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

Actual Data for Fiscal Year 2018

September 2019

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

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 2018 (FY 2018).

SUMMARY

This report is presented to review the outlook of electricity supply–demand and cross-regional interconnection lines in FY 2018, 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, 164,820 MW, was recorded in August, and the monthly electric energy requirement nationwide, 86,276 GWh, was recorded in July due to a severe heat wave across all of Japan.

The reserve margin against summer and winter peak demand was 13.8% and 10.3%, respectively.

Power exchange instructions were issued by the Organization 25 times; 16 of them were dispatched for improvements of supply and demand due to the Hokkaido Eastern Iburi Earthquake.
In addition, long-cycle frequency control was requested for the first time on September 30, and implemented 56 times during the year in the Kyushu EPCO service area.

There were 116 requests to shed power generation of renewables in FY 2018, which occurred on isolated islands as well as on the Kyushu mainland.

The total volume of the utilization of interconnection lines was 110,762 GWh, −21,633 GWh over FY 2017 owing to commercial operation of the New Hokkaido Honshu HVDC Link.

The total number of congestion management hours was 42,113 h, −3,245 h over FY 2017 due to the introduction of the implicit auction scheme for utilizing cross-regional interconnection lines.

The numbers and days of maintenance of interconnection lines totaled 205 times and 446 days, respectively in FY 2018.

We hope this report provides useful information.

CONTENTS

Note:
The text of the Operational Rules was obtained from the amended version of April 1, 2019.
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.

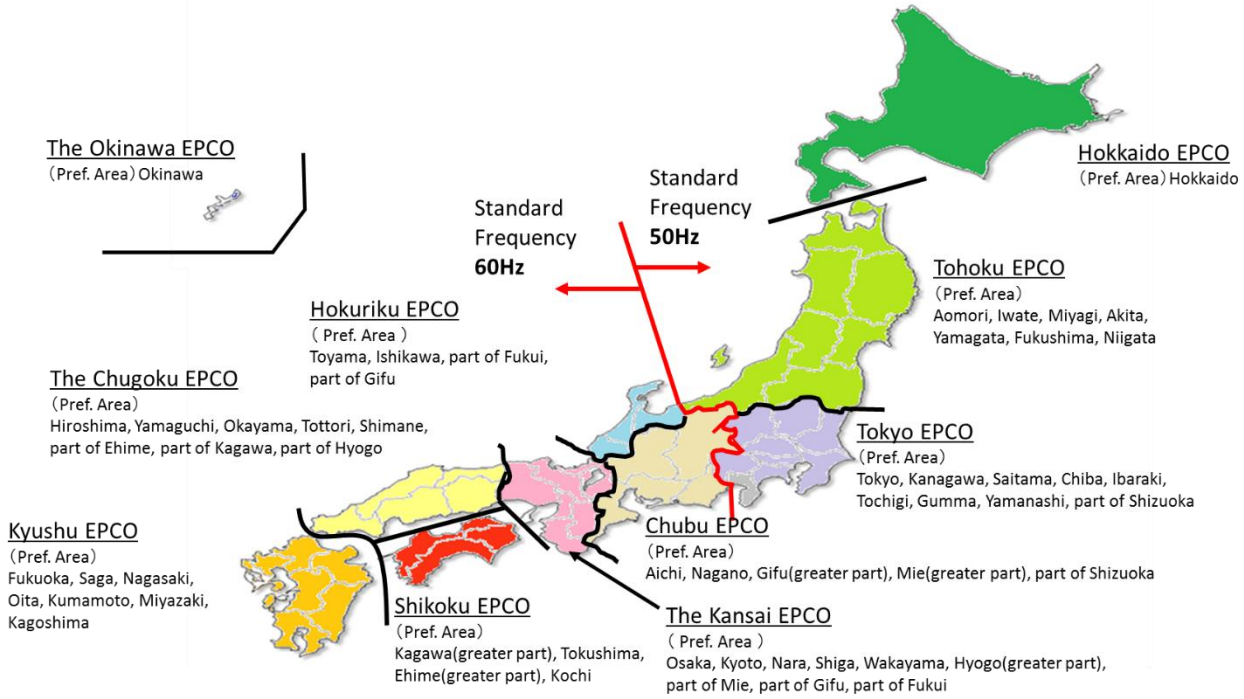

Figure 1-1: The 10 Regional Service Areas in Japan and their Prefectural Distribution

(2) The Definition of Seasons

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

2. Outlook of Actual Weather Nationwide

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

Table 1-1 shows anomalies in the temperature and precipitation ratios from June to August in FY 2018.

