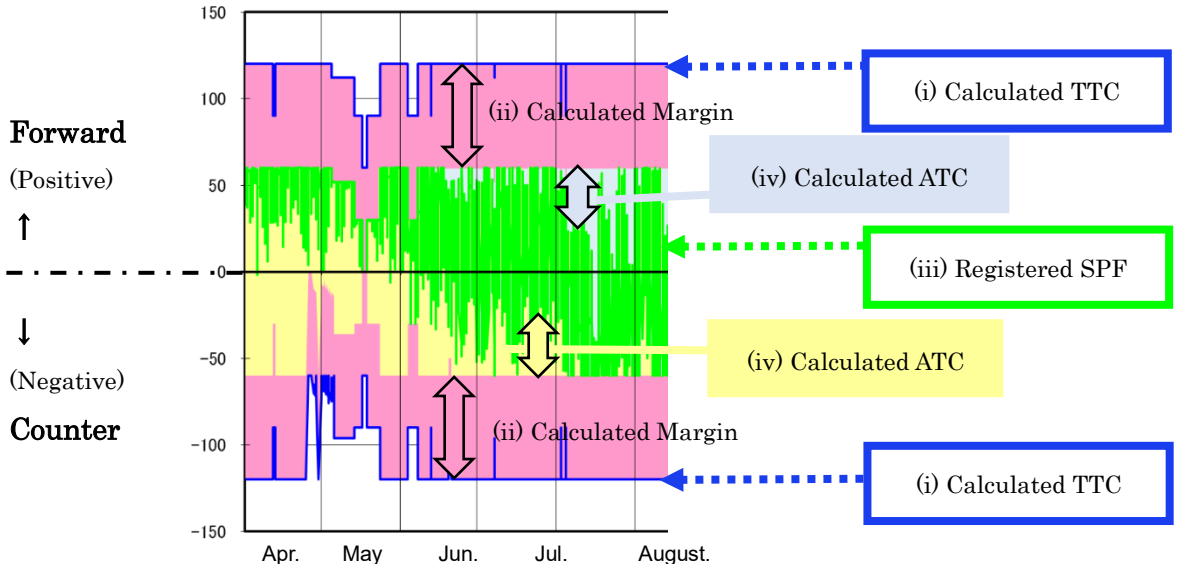

Figure 2-9: How to interpret an ATC graph

Table 2-12: Explanation of the ATC graph components

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

The actual flows on the transmission lines are offset in each direction. Therefore, the scheduled power flow is the offset figure between the forward and counter flows but not the simple addition of each direction. In addition, the offset figures on the graphs are observed as SPF rather than the capacity of each forward 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#

