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

Actual Data for Fiscal Year 2019

September 2020

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 Article 181 of the Operational Rules regarding the matters specified below.

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

The Organization published the actual data for electricity supply–demand and network system utilization ahead of the Annual Report because of the completion of actual data collection up to fiscal year 2019 (FY 2019).

SUMMARY

This report is presented to review the outlook of electricity supply–demand and cross-regional interconnection lines in FY 2019, based on Article 181 of the Operational Rules of the Organization.

The report consists of two parts: the situation of electricity supply and demand, and interconnection lines.

Regarding supply and demand, the peak demand nationwide, 164,610 MW, was recorded in August, and the monthly electric energy requirement nationwide, 83,165 GWh, was recorded in August.

The reserve margin against summer and winter peak demand was 12.9% and 15.0%, respectively.

Power exchange instructions were issued by the Organization 6 times: 5 of them were dispatched for improvements of supply and demand due to the heatwave following Typhoon No.15.
In addition, long-cycle frequency control was implemented 58 times during the year.

There were 122 requests to shed power generation of renewables in FY 2019, which occurred on isolated islands as well as on the Kyushu mainland.

The total volume of the utilization of interconnection lines was 87,471 GWh, −23,291 GWh over FY 2018.

Following the introduction of the implicit auction scheme for utilizing cross-regional interconnection lines, the total number of congestion management hours was zero.

The numbers and days of maintenance of interconnection lines totaled 353 times and 599 days, respectively in FY 2019.

We hope this report provides useful information.

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.

CHAPTER I: ACTUAL ELECTRICITY SUPPLY AND DEMAND

1. Regional Service Areas for 10 General Transmission and Distribution Companies, and the Definition of a Season

(1) Regional Service Areas for 10 General Transmission and Distribution Companies

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

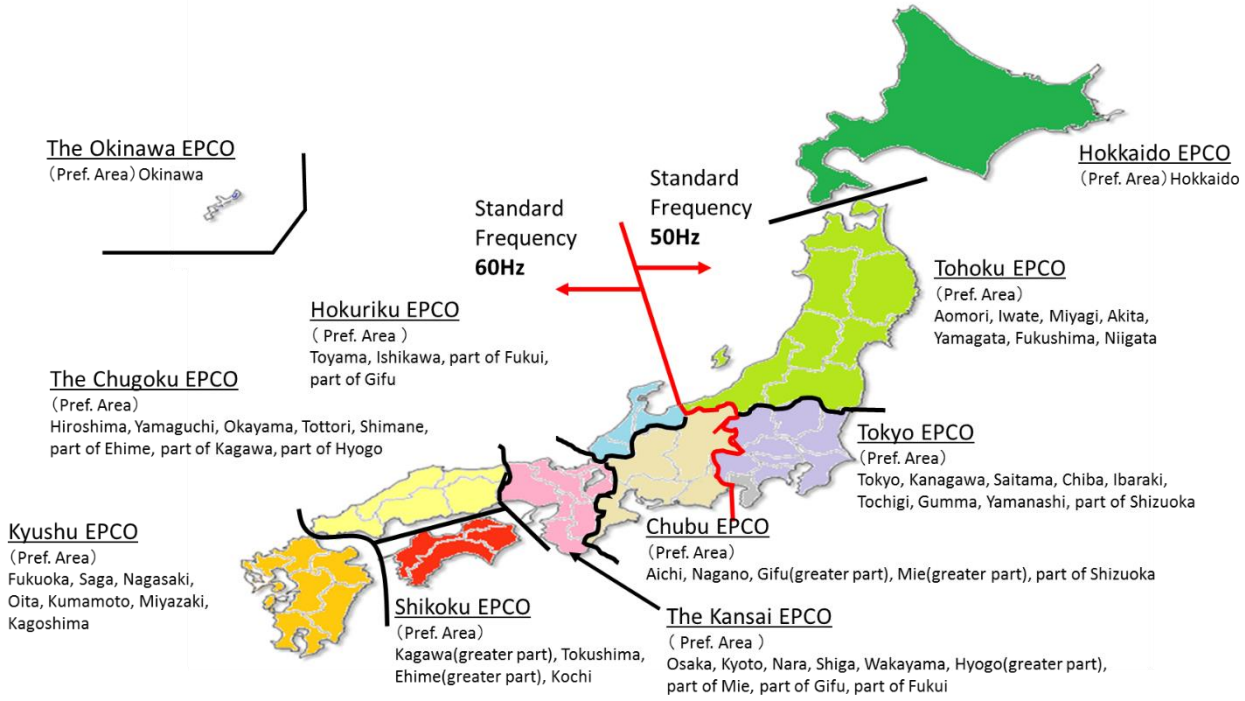

Figure 1-1: The 10 Regional Service Areas in Japan and their Prefectural Distribution

(2) Definition of Seasons

This report divides the seasons into summer and winter periods. The summer period is defined as July to September and the winter as December to February.

This report refers to the actual weather outlook for the previous year from the Seasonal Climate Report over Japan prepared by the Japan Meteorological Agency (JMA), which defines the summer and winter periods as June to August and December to February, respectively.

However, the definitions of the three-month summer period differ by one month between this report and JMA's report.

2. Outlook of Actual Weather Nationwide

(1) Weather during the Summer Period (June to August 2019)

Table 1-1 shows anomalies in the temperature and precipitation ratios from June to August in FY 2019.

(a) The end of the rainy season was delayed in several regions due to a delay in the northward movement of the Baiu front compared with a normal year. In the latter half of August, a low-pressure system and stationary front impacted the weather nationwide. Frequent heavy rainfalls mainly occurred in the western region. Rainfall during the period was significant on the Pacific Sea coast along the western region, while much rain was also recorded on the Pacific coast along the eastern region and on the Japan Sea coast along the western region. The sunshine duration during the period was less than in a normal year on the Pacific coast along the eastern and western regions.

(b) The mean temperature during the period was high in the northern, Okinawa/Amami, and eastern regions. The northern and Okinawa/Amami regions were covered by warm air for long periods, while the eastern region had prolonged sunshine and experienced a severe heatwave due to a Pacific high-pressure system from the end of July to the first half of August.

(c) Rainfall was significant in the Okinawa/Amami region and there was not much sunshine because of the wet air blowing from the Baiu front and typhoons.

Table 1-1: Anomalies in Temperature, Precipitation and Sunshine Duration by Weather Region from June to August

Weather Region	Mean Temperature Anomaly[°C]	Precipitation Ratio[%]	Sunshine Duration Ratio[%]
Northern	+0.8	104	99
Eastern	+0.5	119	94
Western	+0.0	128	89
Okinawa/Amami	+0.2	152	81

Source: Japan Meteorological Agency (JMA), Tokyo Climate Center.
Seasonal Climate Report over Japan for Summer (FY 2019).
http://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=8&year=2019
http://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=8&year=2019

(2) Weather during the Winter Period (December 2019 to February 2020)

Table 1-2 shows the anomalies in temperature and the ratios of rainfall and snowfall from December to February in FY 2019.

(a) Seasonal mean temperatures were very high throughout the nation except in the northern region. Warm days continued during the period due to a weaker cold air flow throughout the nation caused by a shorter winter-pressure pattern. In particular, the highest records were updated in the eastern and western regions.

(b) Snowfall during the period was quite scarce throughout the nation because of the reduced effect of cold air. In particular, the Japan Sea coast along the northern and eastern regions recorded the least snowfall that they had ever had.

(c) There was significantly little sunshine duration on the Pacific Sea coast along the eastern region, while there was plenty of precipitation on the Japan Sea coast along the western region during the period because of a greater effect from a low-pressure system and stationary front.

Table 1-2: Anomalies in Temperature, Precipitation, Sunshine Duration and Snowfall by Weather Region from December to February

Weather Region	Mean Temperature Anomaly[°C]	Precipitation Ratio[%]	Sunshine Duration Ratio[%]	Snowfall Ratio[%]
Northern	+1.2	95	104	44
Eastern	+2.2	116	95	13
Western	+2.0	139	96	6
Okinawa/Amami	+1.3	73	133	-

Source：Japan Meteorological Agency, Tokyo Climate Center.
Seasonal Climate Report over Japan for Winter (FY 2019).
http://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=2&year=2020
http://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=2&year=2020

3. Actual Nationwide Peak Demand

Peak demand describes the highest consumption of electricity during a given period, such as day, month, or year. Table 1-3 shows the monthly peak demand for regional service areas in FY 2019. Figures 1-2 and 1-3 show the nationwide monthly peak demand, and the annual peak demand by regional service areas, respectively. In this report, "peak demand" refers to the maximum hourly value of electric energy requirement.

The values in red are the maximum monthly peak demand (i.e., the annual peak demand) and the values in blue are the lowest monthly peak demand for each regional service area.[1]

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	409	365	356	433	446	417	378	468	485	488	516	461
Tohoku	1,169	1,107	1,070	1,348	1,448	1,266	1,073	1,202	1,243	1,264	1,380	1,166
Tokyo	4,313	4,229	4,186	5,340	5,543	5,390	4,219	4,291	4,482	5,042	4,852	4,162
Chubu	1,986	1,980	2,006	2,486	2,565	2,568	2,160	1,929	2,034	2,161	2,266	2,014
Hokuriku	450	397	404	492	521	489	401	409	451	450	512	455
Kansai	2,032	1,995	2,136	2,666	2,816	2,725	2,326	1,960	2,090	2,254	2,414	2,097
Chugoku	809	746	853	1,034	1,080	1,048	882	854	949	1,014	1,045	893
Shikoku	364	348	398	486	501	500	411	377	399	431	439	392
Kyushu	1,102	1,073	1,212	1,526	1,573	1,466	1,227	1,100	1,260	1,338	1,393	1,186
Okinawa	117	115	145	145	151	151	137	112	98	97	101	95
Nationwide	12,237	12,163	12,553	15,936	16,461	15,914	13,063	12,597	13,127	13,916	14,619	12,545

[1] Please note that the same figures showing a maximum or minimum value is due to rounding at the first decimal place. The same is applied to the following.

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

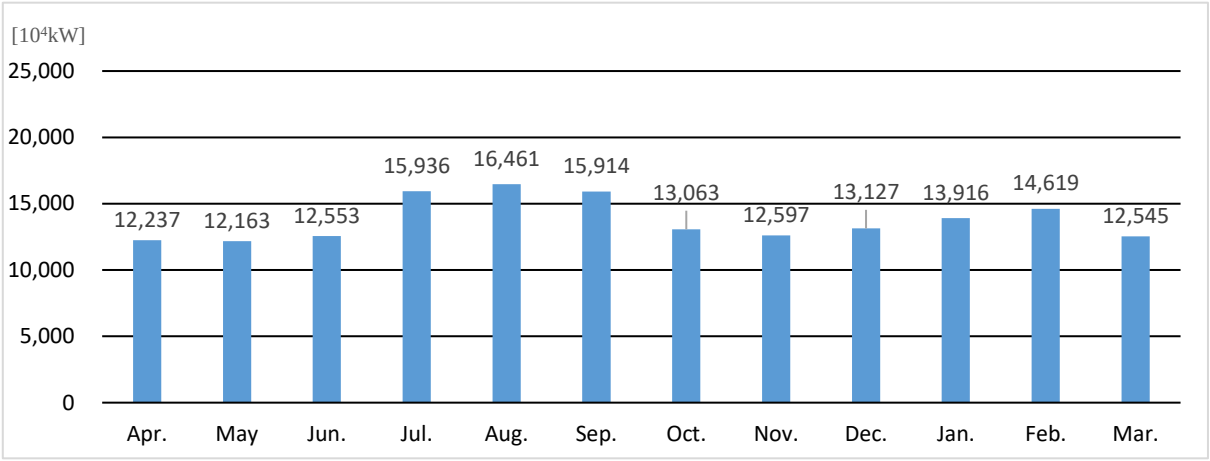

Figure 1-2: Nationwide Monthly Peak Demand

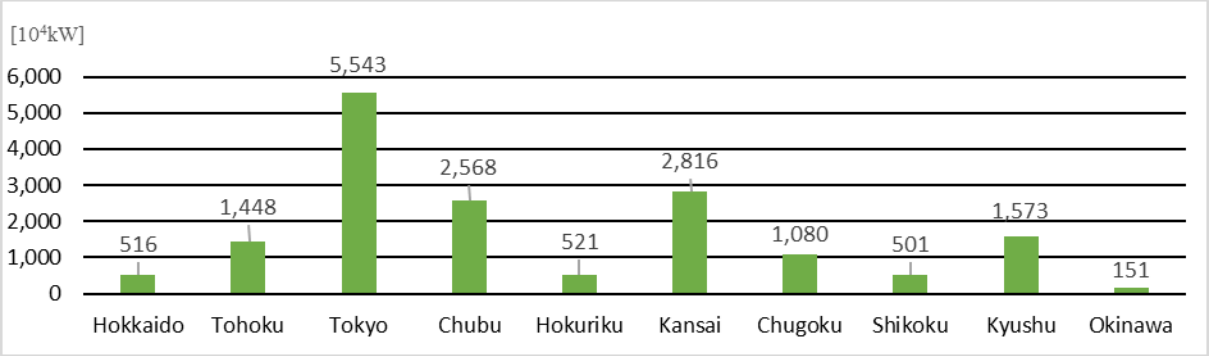

Figure 1-3: Annual Peak Demand for Regional Service Areas

4. Actual Nationwide Electric Energy Requirements

Table 1-4 shows the monthly electric energy requirements for regional service areas in FY 2019. Figures 1-4 and 1-5 show the nationwide monthly electric energy requirements, and annual electric energy requirements for regional service areas, respectively.
The values in red are the maximum monthly energy requirement and the values in blue are the lowest monthly energy requirement for each regional service area.