(a) Greater expansion of both the Pacific high-pressure system and the Tibetan high-pressure system brought more sunny and hot days, and the seasonal mean temperature in the eastern and western regions became significantly higher. In particular, the eastern region was +1.7 ˚C above the climatological normal, which represents the highest recorded mean temperature since the compilation of meteorological statistics began in 1946; in addition, 48 of 153 local meteorological stations in the county recorded the highest mean temperatures.

(b) The active seasonal stationary front and typhoon No. 7/2018 (Prapiroon) brought record-breaking heavy rain to wide areas across the country; especially in the western region, the heavy rainfall led to a major disaster referred to as the "Heavy Rain Event of July 2018." In addition to this disaster, typhoons and the seasonal stationary front brought heavy rainfalls across the entire country.

(c) Rainfall during the period was significant on the Japan Sea coast along the northern region due to the early summer stationary front and the autumnal stationary front, as well as in on the Pacific Sea coast along the western region and the Okinawa/Amami region, which experienced record-breaking heavy rainfalls due to typhoons and the stationary front. In particular, the Okinawa/Amami region recorded the highest rainfall since compilation of meteorological statistics began in 1946.

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

Weather Region	Mean Temperature Anomaly[℃]	Precipitation Ratio[%]
Northern	+0.6	+43
Eastern	+1.7	-7
Western	+1.1	+16
Okinawa/Amami	±0.0	+77

Source: Japan Meteorological Agency (JMA), Tokyo Climate Center.
Seasonal Climate Report over Japan for Summer (FY 2018).
http://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=8&year=2018
http://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=8&year=2018
* JMA defines the summer period as June to August.

(2) Weather during the Winter Period (December 2018 to February 2019)

Table 1-2 shows the anomalies in temperature and the ratios of rainfall and snowfall from December to February in FY 2018.

(a) Seasonal mean temperatures were very high throughout the nation except in the northern region due to a mild winter. In particular, the mean temperature in the Okinawa/Amami region was +1.8 ˚C above the climatological normal, which represents the highest recorded mean temperature.

(b) Precipitation during the period was quite scarce on the Pacific Sea coast along the northern region and scarce in the northern and eastern regions due to the mild effect of a low pressure system and wet air flows. In contrast, the Okinawa/Amami region had much rain due to warm and wet air flows.

(c) Snowfall during the period was very scarce on the Japan Sea coast along the northern, eastern, and western regions. In particular, the Japan Sea coast along the western region experienced record-breaking low snowfall.

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

Weather Region	Mean Temperature Anomaly[℃]	Precipitation Ratio[%]	Snowfall Ratio[%]
Northern	+0.4	-24	-36
Eastern	+1.1	-26	-74
Western	+1.3	+4	-89
Okinawa/Amami	+1.8	+19	-

Source: Japan Meteorological Agency, Tokyo Climate Center.
Seasonal Climate Report over Japan for Winter (FY 2018).
http://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=2&year=2019
http://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=2&year=2019

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 2018. 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.