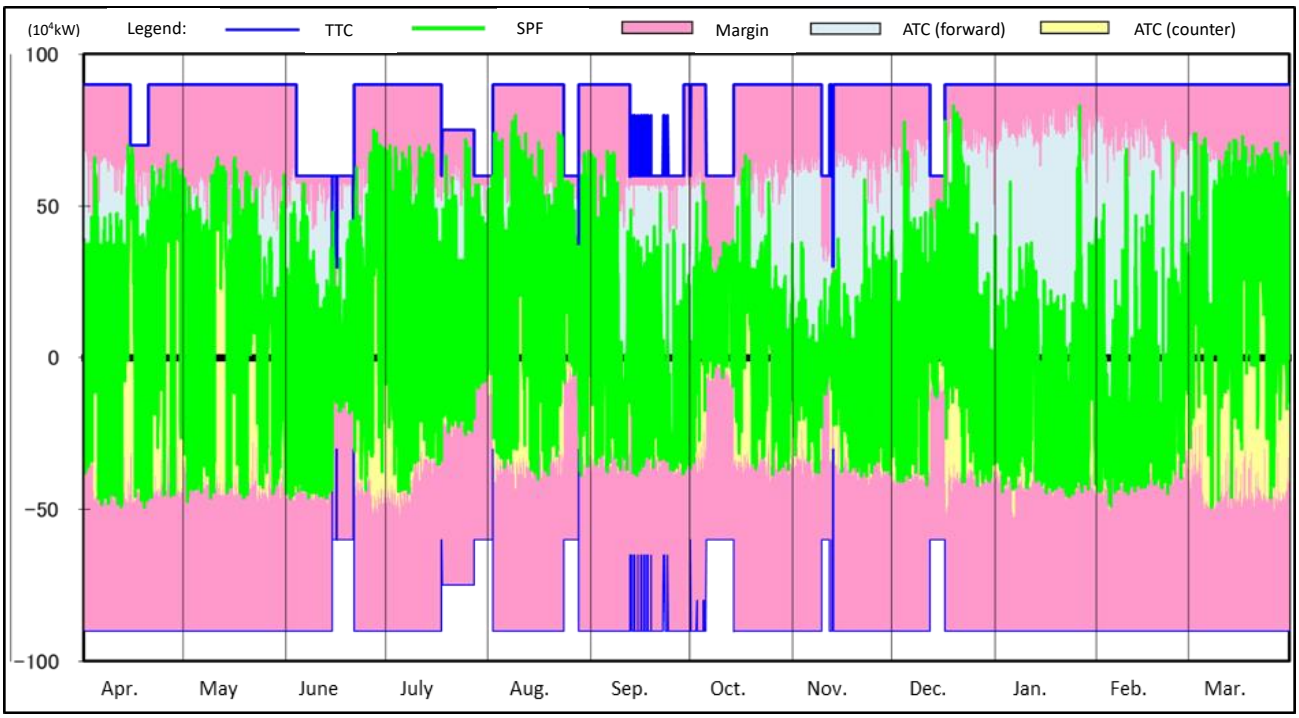

Figure 2-10: Actual ATC for the interconnection facilities between Hokkaido and Honshu
(Hokkaido–Honshu HVDC Link, and New Hokkaido–Honshu HVDC Link)

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

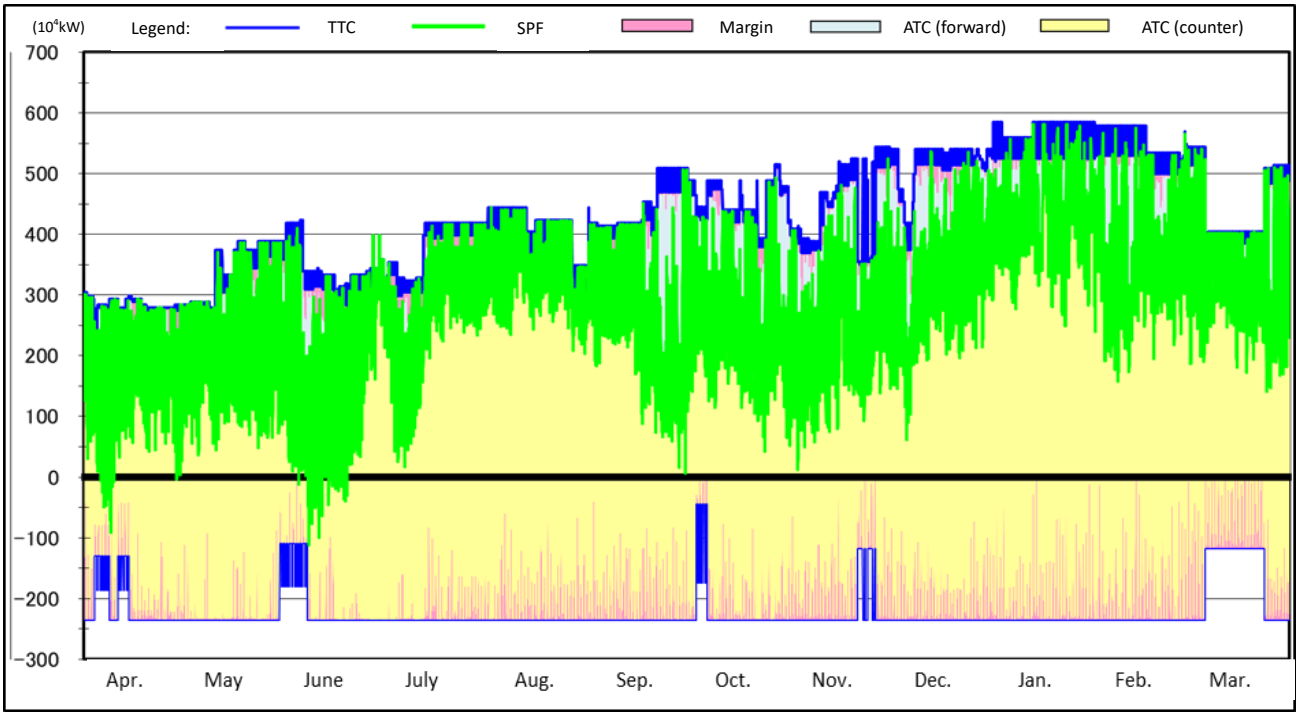

Figure 2-11: Actual ATC for the interconnection lines between Tohoku and Tokyo
(Soma–Futaba Bulk Line and Iwaki Bulk Line)