Table 1-4: Monthly Electric Energy Requirements for Regional Service Areas[3]

[GWh]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido	2,365	2,199	2,123	2,339	2,385	2,215	2,310	2,588	3,071	3,138	2,945	2,728	30,407
Tohoku	6,432	6,036	5,972	6,652	7,156	6,179	6,106	6,540	7,543	7,760	7,402	7,072	80,849
Tokyo	21,382	20,903	21,655	24,608	27,921	24,048	21,896	21,961	25,567	26,228	23,946	23,559	283,673
Chubu	10,278	10,007	10,469	11,838	12,422	11,595	10,456	10,278	11,456	11,746	11,485	11,211	133,241
Hokuriku	2,318	2,133	2,169	2,474	2,596	2,314	2,193	2,287	2,595	2,653	2,619	2,541	28,891
Kansai	10,844	10,616	11,132	12,763	13,775	12,206	11,065	10,740	12,356	12,548	12,142	11,605	141,793
Chugoku	4,560	4,367	4,636	5,241	5,536	5,022	4,727	4,801	5,514	5,506	5,251	4,976	60,138
Shikoku	2,017	1,966	2,080	2,389	2,512	2,322	2,136	2,101	2,400	2,429	2,334	2,264	26,947
Kyushu	6,306	6,337	6,641	7,728	7,990	7,293	6,572	6,369	7,468	7,610	7,141	6,929	84,383
Okinawa	582	640	747	847	871	784	703	688	545	536	579	538	8,061
Nationwide	67,084	65,203	67,624	76,879	83,165	73,977	68,164	68,353	78,515	80,155	75,843	73,424	878,383

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

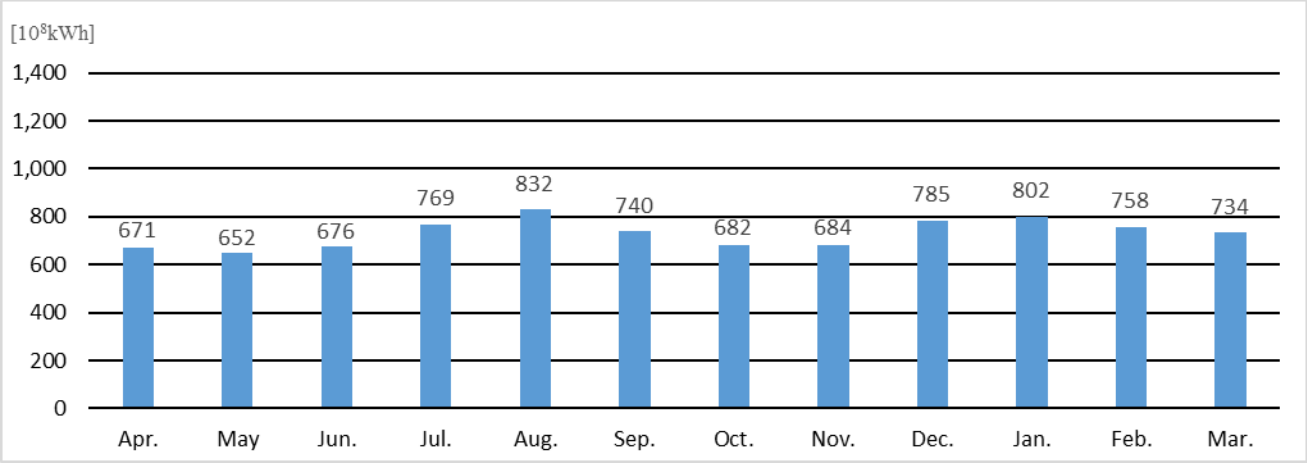

Figure 1-4: Nationwide Monthly Electric Energy Requirements

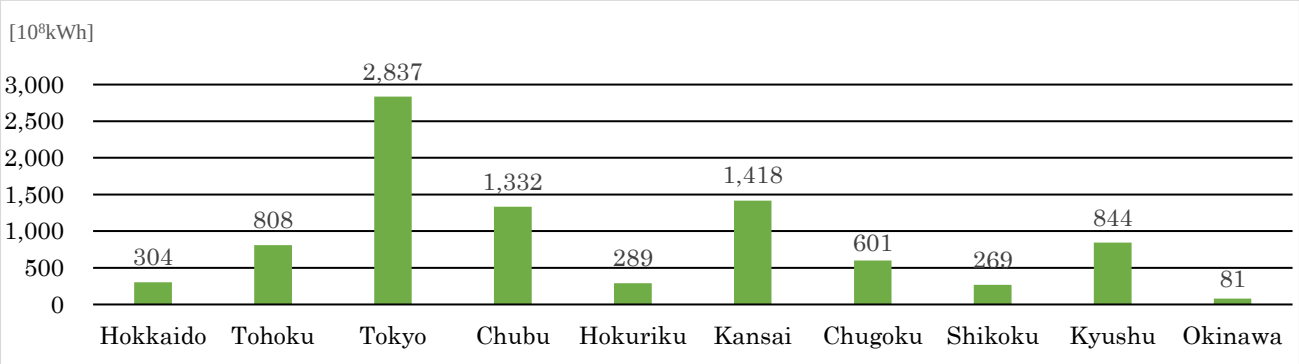

Figure 1-5: Annual Electric Energy Requirements for Regional Service Areas

5. Nationwide Load Factor

The load factor describes the ratio of average demand to peak demand in a given period. Table 1-5 shows the monthly load factor for regional service areas in FY 2019, and Figures 1-6 and 1-7 show the nationwide monthly load factor, and the annual load factor for regional service areas, respectively.

The values in red are the highest monthly load factor and the values in blue are the lowest monthly load factor for each regional service area.

Table 1-5: Monthly Load Factor for Regional Service Areas[4]

[%]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido	80.3	81.1	82.8	72.6	71.8	73.8	82.2	76.8	85.0	86.4	82.0	79.6	67.1
Tohoku	76.4	73.3	77.5	66.3	66.4	67.8	76.5	75.6	81.6	82.5	77.0	81.5	63.6
Tokyo	68.9	66.4	71.9	61.9	67.7	62.0	69.8	71.1	76.7	69.9	70.9	76.1	58.3
Chubu	71.9	67.9	72.5	64.0	65.1	62.7	65.1	74.0	75.7	73.1	72.8	74.8	59.1
Hokuriku	71.5	72.2	74.5	67.6	67.0	65.7	73.4	77.6	77.3	79.2	73.6	75.1	63.1
Kansai	74.1	71.5	72.4	64.4	65.7	62.2	63.9	76.1	79.5	74.8	72.3	74.4	57.3
Chugoku	78.3	78.7	75.5	68.1	68.9	66.6	72.0	78.1	78.1	73.0	72.2	74.9	63.4
Shikoku	76.9	76.0	72.6	66.1	67.4	64.5	69.9	77.4	80.8	75.7	76.4	77.5	61.2
Kyushu	79.5	79.4	76.1	68.1	68.3	69.1	72.0	80.4	79.7	76.4	73.7	78.5	61.1
Okinawa	69.0	74.6	71.7	78.6	77.7	72.2	69.1	84.9	74.6	74.7	82.1	76.5	60.9
Nationwide	76.1	72.0	74.8	64.8	67.9	64.6	70.1	75.4	80.4	77.4	74.5	78.7	60.7

[4] "Nationwide load factor" refers to the load factor calculated for Japan, and not the average of each regional load factor.

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

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

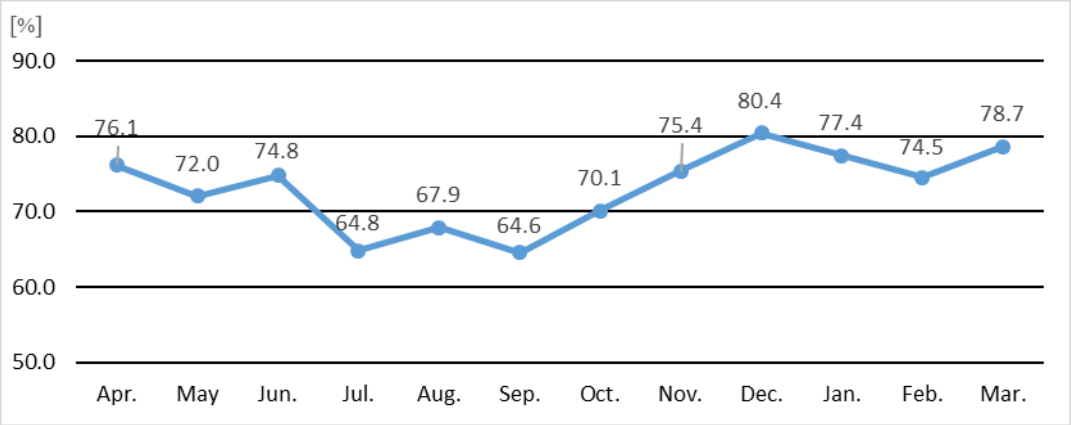

Figure 1-6: Nationwide Monthly Load Factor

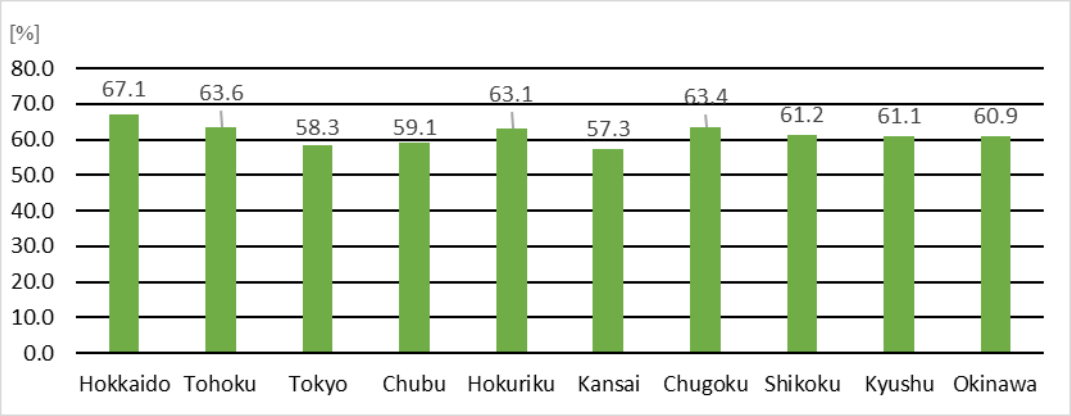

Figure 1-7: Annual Load Factor for Regional Service Areas

6. Nationwide Supply–Demand Status during Peak Demand

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

Table 1-6 shows the supply–demand status during the summer peak demand period for regional service areas in FY 2019.

Table 1-6: Supply–Demand Status during the Summer Peak Demand Period for Regional Service Areas[5]

	Peak Demand [10^4kW]	Occurrence Date & Time			Daily Maximum Temperature [°C]	Supply Capacity [10^4kW]	Reserve Capacity [10^4kW]	Reserve Margin [%]	Daily Energy Supply [10^4kWh]	Daily Load Facter [%]
Hokkaido	446	8/1	Thur.	12	33.0	534	87	19.6	8,999	84.1%
Tohoku	1,448	8/8	Thur.	14	32.5	1,749	301	20.8	26,891	77.4%
Tokyo	5,543	8/7	Wed.	15	35.6	6,126	582	10.5	103,938	78.1%
Chubu	2,568	9/10	Tue.	15	36.6	2,804	236	9.2	48,437	78.6%
Hokuriku	521	8/7	Wed.	15	35.3	586	65	12.4	10,116	80.9%
Kansai	2,816	8/2	Fri.	15	37.5	3,146	330	11.7	53,080	78.5%
Chugoku	1,080	8/5	Mon.	15	37.0	1,257	177	16.4	20,721	79.9%
Shikoku	501	8/2	Fri.	15	36.3	620	119	23.8	9,510	79.1%
Kyushu	1,573	8/2	Fri.	16	34.9	1,829	256	16.3	30,429	80.6%
Okinawa	151	9/12	Thur.	12	32.9	209	58	38.3	2,940	81.1%
Nationwide	16,461	8/2	Fri.	15	-	18,584	2,122	12.9	314,988	79.7%

[5] The daily maximum temperatures are provided by the Japan Meteorological Agency based on the data for the cities where the headquarters of GT&D companies (except for the Okinawa EPCO) are located. (For the regional service area of the Okinawa EPCO, the data from Naha, 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 peak demand. This capacity is the addition of installed generating capacity including the deducted portion, such as generator suspension for maintenance work, derating with the decrease in river flow, and unplanned generator outages.

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

Table 1-7 shows the supply–demand status during the winter peak demand period for regional service areas in FY 2019.

Table 1-7: Supply–Demand Status during the Winter Peak Demand Period for Regional Service Areas[5]

	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	516	2/6	Thur.	7	-7.2	575	59	11.4	11,628	93.9%
Tohoku	1,380	2/6	Thur.	10	-1.7	1,638	257	18.6	30,211	91.2%
Tokyo	5,042	1/28	Tue.	10	4.4	5,749	707	14.0	100,472	83.0%
Chubu	2,266	2/7	Fri.	10	2.8	2,515	248	10.9	45,652	83.9%
Hokuriku	512	2/6	Thur.	10	-1.6	565	54	10.5	11,087	90.2%
Kansai	2,414	2/7	Fri.	10	3.4	2,669	255	10.5	48,869	84.3%
Chugoku	1,045	2/7	Fri.	10	5.1	1,145	101	9.6	21,128	84.2%
Shikoku	439	2/7	Fri.	10	3.8	484	45	10.3	9,193	87.3%
Kyushu	1,393	2/18	Tue.	10	4.8	1,483	90	6.4	29,101	87.0%
Okinawa	101	2/18	Tue.	20	13.2	137	36	35.4	2,030	83.7%
Nationwide	14,619	2/7	Fri.	10	-	16,808	2,189	15.0	303,347	86.5%

7. Nationwide Bottom Demand Period

Table 1-8 shows the status of the bottom demand period for regional service areas (FY 2019).

Table 1-8: Bottom Demand Period for Regional Service Areas[6]

	Bottom Demand [10^4kW]	Occurrence Date & Time			Daily Mean Temperature [℃]	Daily Energy Supply [10^4kWh]
Hokkaido	228	5/5	Sun.	8	16.8	6,153
Tohoku	621	10/13	Sun.	2	18.4	16,833
Tokyo	1,984	5/4	Sat.	6	18.4	56,185
Chubu	882	5/5	Sun.	7	19.8	24,810
Hokuriku	198	5/4	Sat.	1	14.0	5,186
Kansai	1,017	5/5	Sun.	2	19.8	28,390
Chugoku	442	5/4	Sat.	9	20.2	11,586
Shikoku	183	5/5	Sun.	8	19.4	5,169
Kyushu	633	5/5	Sun.	2	20.7	17,460
Okinawa	57	4/1	Mon.	2	16.6	1,747
Nationwide	6,398	5/5	Sun.	2	-	174,027

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

8. Nationwide Peak Daily Energy Supply

Tables 1-9 and 1-10 show the summer peak daily energy supply for regional service areas in FY 2019 (July to September) and the winter peak daily energy supply for regional service areas in FY 2019 (December to February), respectively.[7]

Table 1-9: Summer Peak Daily Energy Supply for Regional Service Areas

	Peak Daily Energy Supply [10^4kWh]	Occurrence Date		Daily Mean Temperature [°C]
Hokkaido	11,628	2/6	Thur.	-7.2
Tohoku	30,211	2/6	Thur.	-1.7
Tokyo	100,472	1/28	Tue.	4.4
Chubu	46,194	2/6	Thur.	2.3
Hokuriku	11,087	2/6	Thur.	-1.6
Kansai	48,869	2/7	Fri.	3.4
Chugoku	21,380	2/6	Thur.	4.0
Shikoku	9,193	2/7	Fri.	3.8
Kyushu	29,101	2/18	Tue.	4.8
Okinawa	2,030	2/18	Tue.	13.2
Nationwide	304,091	2/6	Thur.	-

Table 1-10: Winter Peak Daily Energy Supply for Regional Service Areas

	Peak Daily Energy Supply [10^4kWh]	Occurrence Date		Daily Mean Temperature [°C]
Hokkaido	8,999	8/1	Thur.	28.7
Tohoku	27,573	8/6	Tue.	28.7
Tokyo	104,831	8/2	Fri.	30.2
Chubu	48,437	9/10	Tue.	31.3
Hokuriku	10,130	8/8	Thur.	31.1
Kansai	53,080	8/2	Fri.	31.4
Chugoku	20,812	8/2	Fri.	31.2
Shikoku	9,510	8/2	Fri.	31.1
Kyushu	30,429	8/2	Fri.	30.5
Okinawa	3,049	8/28	Wed.	29.6
Nationwide	314,988	8/2	Fri.	-

[7] See footnote 6.