Table 1-3: Monthly Peak Demand for Regional Service Areas[1]

[10^4kW]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	407	362	364	442	416	383	396	447	504	517	542	431
Tohoku	1,049	1,014	1,178	1,357	1,426	1,173	1,034	1,143	1,303	1,367	1,361	1,185
Tokyo	3,638	3,971	4,727	5,653	5,614	4,766	4,123	3,824	4,702	4,918	4,868	4,303
Chubu	1,777	1,936	2,130	2,607	2,622	2,248	1,911	1,833	2,148	2,345	2,230	2,034
Hokuriku	404	395	440	517	521	455	375	399	468	494	503	433
Kansai	1,831	1,993	2,315	2,865	2,801	2,400	1,932	1,904	2,231	2,432	2,346	2,084
Chugoku	772	769	875	1,106	1,086	960	787	818	971	999	964	852
Shikoku	332	354	426	536	525	443	368	359	422	448	426	395
Kyushu	1,085	1,145	1,273	1,601	1,588	1,394	1,156	1,129	1,319	1,336	1,311	1,166
Okinawa	104	131	150	144	145	151	114	106	115	96	94	95
Nationwide	10,969	**11,967**	**13,584**	**16,432**	**16,482**	**13,871**	**11,541**	**11,819**	**13,768**	**14,603**	**14,417**	**12,457**

[1] "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.

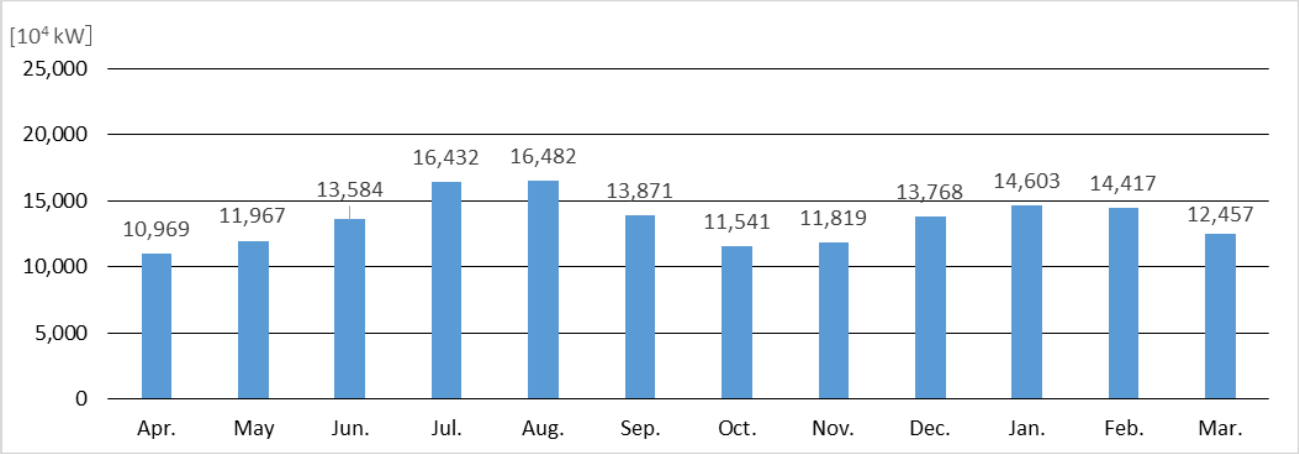

Figure 1-2: Nationwide Monthly Peak Demand

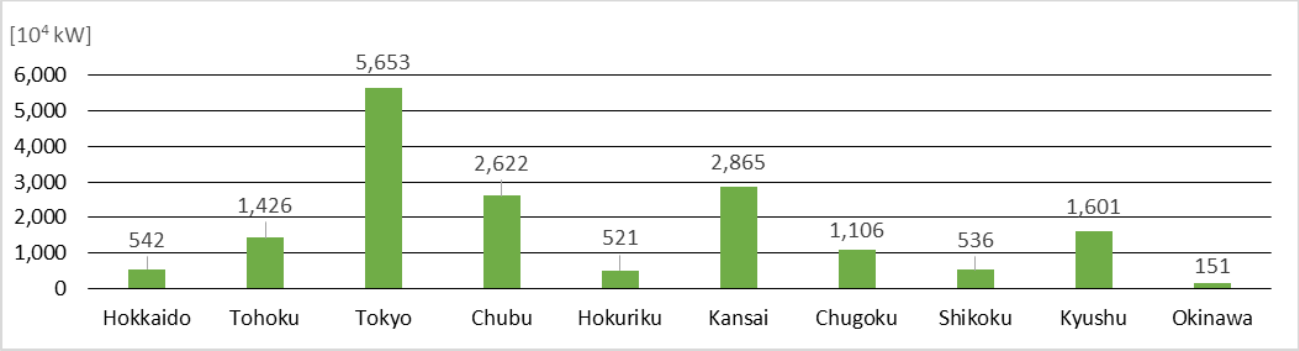

Figure 1-3: Annual Peak Demand for Regional Service Areas

4. Actual Nationwide Electric Energy Requirements

Table 1-4 shows the monthly electric energy requirements for regional service areas in FY 2018. 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[2]