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

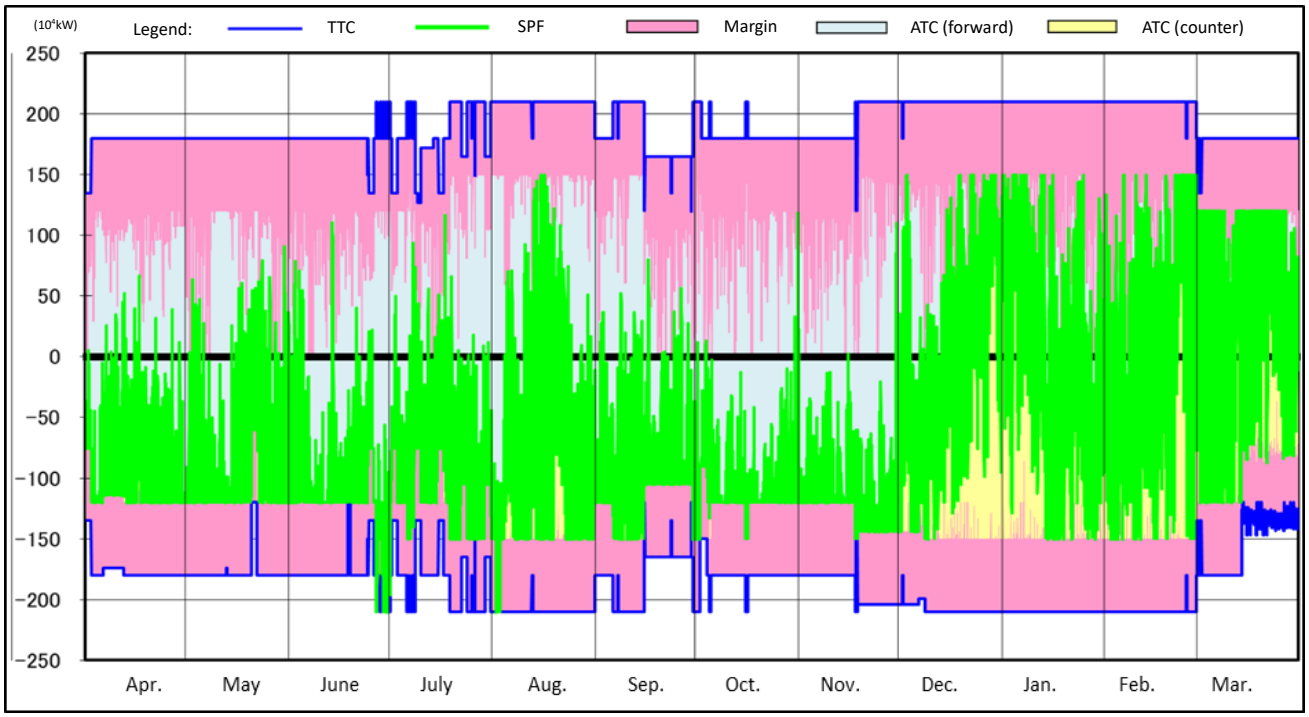

Figure 2-12: Actual ATC for the interconnection facilities between Tokyo and Chubu (Sakuma, Shin Shinano and Higashi Shimizu and Hida–Shinano F.C.)

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

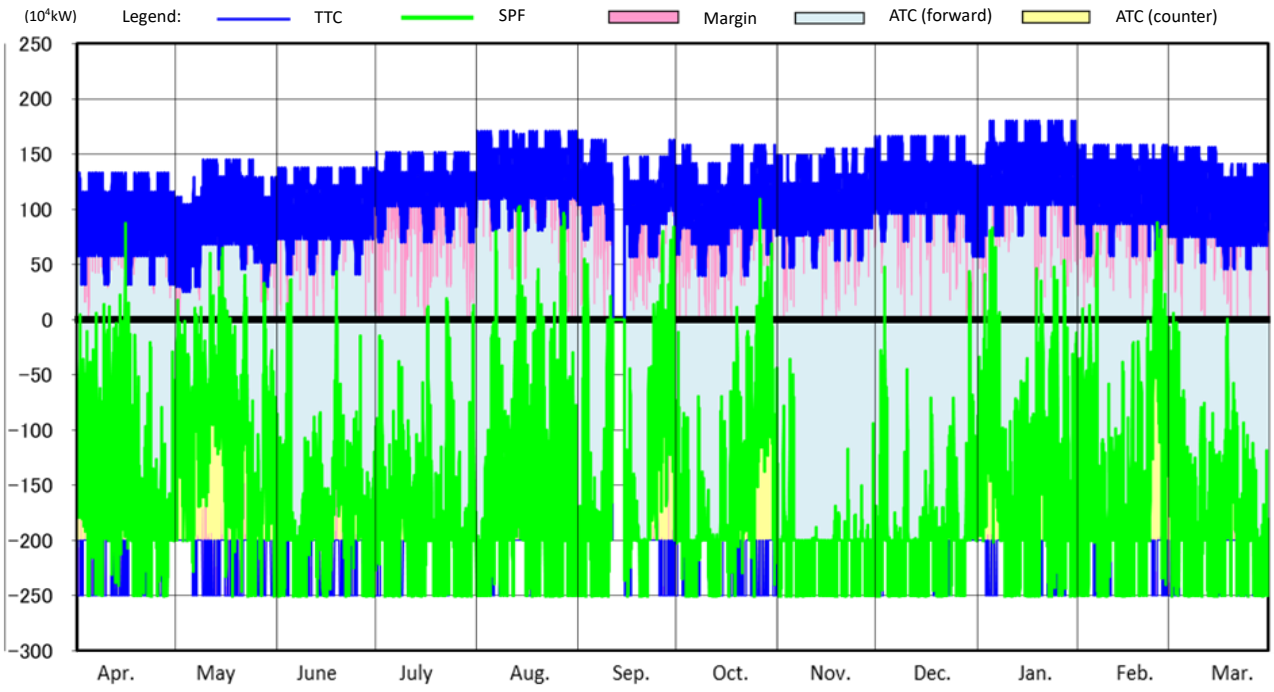

Figure 2-13: Actual ATC for the interconnection line between Chubu and Kansai (Mie–Higashi Omi Line)