9. Actual Power Exchange Instructions by the Organization

Instructions

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

During FY 2019, the Organization required electric power companies to exchange power as stated in Table 1-11 according to items 1 to 3, paragraph 1 of Article 111 of the Operational Rules.[8] [9]

In addition, according to items 4 and 5, paragraph 1 of Article 111, the Organization shall instruct the member to lend, deliver, borrow, or share electrical facilities to or from other members, and take the necessary steps to improve their supply–demand status, in addition to the directions; however, no actual instructions were issued.

Controls

The Organization implemented long-cycle cross-regional frequency control[10] to send surplus electric energy generated from renewable energy-generating facilities in the Kyushu EPCO area to the areas of the Chugoku and Shikoku EPCOs through cross-regional interconnection lines by utilizing their available transfer capability. The Organization received the request for control by Kyushu EPCO for measures against the shortage of ability to reduce power supply.[11] Such controls were implemented 56 times in total during FY 2019.

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

[9] Numbers in the left cells in Table 1-11 are the order of publishing instructions on the website.

[10] This means that frequency control by utilizing the balancing capacity of members that are GT&D companies of other regional service areas through interconnection lines when balancing capacity for redundancy becomes or might become insufficient in regional service areas.

[11] This means the ability to decrease power supply of generators such as thermal power generators. The output of renewable energy fluctuates over a short period; it is indispensable to control output of thermal power generators according to the fluctuation. Among such output controls, the range that can control the output of generators is generally called the “balancing capacity for redundancy.”

Table 1-11: Actual Power Exchange Instructions by the Organization

[1]	Date	July 9, 2019 at 18:08
	Instruction	・The Kansai EPCO shall supply 500 MW of electricity to Kyushu EPCO from 18:30 till 19:30 on July 9. ・Kyushu EPCO shall be supplied 5000 MW of electricity by The Kansai EPCO from 18:30 till 19:30 on July 9.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of generator shutdown in the regional service area of Kyushu EPCO.
[2] & [3]	Date	September 9, 2019 at 15:07 and 15:39
	Instruction	At 15:07 ・The Kansai EPCO shall supply 200 MW of electricity to The Chugoku EPCO from 15:30 till 16:00 on September 9. ・The Chugoku EPCO shall be supplied 200 MW of electricity by The Kansai EPCO from 15:30 till 16:00 on September 9. At 15:39 ・Chubu EPCO shall supply 100 MW of electricity to The Chugoku EPCO from 16:00 till 17:00 on September 9. ・The Kansai EPCO shall supply 200 MW of electricity at most to The Chugoku EPCO from 17:00 till 20:00 on September 9. ・Shikoku EPCO shall supply 200 MW of electricity at most to The Chugoku EPCO from 16:00 till 20:30 on September 9. ・The Chugoku EPCO shall be supplied 300 MW of electricity at most by Chubu, The Kansai, and Shikoku EPCO from 16:00 till 20:30 on September 9.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of unexpected demand growth caused by higher temperature.
[4]	Date	September 10, 2019 at 14:27
	Instruction	・Hokkaido EPCO shall supply 100 MW of electricity to TEPCO PG from 16:00 till 17:00 on September 10. ・The Kansai EPCO shall supply 600 MW of electricity to TEPCO PG from 16:00 till 17:00 on September 10. ・TEPCO PG shall be supplied 700 MW of electricity by Hokkaido EPCO and the Kansai EPCO from 16:00 till 17:00 on September 10.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of unexpected demand growth caused by higher temperature.

Table 1-11(continued): Actual Power Exchange Instructions by the Organization

[5]	Date	September 10, 2019 at 16:18
	Instruction	・The Kansai EPCO shall supply 500 MW of electricity to Chubu EPCO from 16:30 till 18:30 on September 10. ・Chubu EPCO shall be supplied 500 MW of electricity by the Kansai EPCO from 16:30 till 18:30 on September 10.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of unexpected demand growth caused by higher temperature.
[6]	Date	September 10, 2019 at 17:02
	Instruction	・The Kansai EPCO shall supply 300 MW of electricity at most to Kyushu EPCO from 17:30 till 19:00 on September 10. ・The Chugoku EPCO shall supply 100 MW of electricity at most to Kyushu EPCO from 17:30 till 19:00 on September 10. ・Kyushu EPCO shall be supplied 400 MW of electricity at most by The Kansai EPCO and The Chugoku EPCO from 17:30 till 19:00 on September 10.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of unexpected demand growth caused by higher temperature.

10. Output Shedding of Renewable Energy-generating Facilities Operated by Electric Power Companies other than GT&D Companies

GT&D companies may order renewable energy-generating facilities from other electric power companies to shed their output in case of expected oversupply to demand for its regional service areas after shedding the output of generators other than renewable energy-generating facilities of the GT&D company 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 1-12 to 1-19 show the actual output shedding of renewable energy-generating facilities in FY 2019.[12] The bar in each table indicates that there was no output shedding for the day.

Output shedding of renewable energy-generating facilities was implemented in the case that balancing capacity for redundancy might become insufficient; the shedding period was from 09:00 to 16:00 in each implementation for isolated islands, and from 8:00 to 16:00 on the Kyushu mainland.

The Organization confirms and verifies whether the output shedding of renewable energy-generating facilities from other EPCOs that Kyushu EPCO has implemented according to the provisions of Article 180 of the Operational Rules. The result of the confirmation and verification is judged to be proper.

Table 1-12: Actual Output Shedding of Renewable Energy-generating Facilities (April 2019)

Date	Location & Shed Output			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
4/1/(Mon)	630	-	-	115.1
4/2/(Tue)	-	-	-	128.9
4/3/(Wed)	2,340	-	-	138.1
4/4/(Thu)	3,970	-	-	168.9
4/6/(Sat)	3,490	1,780	-	248.2
4/7/(Sun)	3,860	-	-	253.3
4/8/(Mon)	3,150	-	-	195.5
4/9/(Tue)	2,340	-	-	128.6
4/12/(Fri)	-	410	-	152.3
4/13/(Sat)	-	-	-	68.7
4/15/(Mon)	-	1,530	-	155.2
4/16/(Tue)	-	-	-	73.3
4/18/(Thu)	-	240	-	132.5
4/19/(Fri)	-	-	-	154.7
4/20/(Sat)	-	1,450	-	240.5
4/21/(Sun)	-	1,370	-	250.3
4/22/(Mon)	-	660	-	164.0
4/26/(Fri)	1,340	-	-	30.3
4/27/(Sat)	4,580	1,440	-	210.0
4/28/(Sun)	610	-	-	97.1

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

Table 1-13: Actual Output Shedding of Renewable Energy-generating Facilities (May 2019)

Date	Location & Shed Output			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
5/2/(Thu)	3,620	1,630	-	226.3
5/3/(Fri)	3,570	1,640	-	208.3
5/4/(Sat)	3,300	1,350	-	207.6
5/5/(Sun)	3,050	530	-	216.9
5/6/(Mon)		1,660	-	143.5
5/7/(Tue)	2,460	370	-	95.6
5/8/(Wed)	150	-	-	66.4
5/10/(Fri)	270	-	-	57.3
5/11/(Sat)	310	1,290	-	122.3
5/12/(Sun)	3,190	1,860	-	193.6
5/15/(Wed)	-	510	-	-
5/21/(Tue)	2,950	140	-	-
5/22/(Wed)	1,990	-	-	-
5/23/(Thu)	2,670	-	-	-
5/24/(Fri)	2,570	-	-	-
5/25/(Sat)	2,840	-	-	-
5/26/(Sun)	990	-	-	-
5/30/(Thu)	1,910	-	-	-

Table 1-14: Actual Output Shedding of Renewable Energy-generating Facilities (June 2019)

Date	Location & Shed Output			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
6/5/(Wed)	2,010	-	-	-
6/9/(Sun)	-	630	-	-
6/10/(Mon)	900	-	-	-
6/11/(Tue)	1,310	-	-	-
6/12/(Wed)	590	-	-	-
6/15/(Sat)	190	-	-	-
6/16/(Sun)	590	-	-	-
6/20/(Thu)	990	-	-	-
6/23/(Sun)	-	150	-	-
6/24/(Mon)	1,120	-	-	-

Table 1-15: Actual Output Shedding of Renewable Energy-generating Facilities (October 2019)[13]

Date	Location & Shed Output			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
10/12/(Sat)	230	-	-	-
10/13/(Sun)	-	880	-	62.2
10/14/(Mon)	-	1,150	-	29.3
10/20/(Sun)	-	660	-	-
10/22/(Tue)	-	450	-	-
10/27/(Sun)	-	1,230	-	26.7
10/28/(Mon)	-	-	-	53.0
10/30/(Wed)	330	-	-	58.6
10/31/(Thu)	10	490	-	24.9

Table 1-16: Actual Output Shedding of Renewable Energy-generating Facilities (November 2019)

Date	Location & Shed Output			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
11/1/(Fri)	-	610	-	8.1
11/2/(Sat)	-	430	-	115.3
11/4/(Mon)	-	380	-	101.8
11/5/(Tue)	-	-	-	12.8
11/6/(Wed)	1,390	-	-	55.0
11/9/(Sat)	1,170	450	-	110.5
11/10/(Sun)	850	-	-	109.9
11/12/(Tue)	1,130	-	-	86.1
11/14/(Thu)	410	-	-	-
11/15/(Fri)	430	-	-	90.1
11/16/(Sat)	2,040	-	-	71.6
11/17/(Sun)	1,830	-	-	123.0
11/21/(Thu)	-	-	-	28.2
11/23/(Sat)	-	890	-	80.1
11/29/(Fri)	160	-	-	-
11/30/(Sat)	-	-	-	107.3

[13] Generating facilities with online output control that were capable of flexible output control according to the condition at two hours ahead of real supply and demand were utilized effectively. The system was implemented by reviewing the operation method for output shedding of renewable energy-generating facilities in the aspect of reduction in output shedding after October 2019.

Table 1-17: Actual Output Shedding of Renewable Energy-generating Facilities (December 2019)

Date	Location & Shed Output			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
12/4/(Wed)	220	-	-	-
12/15/(Sun)	-	-	-	157.7
12/23/(Mon)	280	-	-	-

Table 1-18: Actual Output Shedding of Renewable Energy-generating Facilities (January 2020)

Date	Location & Shed Output			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
1/1/(Wed)	1,320	-	-	161.2
1/2/(Thu)	-	-	-	125.6
1/3/(Fri)	-	-	-	59.7
1/4/(Sat)	500	-	-	178.0
1/5/(Sun)	700	-	-	146.7
1/9/(Thu)	-	-	-	111.7
1/10/(Fri)	-	-	-	66.2
1/13/(Mon)	-	-	-	45.0
1/17/(Fri)	170	-	-	-

Table 1-19: Actual Output Shedding of Renewable Energy-generating Facilities (February 2020)

Date	Location & Shed Output			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
2/1/(Sat)	170	-	-	51.2
2/2/(Sun)	230	-	-	204.8
2/5/(Wed)	1,420	-	-	106.6
2/6/(Thu)	1,550	-	-	-
2/8/(Sat)	970	-	-	46.1
2/9/(Sun)	840	-	-	-
2/11/(Tue)	-	-	-	186.7
2/13/(Thu)	-	-	-	104.3
2/14/(Fri)	-	-	-	41.9
2/19/(Wed)	-	-	-	129.5
2/20/(Thu)	-	-	-	146.3
2/21/(Fri)	-	-	-	183.5
2/22/(Sat)	-	-	-	175.1
2/23/(Sun)	2,880	-	600	262.7
2/24/(Mon)	3,830	-	-	224.0
2/26/(Wed)	360	-	-	87.9
2/27/(Thu)	2,300	-	-	53.3

Table 1-20: Actual Output Shedding of Renewable Energy-generating Facilities (March 2020)

Date	Location & Shed Output			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
3/2/(Mon)	3,370	-	-	197.2
3/5/(Thu)	2,230	-	-	227.8
3/6/(Fri)	-	-	-	243.1
3/8/(Sun)	3,380	-	-	363.9
3/9/(Mon)	-	-	-	140.4
3/11/(Wed)	3,350	-	-	244.9
3/12/(Thu)	-	-	-	254.8
3/14/(Sat)	2,570	-	-	277.6
3/15/(Sun)	-	680	-	355.7
3/16/(Mon)	3,910	-	-	-
3/17/(Tue)	590	-	-	96.0
3/18/(Wed)	990	220	-	88.6
3/19/(Thu)	410	590	-	115.6
3/20/(Fri)	4,740	1,010	1,150	154.5
3/21/(Sat)	4,590	1,640	710	164.7
3/23/(Mon)	2,650	200	-	76.4
3/24/(Tue)	4,820	500	-	78.6
3/25/(Wed)	620	1,110	-	96.5
3/29/(Sun)	-	-	-	257.3

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 members that are GT&D companies. 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 secure the supply–demand balance in case of insufficient supply capacity for each regional service area. Figure 2-1 and Table 2-1 show the cross-regional interconnection lines in Japan.

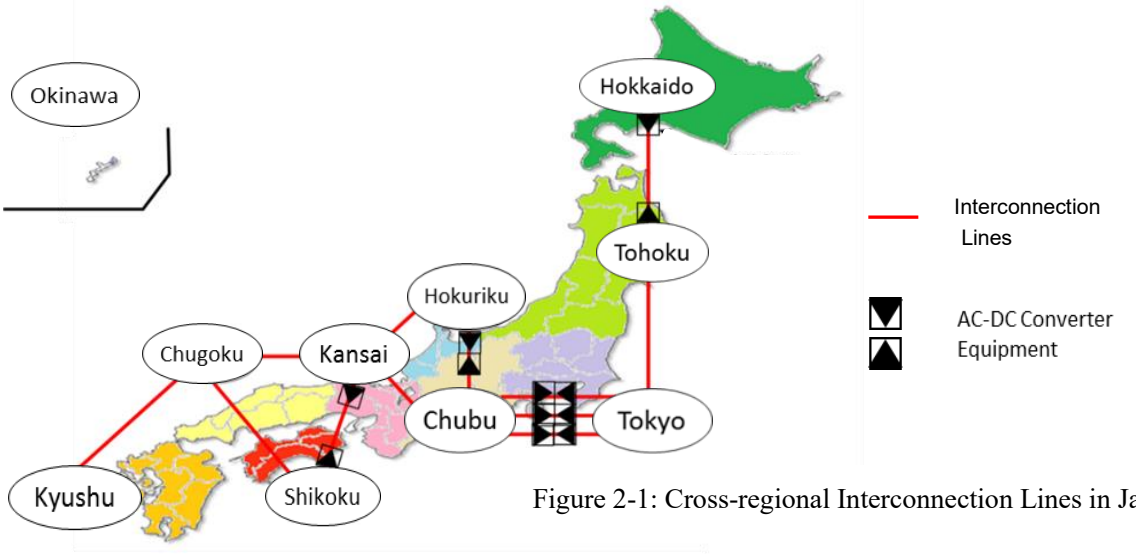

Figure 2-1: Cross-regional Interconnection Lines in Japan

Table 2-1: Summary of Cross-regional Interconnection Lines (at the end of FY 2019)

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	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 C.S.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 C.S.	DC
	Counter	Shikoku	→	Kansai		
Interconnection line between Chugoku and Shikoku	Forward	Chugoku	→	Shikoku	Honshi interconnection line	AC
	Counter	Shikoku	→	Chugoku		
Interconnection line between Chugoku and Kyushu	Forward	Chugoku	→	Kyushu	Kanmon interconnection line	AC
	Counter	Kyushu	→	Chugoku		

(2) Management of Cross-regional Interconnection Lines

The Organization manages the interconnection lines according to the Operational Rules. The Organization has currently revised cross-regional interconnection utilization rules from those based on a first-come, first-served principle to being based on the "implicit auction scheme"[14] with respect to 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 entirely allocates 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 change of timing at capability registration

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

Thus, there are no capability allocation plans, and 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.

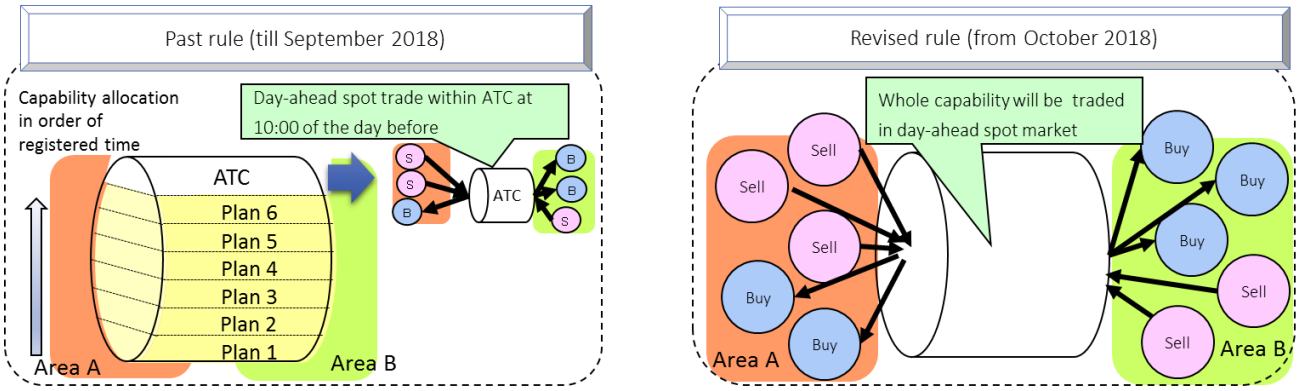


Figure 2-2: Management of Interconnection Lines

[14] 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 are managed according to the provisions of Article 124 of the Operational Rules.

(1) Actual Utilization of Cross-regional Interconnection Lines in FY 2019

Table 2-2 and Figure 2-3 show the monthly utilization of cross-regional interconnection lines for regional service areas in FY 2019.

Table 2-2: Monthly Utilization of Cross-regional Interconnection Lines for Regional Service Areas

[GWh]

		Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	**Annual**
Hokkaido-Honshu	→Tohoku (Forward)	35	69	82	23	25	3	5	10	8	2	1	17	279
	→Hokkaido (Counter)	137	84	73	102	230	129	203	214	287	305	287	66	2,117
Tohoku-Tokyo	→Tokyo (Forward)	1,842	2,156	1,998	2,877	2,800	2,186	1,717	2,086	2,482	2,360	2,573	2,498	27,575
	→Tohoku (Counter)	29	9	10	16	31	13	54	19	20	27	17	7	252
Tokyo-Chubu	→Chubu (Forward)	32	13	34	23	7	40	28	27	40	52	52	5	354
	→Tokyo (Counter)	303	303	361	412	440	403	401	203	330	360	367	264	4,147
Chubu-Kansai	→Kansai (Forward)	41	39	68	74	144	164	77	72	125	68	64	43	980
	→Chubu (Counter)	638	625	724	803	414	350	669	596	276	527	786	768	7,175
Chubu-Hokuriku	→Hokuriku (Forward)	0	1	0	0	1	4	1	0	0	0	0	0	7
	→Chubu (Counter)	0	12	12	2	0	2	6	2	0	0	2	2	40
Hokuriku-Kanasai	→Kansai (Forward)	139	172	312	153	165	164	208	197	307	569	282	249	2,918
	→Hokuriku (Counter)	32	24	18	92	46	136	98	38	23	4	20	15	547
Kansai-Chugoku	→Chugoku (Forward)	62	30	68	35	32	62	45	30	67	47	47	52	578
	→Kansai (Counter)	754	1,106	572	1,091	1,054	784	936	949	731	707	559	549	9,793
Kansai-Shikoku	→Shikoku (Forward)	0	0	11	0	0	0	0	20	0	0	0	0	31
	→Kansai (Counter)	448	501	861	1,025	1,040	998	1,029	596	859	914	867	819	9,956
Chugoku-Shikoku	→Shikoku (Forward)	6	5	29	7	7	15	7	5	6	20	9	15	131
	→Chugoku (Counter)	341	559	325	575	511	365	361	539	354	86	70	56	4,143
Chugoku-Kyushu	→Kyushu (Forward)	4	7	15	23	22	17	16	3	5	3	19	2	138
	→Chugoku (Counter)	1,088	1,087	851	1,306	1,441	1,278	1,380	1,485	1,598	1,703	1,599	1,497	16,311

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

Figure 2-3: Monthly Utilization of Cross-regional Interconnection Lines for Regional Service Areas

(2) Actual Utilization of Cross-regional Interconnection Lines for FY 2010–2019

Table 2-3 and Figure 2-4 show the annual utilization of cross-regional interconnection lines for regional service areas for FY 2010–2019.

Table 2-3 Annual Utilization of Cross-regional Interconnection Lines for Regional Service Areas (FY 2010–2019)

[GWh]

		FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Hokkaido-Honshu	→Tohoku (Forward)	972	3,925	214	182	143	146	237	340	130	279
	→Hokkaido (Counter)	12	7	673	505	617	804	1,033	1,270	1,005	2,117
Tohoku-Tokyo	→Tokyo (Forward)	27,519	9,454	16,084	22,450	21,273	22,587	23,097	28,238	27,298	27,575
	→Tohoku (Counter)	12,219	5,674	4,520	3,891	4,029	3,714	4,660	7,071	3,139	252
Tokyo-Chubu	→Chubu (Forward)	188	1,151	1,579	2,829	2,702	693	2,729	3,954	1,711	354
	→Tokyo (Counter)	1,271	2,426	1,288	536	2,755	4,513	5,144	5,328	5,116	4,147
Chubu-Kansai	→Kansai (Forward)	943	3,734	7,487	7,049	7,131	3,412	5,538	8,106	3,675	980
	→Chubu (Counter)	10,721	8,403	5,726	4,928	6,342	7,577	6,544	9,889	9,980	7,175
Chubu-Hokuriku	→Hokuriku (Forward)	117	169	452	170	231	108	241	353	134	7
	→Chubu (Counter)	2,310	130	183	310	296	172	59	108	76	40
Hokuriku-Kanasai	→Kansai (Forward)	4,957	1,127	1,590	1,406	2,265	2,047	2,033	2,949	2,033	2,918
	→Hokuriku (Counter)	2,850	730	464	587	491	502	640	1,260	2,540	547
Kansai-Chugoku	→Chugoku (Forward)	1,423	1,483	2,836	2,326	2,252	948	716	4,493	4,734	578
	→Kansai (Counter)	7,916	10,520	6,788	5,468	5,994	9,138	13,179	16,727	13,388	9,793
Kansai-Shikoku	→Shikoku (Forward)	0	0	208	0	1	2	2	1	82	31
	→Kansai (Counter)	9,299	9,810	8,938	9,073	9,362	9,611	8,856	9,510	8,840	9,956
Chugoku-Shikoku	→Shikoku (Forward)	2,502	3,475	3,575	3,583	2,677	3,423	3,294	4,061	2,579	131
	→Chugoku (Counter)	7,496	6,727	3,564	3,694	3,912	4,631	7,638	7,540	4,023	4,143
Chugoku-Kyushu	→Kyushu (Forward)	903	2,582	4,210	3,838	3,596	2,174	1,935	3,014	1,998	138
	→Chugoku (Counter)	13,095	13,905	13,596	13,847	11,218	14,947	15,476	18,183	18,280	16,311

* Based on the scheduled power flows of cross-regional interconnection lines

* The values in red are the annual maximum capability and the values in blue are the annual minimum capability in each line and direction for 2010–2019, respectively.

Figure 2-4: Annual Utilization of Cross-regional Interconnection Lines for Regional Service Areas (FY 2010–2019)

(3) Monthly Utilization of Cross-regional Interconnection Lines by Transaction in FY 2019

Table 2-4 shows the monthly utilization of cross-regional interconnection lines by transaction in FY 2019.

Table 2-4: Monthly Utilization of Cross-regional Interconnection Lines by Transaction

[GWh]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	**Annual**
Bilateral	99	55	14	10	2	4	6	32	7	1	4	20	255
Day-ahead	5,624	6,535	6,060	8,322	8,036	6,706	6,844	6,706	7,181	7,400	7,211	6,592	83,216
1 Hour-ahead	209	213	351	308	371	402	390	353	330	354	405	314	4,000

* The values in red are the annual maximum capability and the values in blue are the annual minimum capability, respectively.
* The implicit auction scheme was introduced in October 2018.

(4) Annual Utilization of Cross-regional Interconnection Lines by Transaction for FY 2010–2019

Table 2-5 and Figures 2-5, 2-6, and 2-7 show the annual utilization of cross-regional interconnection lines by transaction for FY 2010–2019.

Table 2-5: Annual Utilization of Cross-regional Interconnection Lines by Transaction (FY 2010–2019)

[GWh]

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Bilateral	100,444	79,693	76,328	73,289	71,558	75,947	84,843	109,842	56,710	255
Day-ahead	6,251	5,718	7,155	11,632	14,174	13,152	14,817	18,350	51,120	83,216
1 Hour-ahead	2	22	493	1,750	1,554	2,050	3,392	4,203	2,932	4,000

* "Hour-ahead" means the transaction that is 4 hours ahead of the gate closure in FY 2015. From FY 2016, it refers to the transaction that is 1 hour ahead of the gate closure.

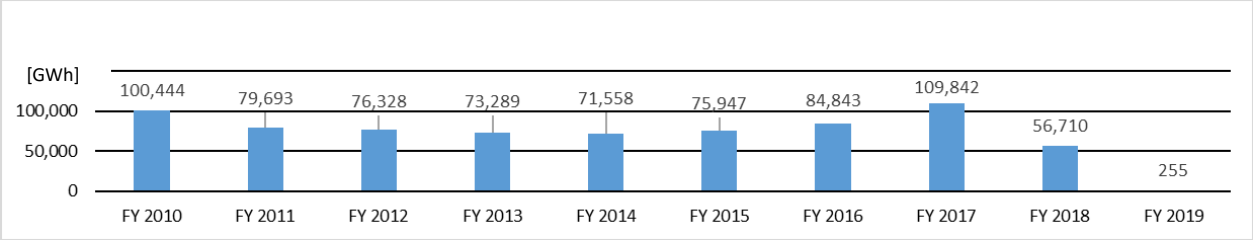


Figure 2-5: Annual Utilization of Cross-regional Interconnection Lines by Bilateral Transaction (FY 2010–2019)

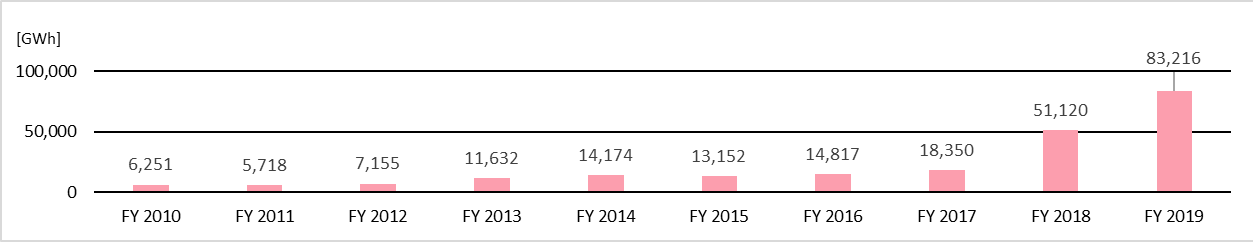


Figure 2-6: Annual Utilization of Cross-regional Interconnection Lines by Day-ahead Transaction (FY 2010–2019)

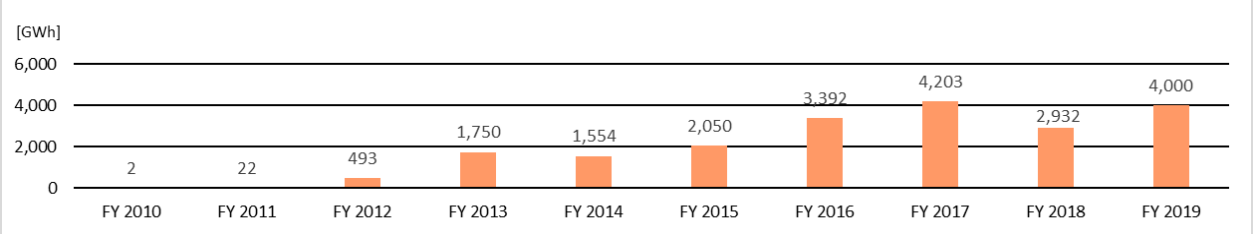


Figure 2-7: Annual Utilization of Cross-regional Interconnection Lines by Hour-ahead Transaction (FY 2010–2019)

3. Congestion Management and Constraints of Cross-regional Interconnection Lines

The following are the actual congestion management and constraints of cross-regional interconnection lines implemented according to the provisions of Article 143 of the Operational Rules.