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

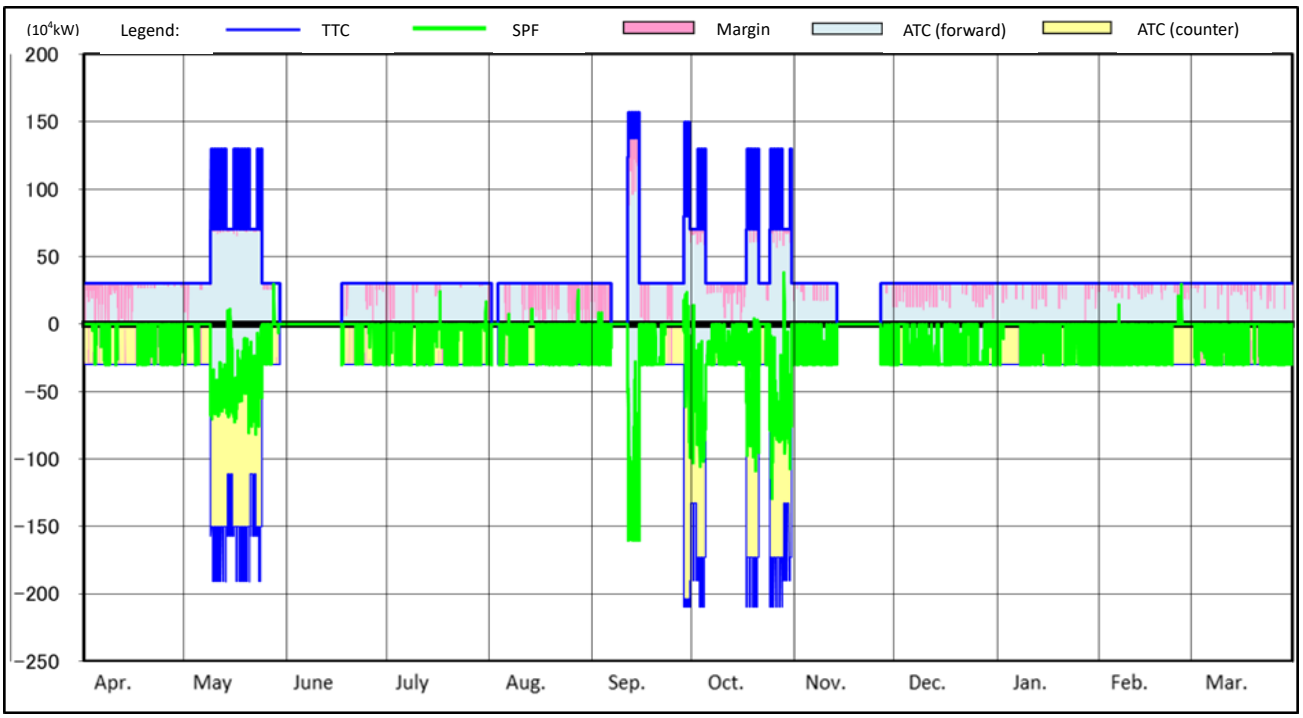

Figure 2-14: Actual ATC for the interconnection facilities between Chubu and Hokuriku (Minami Fukumitsu HVDC BTB Converter Station and Minami Fukumitsu Substation)

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

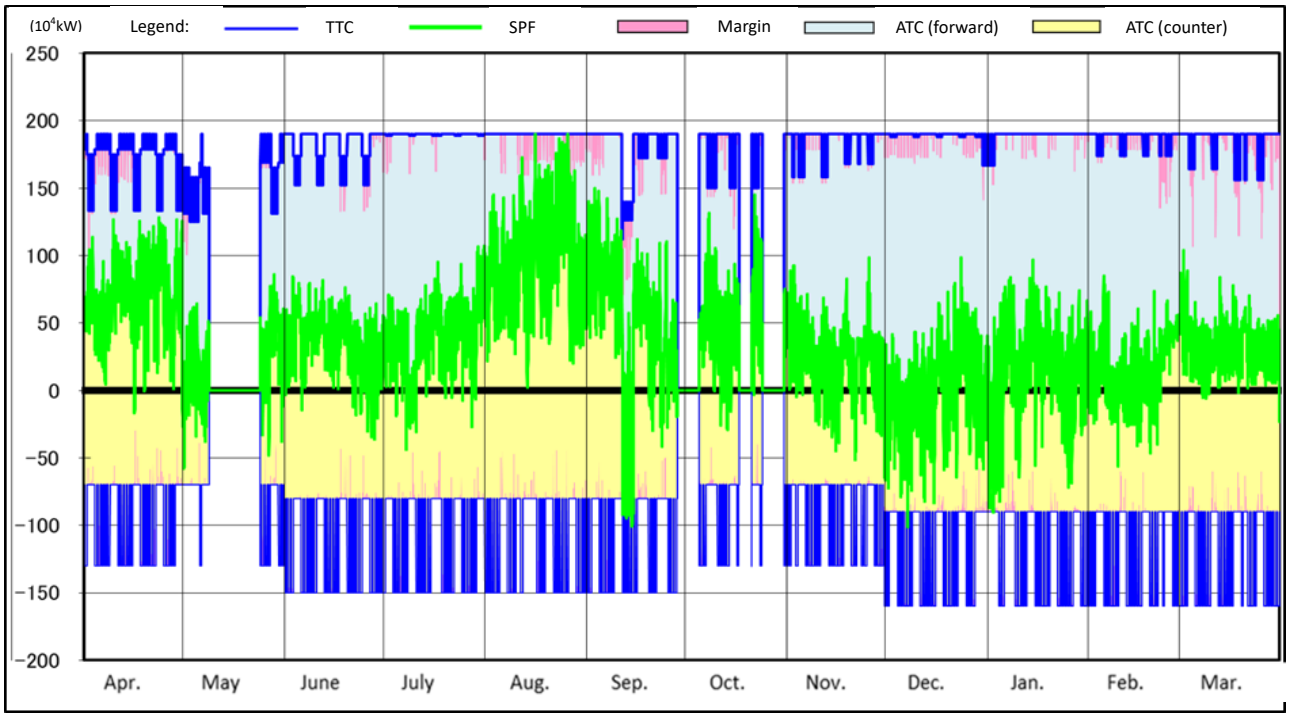

Figure 2-15: Actual ATC for the interconnection line between Hokuriku and Kansai (Echizen–Reinan Line)

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

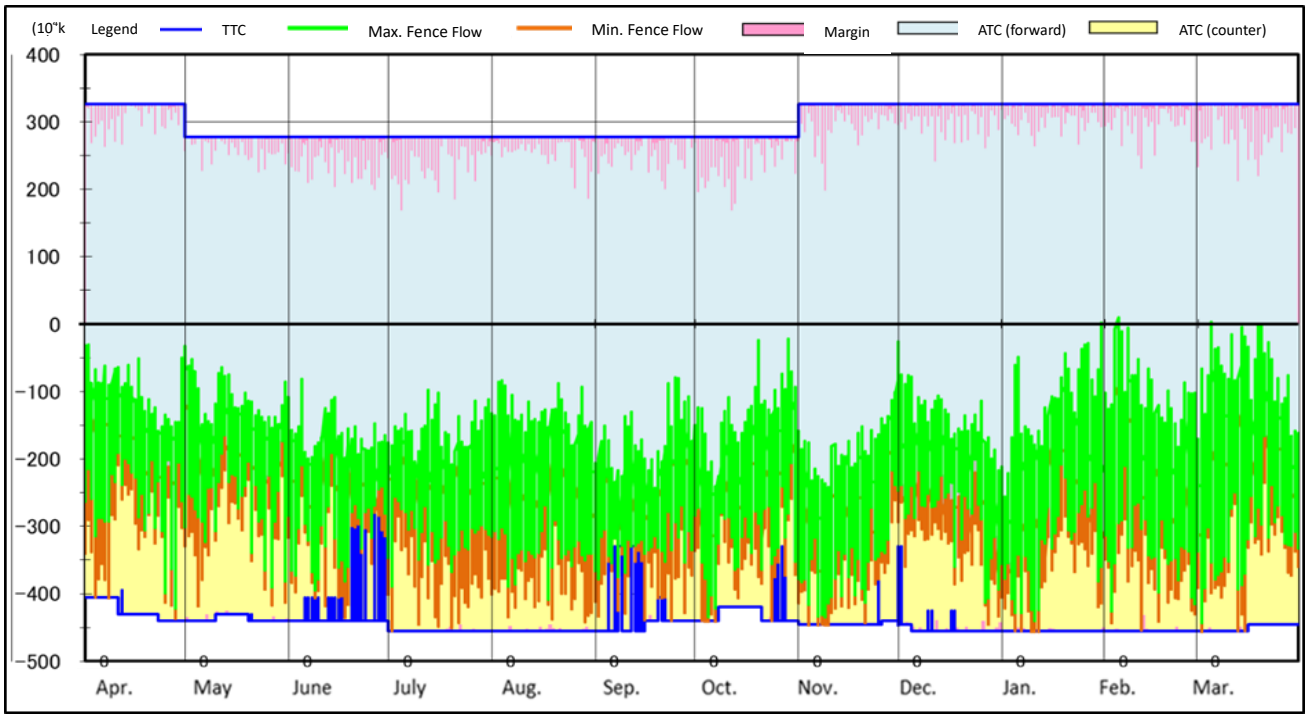

Figure 2-16: Actual ATC for the interconnection lines between Kansai and Chugoku
(Seiban–Higashi Okayama Line and Yamazaki–Chizu Line)