(1) Monthly Congestion Management of Cross-regional Interconnection Lines by Weekly Plan Submission in FY 2019

There was no congestion management of cross-regional interconnection lines due to the introduction of the implicit auction scheme in FY 2019.

(2) Annual Congestion Management of Cross-regional Interconnection Lines by Weekly Plan Submission for FY 2010–2019

Table 2-6 and Figure 2-8 show the annual congestion management of cross-regional interconnection lines by weekly plan submissions for FY 2010–2019.

Table 2-6: Annual Congestion Management of Cross-regional Interconnection Lines by Weekly Plan Submissions
(FY 2010–2019)

[h]

	Weekly Plan Submission	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
FY 2019	Total	0	0	0	0	0	0	0	0	0	0	0	0	0
	Before Submission	0	0	0	0	0	0	0	0	0	0	0	0	0
	After Submission	0	0	0	0	0	0	0	0	0	0	0	0	0
FY 2018	Total	5,111	6,677	7,765	7,035	7,553	7,973	0	0	0	0	0	0	42,113
	Before Submission	972	3,044	2,170	1,996	2,388	2,752	0	0	0	0	0	0	13,322
	After Submission	4,139	3,633	5,595	5,039	5,165	5,221	0	0	0	0	0	0	28,791
FY 2017	Total	2,210	3,758	2,789	2,985	2,682	2,851	3,024	4,433	5,188	5,263	4,519	5,659	45,358
	Before Submission	1,000	1,694	1,288	1,764	1,758	1,222	1,798	1,124	762	1,714	636	722	15,482
	After Submission	1,210	2,064	1,501	1,221	924	1,629	1,226	3,309	4,426	3,549	3,883	4,937	29,876
FY 2016	Total	533	1,006	123	221	136	422	703	467	499	508	12	541	5,167
	Before Submission	533	763	0	144	130	310	582	208	476	506	0	431	4,083
	After Submission	0	243	123	77	6	112	121	259	23	2	12	110	1,085
FY 2015	Total	1,175	3,858	1,293	761	791	996	1,396	854	946	774	723	1,275	14,840
	Before Submission	1,076	3,778	1,257	744	744	766	772	734	884	744	696	1,216	13,410
	After Submission	99	80	36	17	47	231	624	120	62	30	27	59	1,430
FY 2014	Total	1,132	1,820	411	18	48	250	101	21	49	76	108	44	4,075
	Before Submission	898	1,701	256	0	12	82	30	0	0	0	0	0	2,978
	After Submission	234	120	155	18	36	168	71	21	49	76	108	44	1,097
FY 2013	Total	1,106	1,189	134	3	19	94	873	0	10	474	205	16	4,121
	Before Submission	736	476	100	0	0	32	814	0	5	196	0	0	2,359
	After Submission	370	713	34	3	19	62	59	0	5	278	205	16	1,762
FY 2012	Total	458	1,237	502	620	727	1,025	299	1,039	795	1	667	469	7,836
	Before Submission	234	1,032	0	0	0	447	198	808	698	0	667	420	4,503
	After Submission	224	205	502	620	727	578	101	231	97	1	0	49	3,333
FY 2011	Total	142	771	994	604	1,236	757	657	296	524	444	2,071	1,622	10,114
	Before Submission	84	541	144	224	1,178	384	302	1	0	0	1,543	1,488	5,889
	After Submission	58	230	850	380	58	373	355	295	524	444	528	134	4,226
FY 2010	Total	553	13	277	52	144	2	5	1	4	551	0	120	1,721
	Before Submission	420	0	0	0	0	0	0	0	0	504	0	0	924
	After Submission	133	13	277	52	144	2	5	1	4	48	0	120	798

* The values in red are the annual maximum capability.
* The managed hours are collected as 30 minutes and rounded up to 1 hour.
* The total number of hours of utilization plans that managed to mitigate congestion.
* In-service dates of function for capability allocation plan revision of the Cross-regional Operation System are as below.
  1. The function for revision of the weekly capability allocation plan and its congestion management: September 2016.
  2. The function for revision of the monthly capability allocation plan and its congestion management: February 2017.
  3. Introduction of the implicit auction scheme: October 2018.

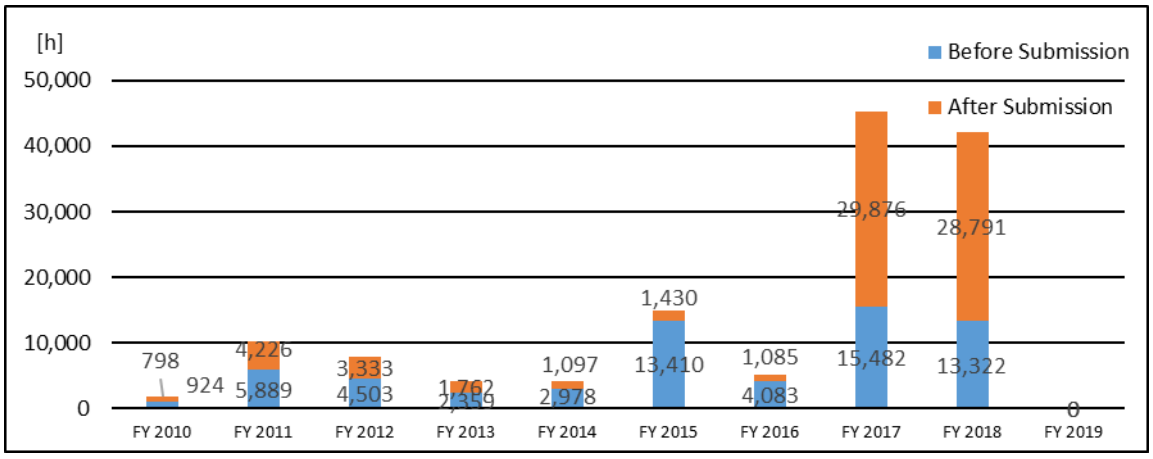


Figure 2-8: Annual Congestion Management of Cross-regional Interconnection Lines by Weekly Plan Submissions
(FY 2010–2019)

(3) Monthly Congestion Management of Cross-regional Interconnection Lines by Constraints in FY 2019

There was no congestion management of cross-regional interconnection lines due to the introduction of the implicit auction scheme in FY 2019.

(4) Annual Congestion Management of Cross-regional Interconnection Lines by Constraints for FY 2010–2019

Table 2-7 and Figure 2-9 show the annual congestion management of cross-regional interconnection lines by constraints for FY 2010–2019.

Table 2-7 Annual Congestion Management of Cross-regional Interconnection Lines by Constraints (FY 2010–2019)

[h]

	Constraints	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
FY 2019	Total	0	0	0	0	0	0	0	0	0	0	0	0	0
	Over Capability	0	0	0	0	0	0	0	0	0	0	0	0	0
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	0
FY 2018	Total	768	1,608	2,370	1,790	1,576	2,110	0	0	0	0	0	0	10,222
	Over Capability	768	1,608	2,370	1,790	1,576	2,110	0	0	0	0	0	0	10,222
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	0
FY 2017	Total	2,210	3,758	2,789	2,985	2,682	2,851	3,024	4,433	5,188	5,263	4,519	5,659	45,358
	Over Capability	2,210	3,758	2,789	2,985	2,682	2,851	3,024	4,433	5,188	5,263	4,519	5,659	45,358
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	0
FY 2016	Total	533	1,006	123	221	136	422	703	467	499	508	12	541	5,167
	Over Capability	533	1,006	123	221	136	422	703	467	499	508	12	541	5,167
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	0
FY 2015	Total	1,175	3,858	1,293	761	791	996	1,396	854	946	774	723	1,275	14,840
	Over Capability	1,175	2,437	1,293	761	791	863	1,233	854	946	774	723	1,275	13,123
	Minimum Flow	0	1,421	0	0	0	133	163	0	0	0	0	0	1,717
FY 2014	Total	1,132	1,820	411	18	48	250	101	21	49	76	108	44	4,075
	Over Capability	990	1,661	411	18	48	192	73	21	49	76	108	44	3,688
	Minimum Flow	142	160	0	0	0	58	28	0	0	0	0	0	387
FY 2013	Total	1,106	1,189	134	3	19	94	873	0	10	474	205	16	4,121
	Over Capability	928	853	134	3	19	94	324	0	10	474	205	16	3,058
	Minimum Flow	178	336	0	0	1	0	549	0	0	0	0	0	1,063
FY 2012	Total	458	1,237	502	620	727	1,025	299	1,039	795	1	667	469	7,836
	Over Capability	457	1,160	496	324	511	928	0	325	675	0	667	469	6,010
	Minimum Flow	1	77	6	296	217	97	299	715	120	1	0	0	1,826
FY 2011	Total	142	771	994	604	1,236	757	657	296	524	444	2,071	1,622	10,114
	Over Capability	114	613	144	9	10	143	124	36	496	434	2,069	1,621	5,810
	Minimum Flow	29	158	850	595	1,226	614	534	260	28	10	2	1	4,304
FY 2010	Total	553	13	277	52	144	2	5	1	4	551	0	120	1,721
	Over Capability	500	4	2	49	0	2	5	1	2	19	0	97	680
	Minimum Flow	53	9	276	3	144	0	0	0	2	532	0	24	1,042

* The values in red are the annual maximum capability.
* The managed hours are collected as 30 minutes and rounded up to 1 hour.
* The total number of hours of capability allocation plans that managed to mitigate congestion.
* In-service dates of function for capability allocation plan revision of the Cross-regional Operation System are as below.
  1. The function for revision of the weekly capability allocation plan and its congestion management: September 2016.
  2. The function for revision of the monthly capability allocation plan and its congestion management: February 2017.
  3. Introduction of the implicit auction scheme: October 2018.

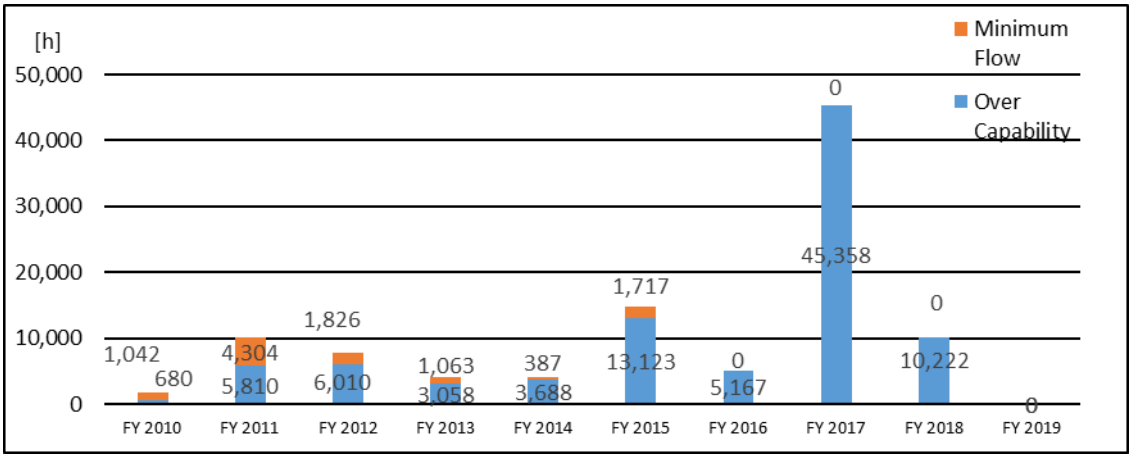


Figure 2-9: Annual Congestion Management of Cross-regional Interconnection Lines by Constraints (FY 2010–2019)

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

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

(1) Actual Monthly Maintenance Work on Cross-regional Interconnection Lines in FY 2019

Table 2-8 shows the monthly maintenance work on cross-regional interconnection lines in FY 2019, and Figure 2-10 shows the nationwide monthly planned outage rate in FY 2019.

Table 2-8: Monthly Maintenance Work 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	24	11	10	8	8	11	10	31	7	2	7	28	7	7	4	3	2	2					11	31	90	134
Tohoku-Tokyo	Soma-Futaba bulk line, Iwaki bulk line			3	12	5	7			3	20	6	30	1	4	4	30	6	31	2	31	2	27			32	192
Tokyo-Chubu	Sakuma FC C.S.	5	4			1	1									9	6									15	11
	Shin Shinano FC C.S.	2	2	6	4	2	1			1	1			1	1	16	19	7	8					5	13	40	49
	Higashi Shimizu FC C.S.	1	1			4	4																	5	12	10	17
Chubu-Kansai	Mie-Higashi Omi line			11	5	7	4					1	1	2	1											21	11
Chubu-Hokuriku	Minami Fukumitsu HVDC BTB C.S., Minami Fukumitsu Substation					1	1							13	16											14	17
Hokuriku-Kansai	Echizen-Reinan line			1	1	1	1							1	1											3	3
Kansai-Chugoku	Seiban-Higashi Okayama line, Yamazaki-Chizu line	18	8									33	20	10	7	11	8									72	43
Kansai-Shikoku	Kihoku and Anan AC/DC C.S.	22	5			2	4					1	2			2	26	2	9							29	46
Chugoku-Shikoku	Honshi interconnection line	3	25	3	27									1	1											7	53
Chugoku-Kyushu	Kanmon interconnection line	10	12	10	11																					20	23
Nationwide (Cumulative works for the same facilities deducted)		85	68	44	68	31	34	10	31	11	23	48	81	36	38	46	92	17	50	2	31	2	27	21	56	353	599

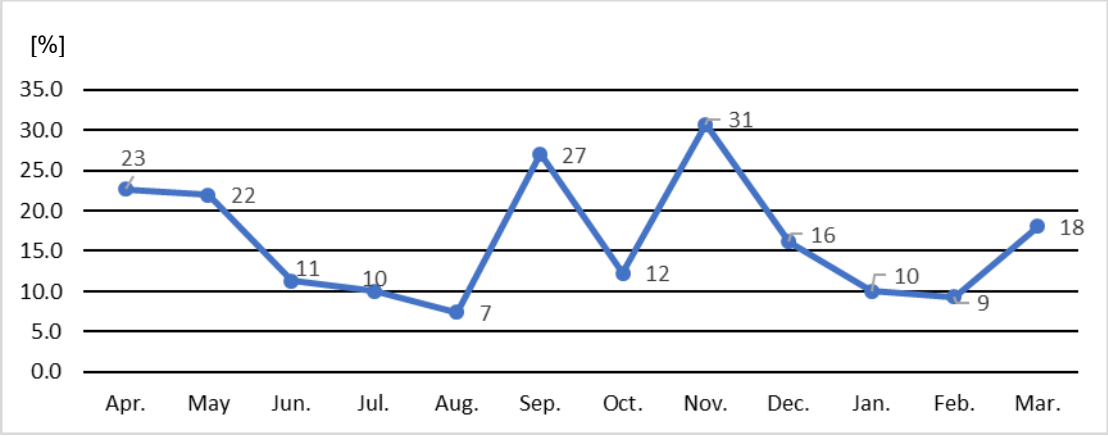


Figure 2-10: Nationwide Monthly Planned Outage Rate

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

(2) Annual Maintenance Work on Cross-regional Interconnection Lines for FY 2010–2019

Table 2-9 shows the annual maintenance work on cross-regional interconnection lines for FY 2010–2019.