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

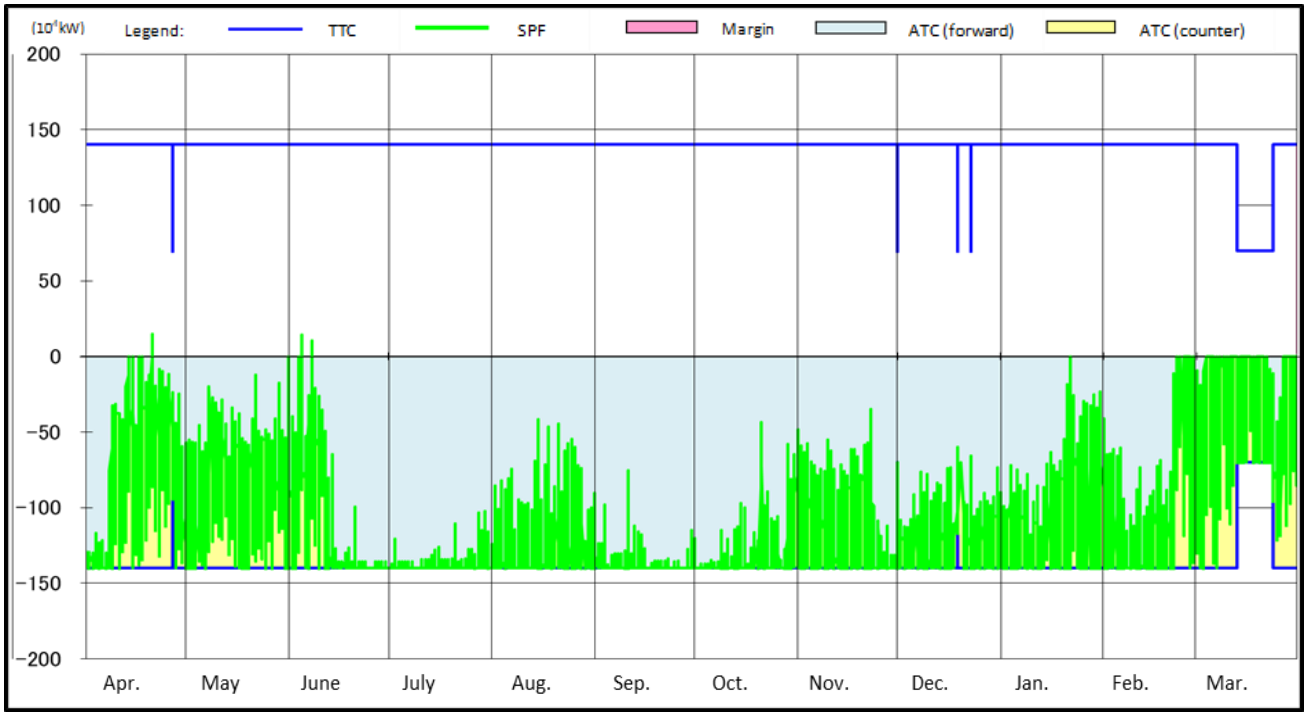

Figure 2-17: Actual ATC for the interconnection facilities between Kansai and Shikoku
(Interconnection facilities between Kihoku and Anan AC/DC Converter Station)

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

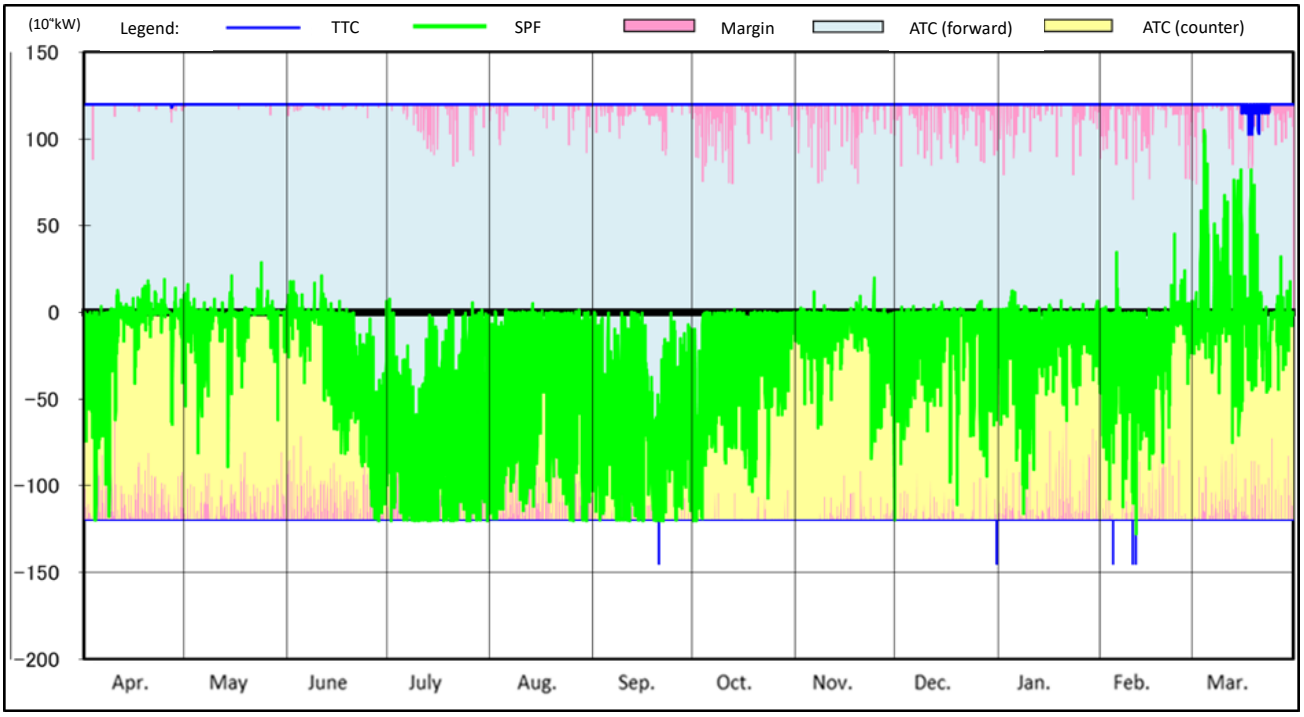

Figure 2-18: Actual ATC for the interconnection line between Chugoku and Shikoku (Honshi Interconnection Line)

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

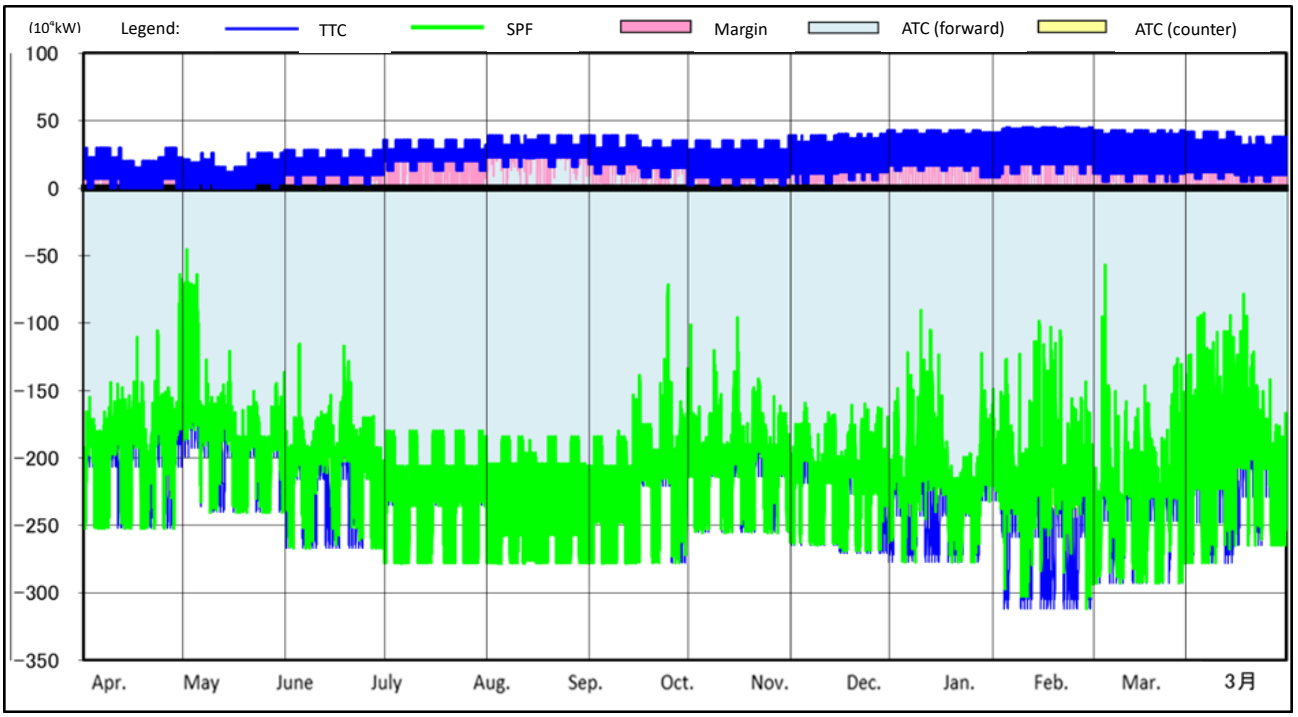

Figure 2-19: Actual ATC for the interconnection line between Chugoku and Kyushu (Kanmon Interconnection Line)

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

7. Actual Constraints on Cross-Regional Interconnection Lines Nationwide

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

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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

To determine the actual electricity supply and demand, data on peak demand, electric energy requirement, load factor, supply–demand status during the peak and lowest demand periods, and the peak daily energy supply were collected. Additionally, instructions about power exchanges (according to the provisions of Paragraph 1 of Article 28–44 of the Electricity Business Act) and the actual output shedding of renewable energy generating facilities (according to the provisions of the Ministerial Ordinance of the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electric Utilities) were aggregated. Furthermore, instructions regarding the tight supply–demand balance in the summer and winter of FY 2023 are described in detail.