Table 2-9: Annual Maintenance Work on Cross-regional Interconnection Lines (FY 2010–2019)

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	Total	10-years Average
Number	64	56	58	38	63	91	218	267	205	353	1,413	141

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

5. Unplanned Outage of Cross-regional Interconnection Lines

(1) Unplanned Outage of Cross-regional Interconnection Lines in FY 2019

Table 2-10 shows the unplanned outage of cross-regional interconnection lines in FY 2019.

Table 2-10: Unplanned Outage of Cross-regional Interconnection Lines

Date	Facility	Background
May 7	Hokuto-Imabetsu HVDC Link	Secondary accident of Imabetsu Trunk Lines(275 kV) No.1 & 2; estimated cause: thunderstruck
May 19	Hokuto-Imabetsu HVDC Link	Malfunction of cooling system at Hokuto Converter Station
Jun. 9	Kihoku and Anan AC/DC C.S.	Water leakage of cooling system for Group 1 valves at Anan Converter Station
Jun. 11	Shin Shinano FC unit No.2	Secondary accident of network
Aug. 20	Shin Shinano FC unit No.2	Secondary accident of network
Sep. 10	Shin Shinano FC unit No.2	Secondary accident of network
Oct. 12	Shin Shinano FC unit No.1/ Sakuma FC/ Hokuto-Imabetsu HVDC Link	Secondary accident of frequency fall due to shutdown of Chiba Thermal Power Plant caused by outage of North Chiba Lines(275 kV) No.1 and 2; estimated casuse: physical contact by rainstorm
Nov. 26	Hokuto-Imabetsu HVDC Link	Secondary accident of network
Dec. 12	Hokuto-Imabetsu HVDC Link	Secondary accident of network

* The unplanned outage affecting TTC is described.

(2) Annual Unplanned Outage of Cross-regional Interconnection Lines for FY 2010–2019

Table 2-11 shows the annual unplanned outage of cross-regional interconnection lines for FY 2010–2019.

Table 2-11: Annual Unplanned Outage of Cross-regional Interconnection Lines (FY 2010–2019)

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	Total	10-years Average
Number	9	5	6	9	1	3	3	3	6	9	54	5

6. Actual Employment of the Transmission Margin

The “employment of the transmission margin” describes the supply of electricity by GT&D companies utilizing their transmission margin to interconnection lines where the supply–demand balance is restricted or insufficient to reduce power supply, or other such possibilities. Table 2-12 shows the actual employment of the transmission margin for FY 2019 according to the provisions of Article 152 of the Operational Rules.

Table 2-12: Actual Employment of the Transmission Margin

Date	Facility	Background
Sep. 10	Interconnection facilities between Tokyo and Chubu (Flow from Chubu to Tokyo)	Insufficient ATC of the corresponding facilities in the regional service area of TEPCO PG which is subject to the instruction of power exchanges because of demand growth due to higher temperature

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

The actual ATC values calculated and published are shown in Figures 2-12 to 2-21. Figures 2-11 and Table 2-13 detail how to interpret the ATC graph.

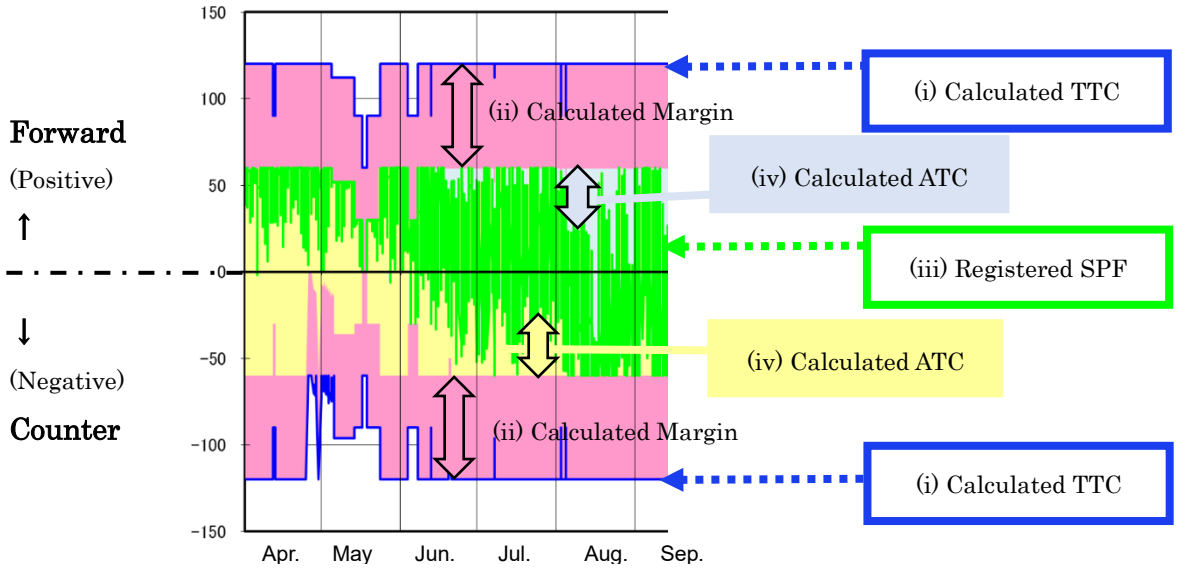


Figure 2-11: How to Interpret the ATC graphs

Table 2-13: Explanations of ATC graphs 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

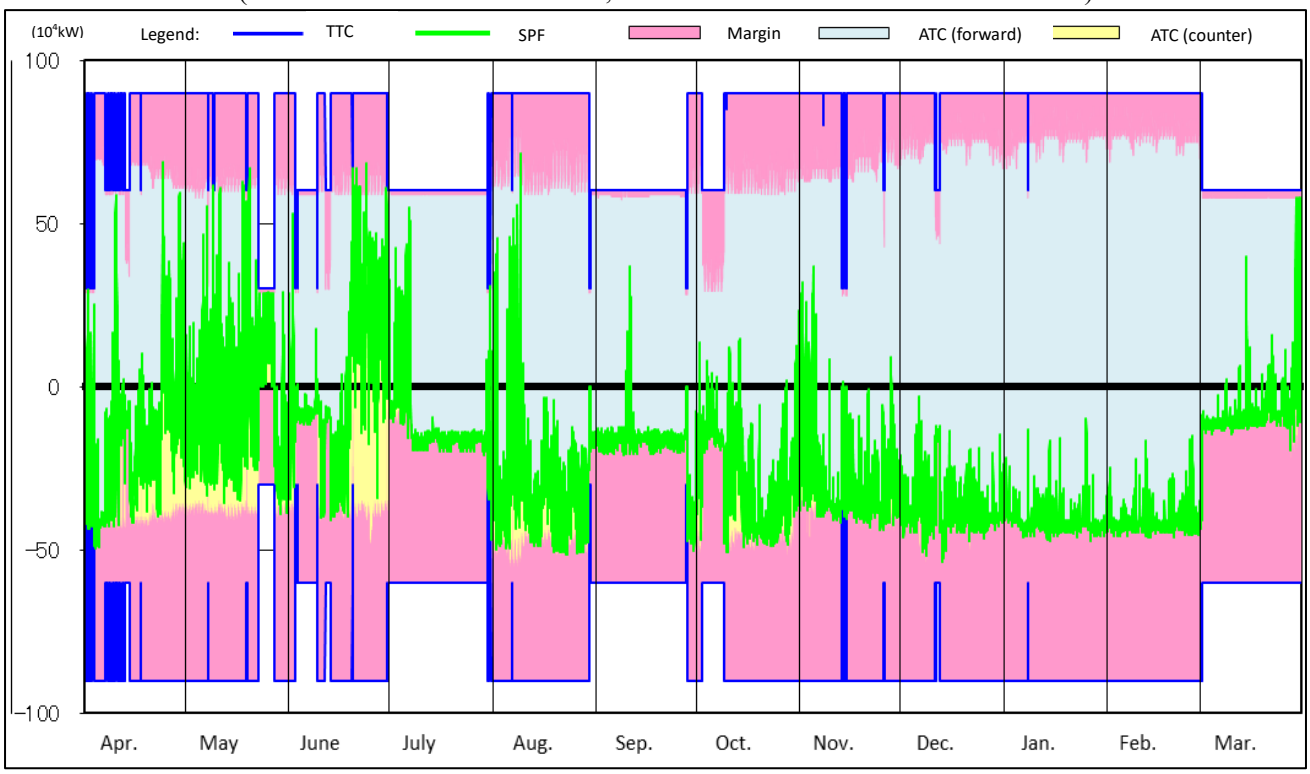
The actual flows on the transmission lines are offset in each direction. Therefore, the scheduled power flow is the offset figure between forward and counter flows, not the simple addition of each direction. In addition, offset figures on the graphs are observed as SPF, not observing the capacity of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

(Reference) Publishing actual ATC

Detailed network system information including actual ATC is available at the URL below.

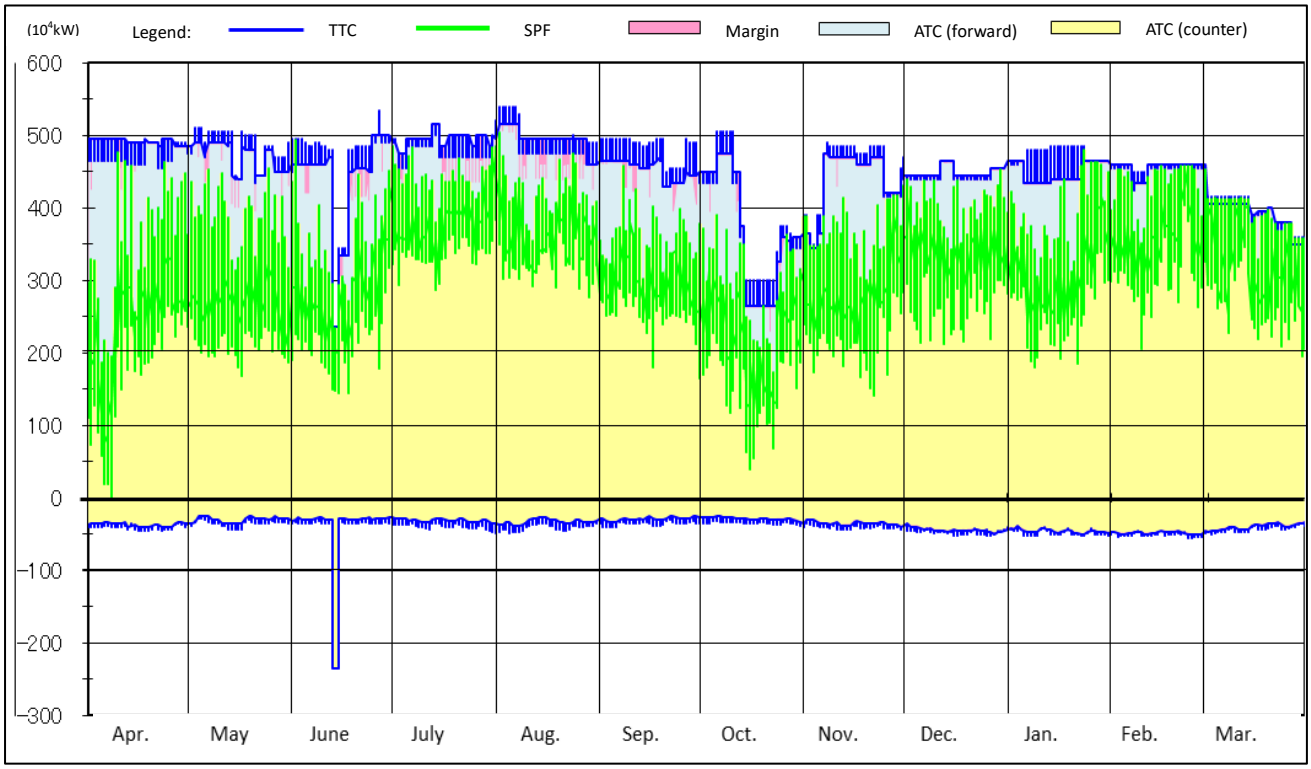
URL http://occtonet.occto.or.jp/public/dfw/RP11/OCCTO/SD/LOGIN_login#

Figure 2-12: Actual ATC of Interconnection Facilities between Hokkaido and Honshu
(Hokkaido–Honshu HVDC Link, and New Hokkaido–Honshu HVDC Link)



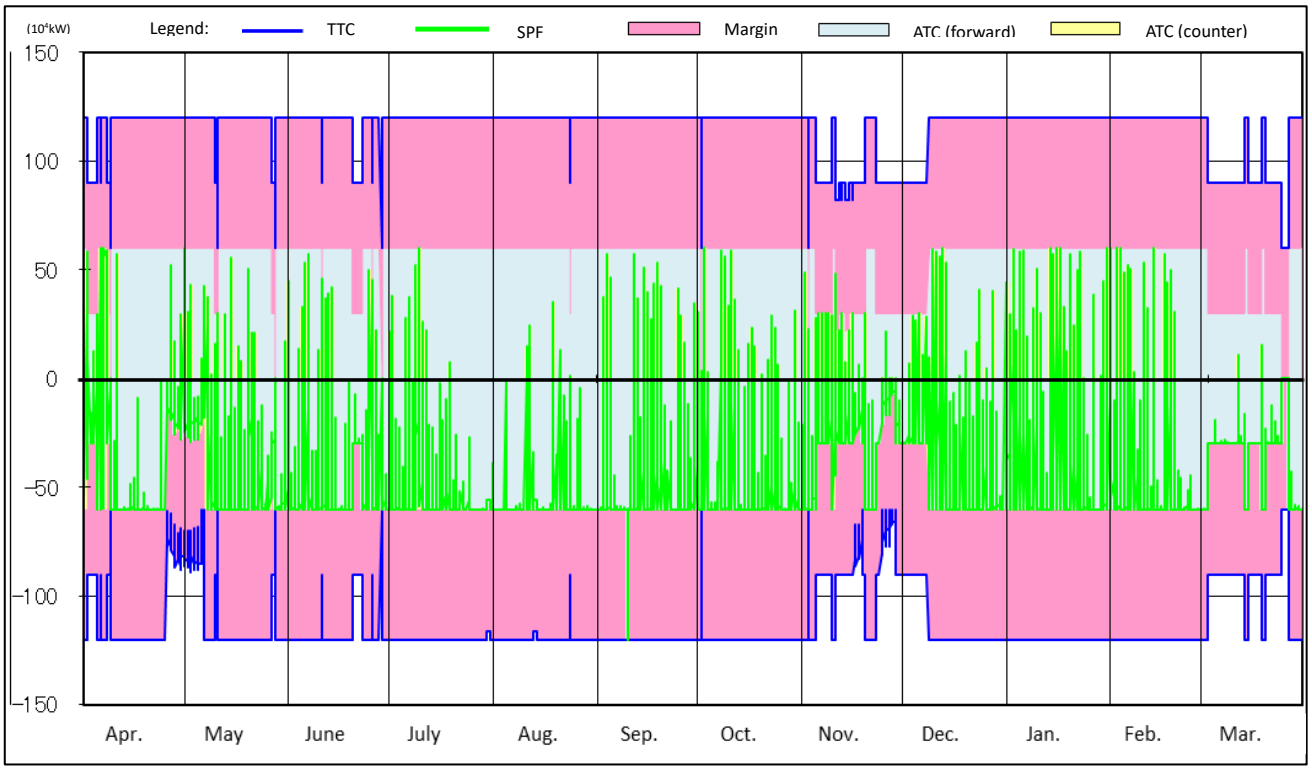
Note: Hokkaido to Tohoku as forward (positive) flow, Tohoku to Hokkaido as counter (negative) flow.

Figure 2-13: Actual ATC of Interconnection Lines between Tohoku and Tokyo
(Soma-Futaba Bulk Line and Iwaki Bulk Line)



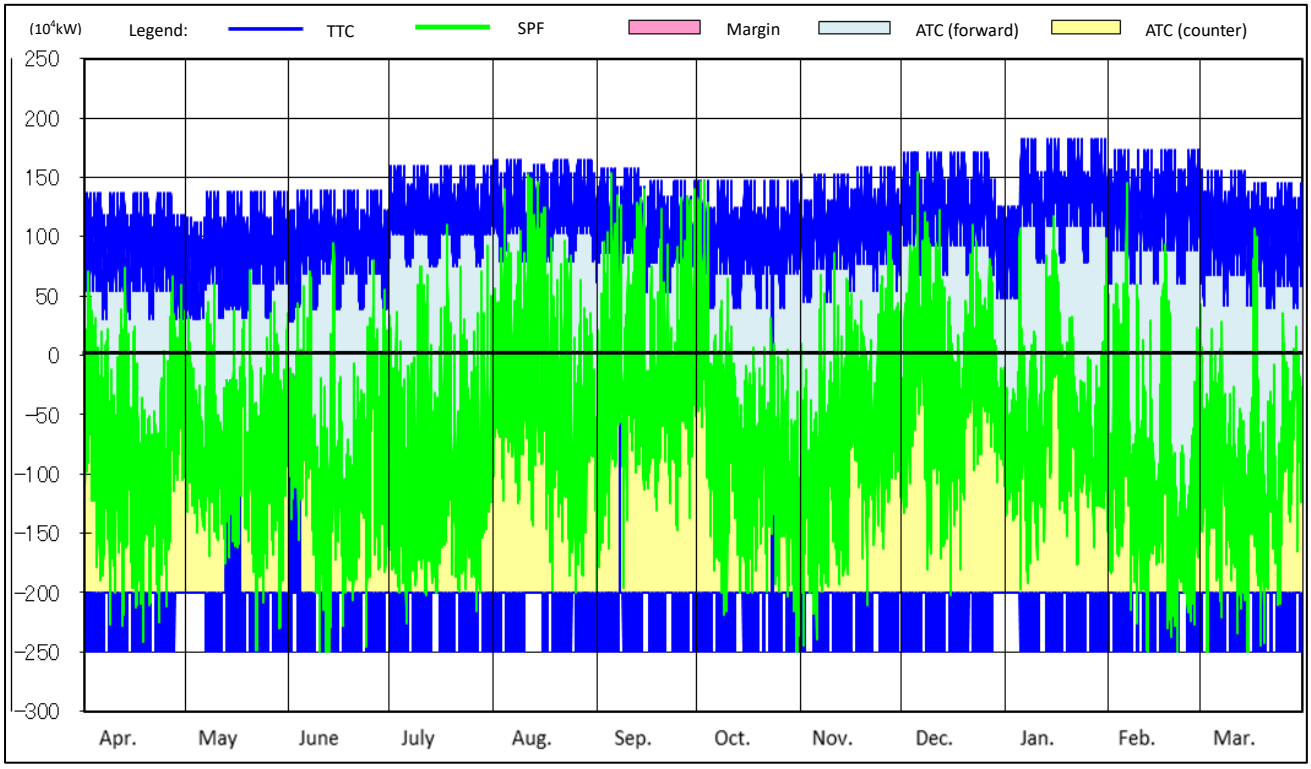
Note: Tohoku to Tokyo as forward (positive) flow, Tokyo to Tohoku as counter (negative) flow.

Figure 2-14: Actual ATC of Interconnection Facilities between Tokyo and Chubu
(Sakuma, Shin-Shinano and Higashi Shimizu F.C.)



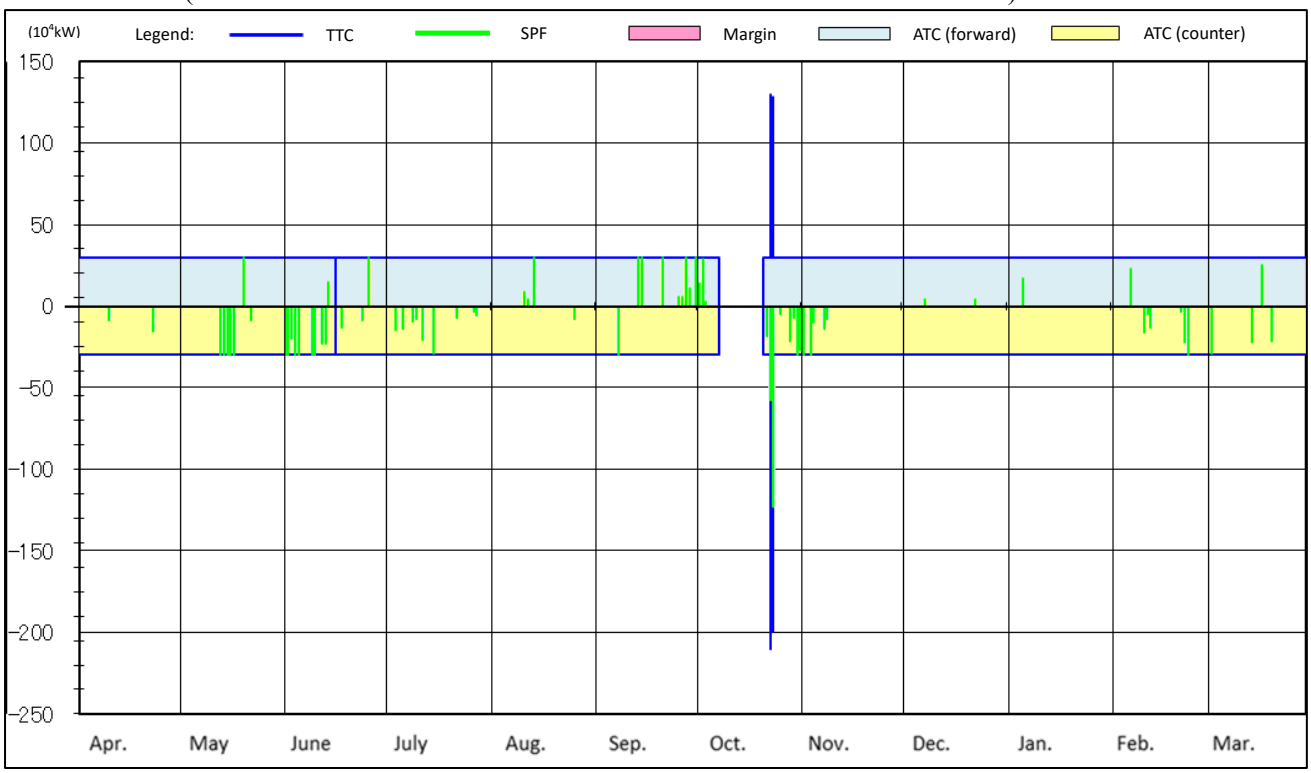
Note: Tokyo to Chubu as forward (positive) flow, Chubu to Tokyo as counter (negative) flow.

Figure 2-15: Actual ATC of the Interconnection Line between Chubu and Kansai (Mie-Higashi Omi Line)



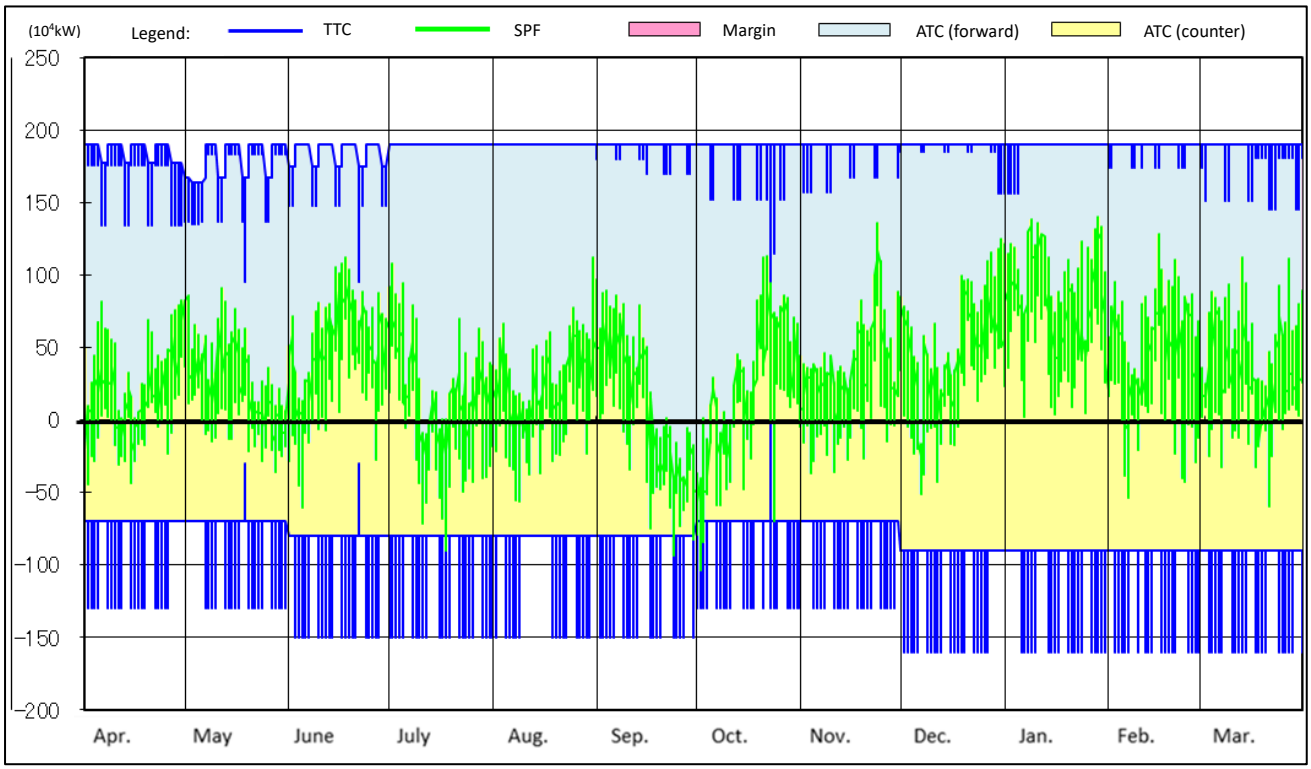
Note: Chubu to Kansai as forward (positive) flow, Kansai to Chubu as counter (negative) flow.