Actual Utilization of Cross-Regional Interconnection Lines

For the actual utilization of cross-regional interconnection lines, data on the utilization, congestion management, maintenance work, unplanned outage, employment of transmission margin, and available transfer capability were collected.

<Reference> Details of Actual Power Exchange Instructions and, Instructions and Requests to Generation Companies and Retail Companies Issued by the Oraganization.

The details of the actual power exchange instructions issued by the Organization in FY 2023 are listed below. They include measures for reducing power supply in June 2023.

Actual power exchange instructions by the Organization

1	Issued at	11:40 on June 3, 2023
	Instruction	・Kansai T&D shall supply 500 MW of electricity at most to TEPCO PG from 12:00 to 12:30 on June 3. ・TEPCO PG shall be supplied 500 MW of electricity by Kansai T&D from 12:00 to 12:30 on June 3. (The transmission margin 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 the insufficient ability to reduce the power supply in the regional service area of Kansai T&D due to unexpected demand decrease and solar power output increase.
2	Issued at	12:07 on June 3, 2023
	Instruction	・Kansai T&D shall supply 500 MW of electricity at most to TEPCO PG and Hokuriku T&D from 12:30 to 15:00 June 3. ・TEPCO PG shall be supplied 490 MW of electricity at most by Kansai T&D from 12:30 to 15:00 on June 3. (The transmission margin of an interconnection line was partly utilized to the power exchange for TEPCO PG.) ・Hokuriku T&D shall be supplied 50 MW of electricity at most by Kansai T&D from 12:30 to 15:00 on June 3.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of the insufficient ability to reduce the power supply in the regional service area of Kansai T&D due to unexpected demand decrease and solar power output increase.
3	Issued at	14:00 on June 3, 2023
	Instruction	・Kansai T&D shall supply 110 MW of electricity at most to TEPCO PG from 14:30 to 15:00 June 3. ・TEPCO PG shall be supplied 110 MW of electricity at most by Kansai T&D from 14:30 to 15:00 on June 3. (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 the insufficient ability to reduce the power supply in the regional service area of Kansai T&D due to unexpected demand decrease and solar power output increase.
4	Issued at	14:13 on June 3, 2023
	Instruction	・Kansai T&D shall supply 600 MW of electricity to TEPCO PG from 15:00 to 15:30 on June 3. ・TEPCO PG shall be supplied 600 MW of electricity by Kansai T&D from 15:00 to 15:30 on June 3. (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 the insufficient ability to reduce the power supply in the regional service area of Kansai T&D due to unexpected demand decrease and solar power output increase.
5	Issued at	14:38 on June 3, 2023
	Instruction	・Kansai T&D shall supply 78 MW of electricity to TEPCO PG from 15:30 to 16:00 on June 3. ・TEPCO PG shall be supplied 78 MW of electricity by Kansai T&D from 15:30 to 16:00 on June 3.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of the insufficient ability to reduce the power supply in the regional service area of Kansai T&D due to unexpected demand decrease and solar power output increase.

6	Issued at	16:37 on January 1, 2023
	Instruction	・Kanasai T&D shall supply 600 MW of electricity to Hokuriku T&D from 17:00 to 18:00 on January 1. ・Hokuriku T&D shall be supplied 600 MW of electricity by Kansai T&D from 17:00 to 18:00 on January 1.
	Background	The supply–demand status may degrade without power exchanges through the cross-regional interconnection lines because of a shortage of supply capacity in the regional service area of Hokuriku T&D due to an earthquake.
7	Issued at	17:20 on January 1, 2024 (This instruction changed at **bold character writing** in 18:07 on January 1)
	Instruction	・Kanasai T&D shall supply 600 MW of electricity to Hokuriku T&D from 18:00 to 22:30 on January 1. ・Hokuriku T&D shall be supplied 600 MW of electricity by Kansai T&D from 18:00 to 22:30 on January 1.
		・Kanasai T&D shall supply 600 MW of electricity **at most** to Hokuriku T&D from 18:00 to 22:30 on January 1. ・Hokuriku T&D shall be supplied 600 MW of electricity **at most** by Kansai T&D from 18:00 to 22:30 on January 1.
	Background	The supply–demand status may degrade without power exchanges through the cross-regional interconnection lines because of a shortage of supply capacity in the regional service area of Hokuriku T&D due to an earthquake.
8	Issued at	19:48 on January 1, 2024
	Instruction	・Kanasai T&D shall supply 550 MW of electricity at most to Hokuriku T&D from 22:30 to 24:00 on January 1. ・Hokuriku T&D shall be supplied 550 MW of electricity at most by Kansai T&D from 22:30 to 24:00 on January 1.
	Background	The supply–demand status may degrade without power exchanges through the cross-regional interconnection lines because of a shortage of supply capacity in the regional service area of Hokuriku T&D due to an earthquake.

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