Figure 2-16: Actual ATC of Interconnection Facilities between Chubu and Hokuriku
(Minami Fukumitsu HVDC BTB C.S. and Minami Fukumitsu Substation)



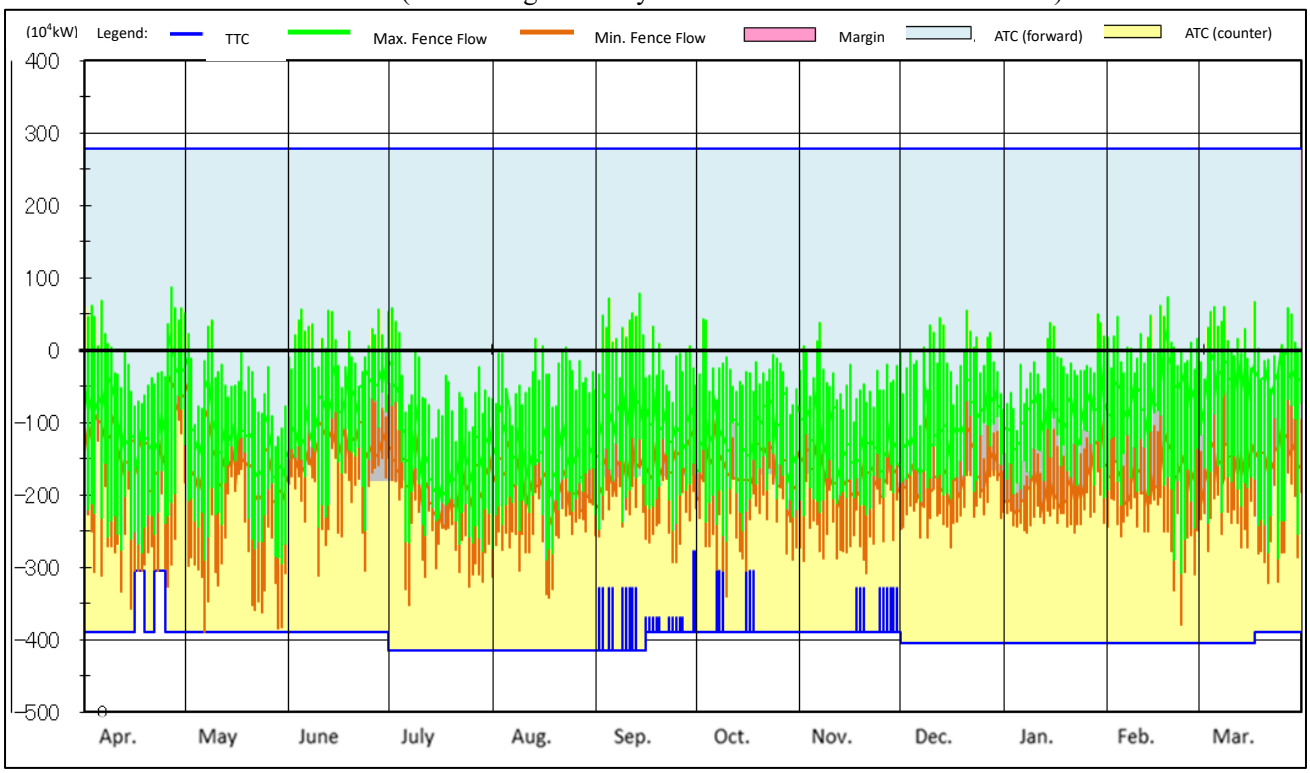
Note: Chubu to Hokuriku as forward (positive) flow, Hokuriku to Chubu as counter (negative) flow.

Figure 2-17: Actual ATC of the Interconnection Line between Hokuriku and Kansai (Echizen-Reinan Line)



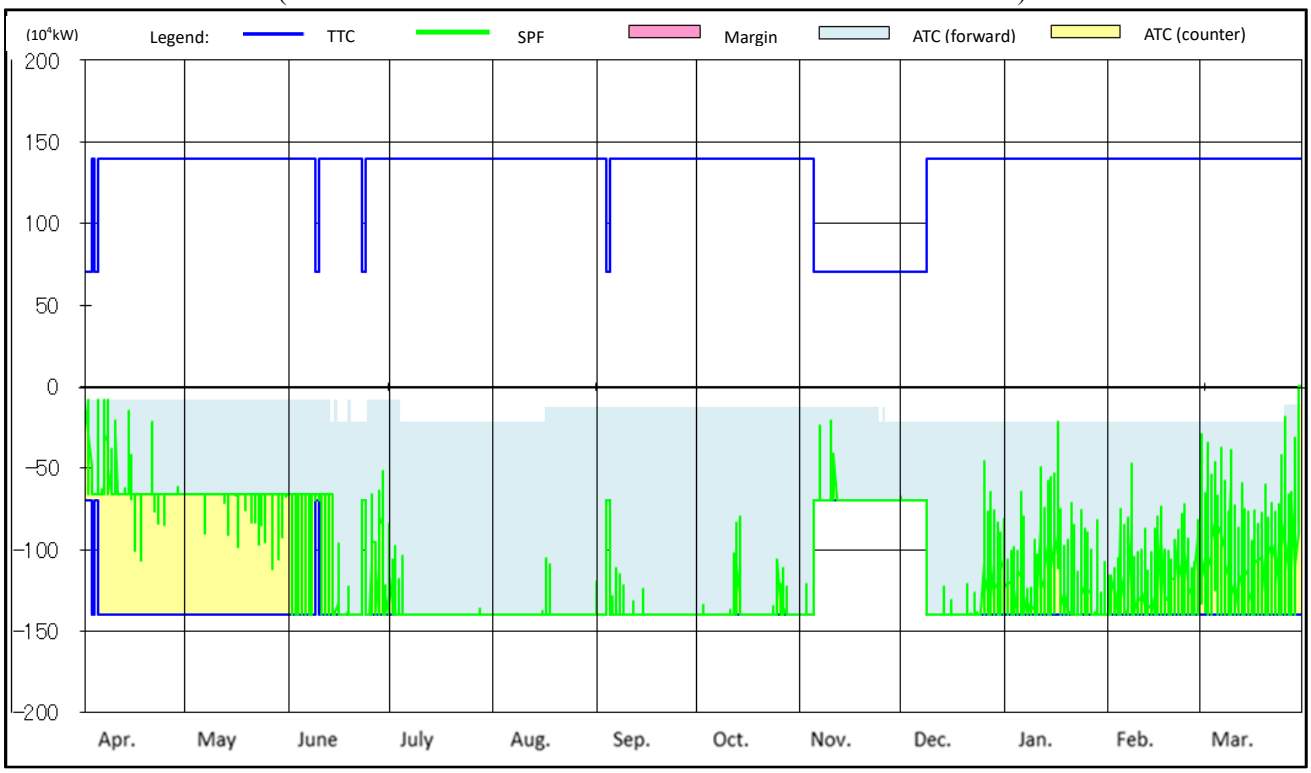
Note: Hokuriku to Kansai as forward (positive) flow, Kansai to Hokuriku as counter (negative) flow.

Figure 2-18: Actual ATC of Interconnection Lines between Kansai and Chugoku
(Seiban-Higashi Okayama Line and Yamazaki-Chizu Line)



Note: Kansai to Chugoku as forward (positive) flow, Chugoku to Kansai as counter (negative) flow.

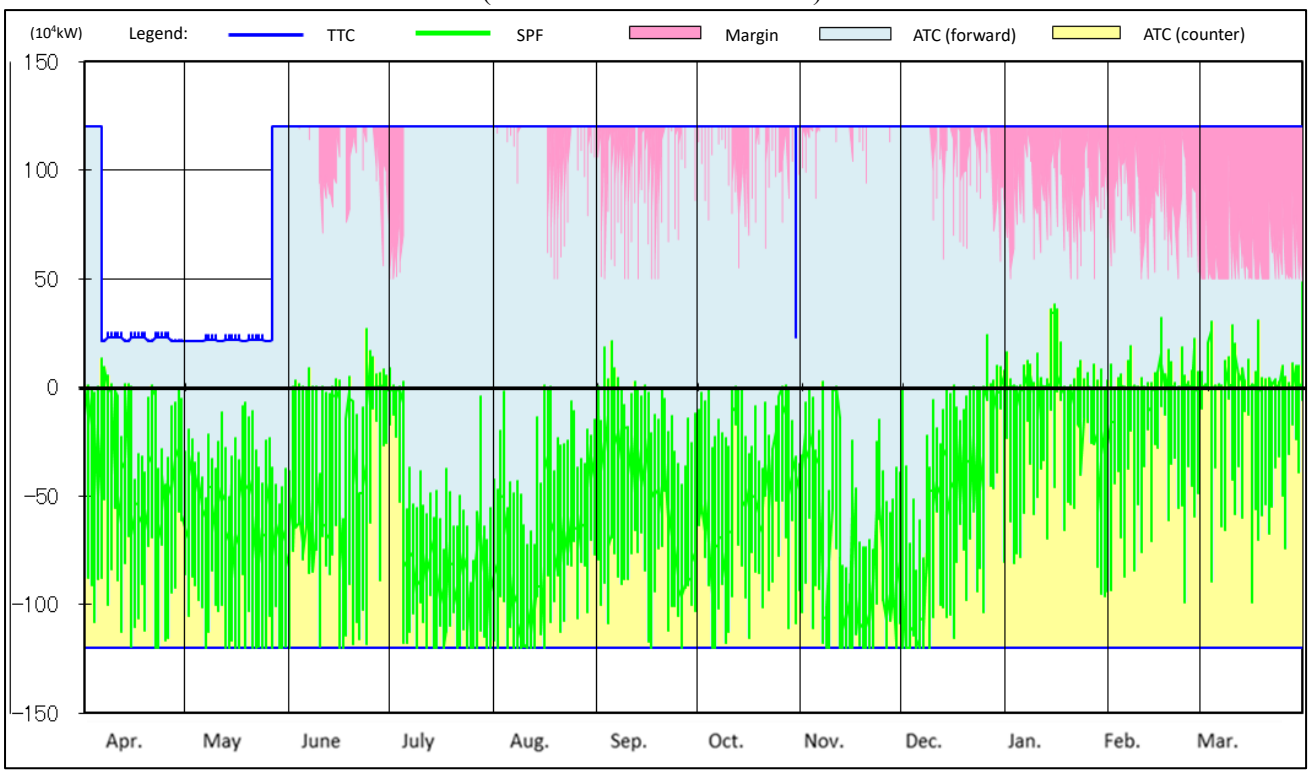
Figure 2-19: Actual ATC of Interconnection Facilities between Kansai and Shikoku
(Interconnection facilities between Kihoku and Anan AC/DC C.S.)



Note: Kansai to Shikoku as forward (positive) flow, Shikoku to Kansai as counter (negative) flow.

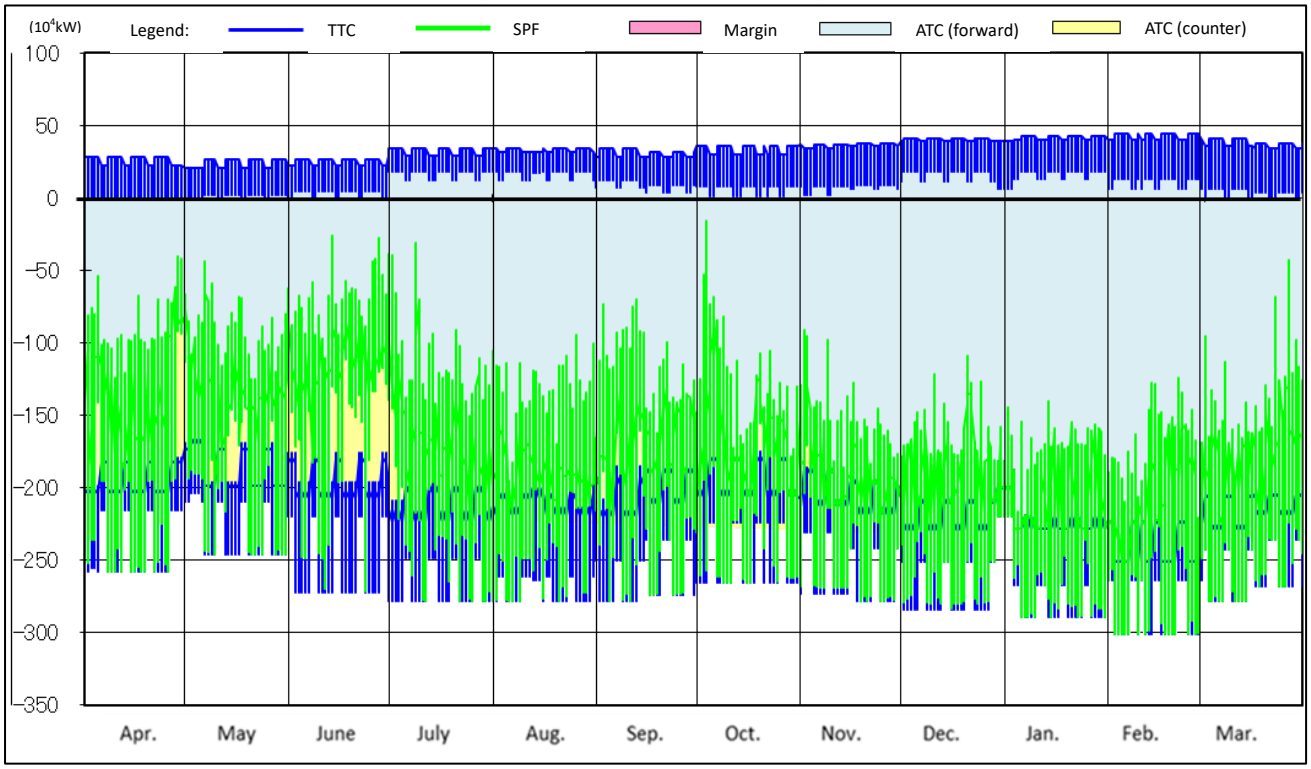
* ATC on forward flow is calculated and chosen from the smaller value from the following.
・TTC－transfer margin－SPF.
・TTC of Minami Awa Bulk Line－(Supply Capacity of Tachibanawan Thermal Power Station－SPF of Anan-Kihoku DC Bulk Line).

Figure 2-20: Actual ATC of the Interconnection Line between Chugoku and Shikoku
(Honshi Interconnection Line)



Note: Chugoku to Shikoku as forward (positive) flow, Shikoku to Chugoku as counter (negative) flow.

Figure 2-21: Actual ATC of the Interconnection Line between Chugoku and Kyushu
(Kanmon Interconnection Line)



Note: Chugoku to Kyushu as forward (positive) flow, Kyushu to Chugoku as counter (negative) flow.

8. Actual Constraints on Cross-regional Interconnection Lines Nationwide

For the constraints on each regional service area of the 10 GT&D, 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:
http://www.rikuden.co.jp/nw_notification/U_154seiyaku.html#akiyouryu
Kansai Transmission and Distribution, Inc.:
https://www.kansai-td.co.jp/consignment/disclosure/distribution-equipment/index.html
Chugoku Electric Power Transmission & Distribution Company, Incorporated:
https://www.energia.co.jp/nw/service/retailer/keitou/access/
Shikoku Electric Power Transmission & Distribution Company, Incorporated:
https://www.yonden.co.jp/nw/line_access/index.html
Kyushu Electric Power Transmission & Distribution Co., Inc.:
https://www.kyuden.co.jp/td_service_wheeling_rule-document_disclosure
The Okinawa Electric Power Company Incorporated:
http://www.okiden.co.jp/business-support/service/rule/plan/index.html

CONCLUSION

Actual Electricity Supply–Demand

For actual electricity supply–demand, data on the peak demand, electric energy requirement, load factor, and supply–demand status during the peak demand period and the bottom demand period, and peak daily energy supply are collected. In addition, instructions concerning power exchange according to the provisions of paragraph 1 of Article 28-44 of the Electricity Business Act, and 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 are aggregated.

Actual Utilization of Cross-regional Interconnection Lines

For 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 are collected.

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