[GWh]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido	2,383	2,276	2,195	2,396	2,368	2,051	2,314	2,532	3,146	3,246	2,914	2,762	30,583
Tohoku	6,240	6,109	6,233	7,235	6,963	6,093	6,311	6,645	7,906	8,369	7,434	7,250	82,787
Tokyo	20,762	21,348	22,570	28,795	28,083	22,928	22,040	21,700	25,794	27,320	24,290	23,758	289,387
Chubu	9,947	10,053	10,753	13,143	12,782	10,922	10,611	10,487	11,837	12,537	11,375	11,509	135,957
Hokuriku	2,263	2,200	2,268	2,739	2,648	2,267	2,303	2,377	2,763	2,914	2,618	2,592	29,953
Kansai	10,514	11,000	11,299	14,331	14,187	11,462	10,872	11,015	12,668	13,465	12,084	12,100	144,997
Chugoku	4,501	4,458	4,665	5,735	5,840	4,818	4,688	4,795	5,530	5,775	5,183	5,084	61,073
Shikoku	1,994	2,033	2,134	2,640	2,668	2,199	2,110	2,086	2,414	2,538	2,272	2,294	27,382
Kyushu	6,283	6,506	6,827	8,450	8,702	7,001	6,466	6,572	7,663	7,905	6,991	7,064	86,431
Okinawa	571	692	780	811	836	784	631	587	590	567	519	556	7,924
Nationwide	65,458	**66,677**	**69,723**	**86,276**	**85,076**	**70,524**	**68,345**	**68,795**	**80,311**	**84,636**	**75,681**	**74,970**	**896,473**

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

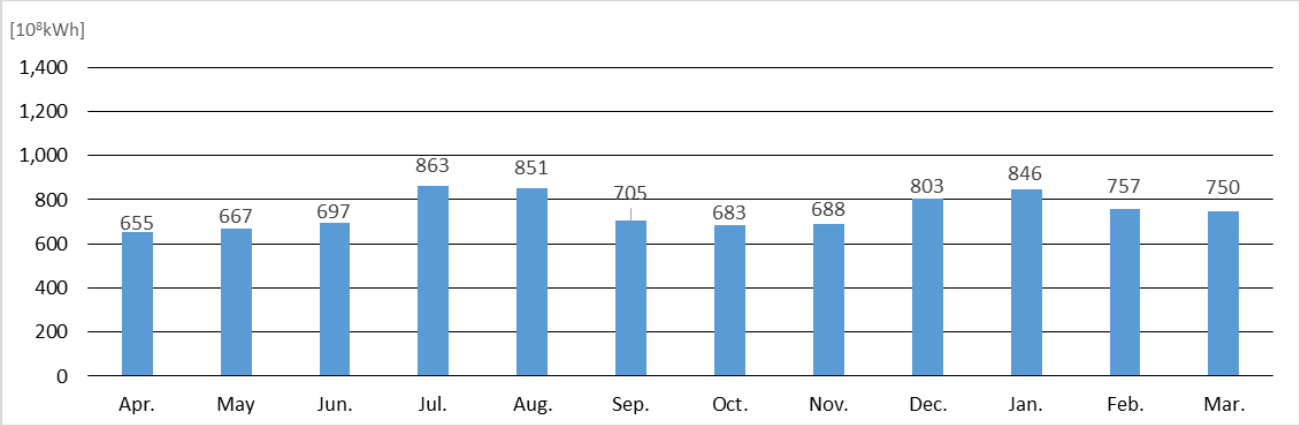

Figure 1-4: Nationwide Monthly Electric Energy Requirements

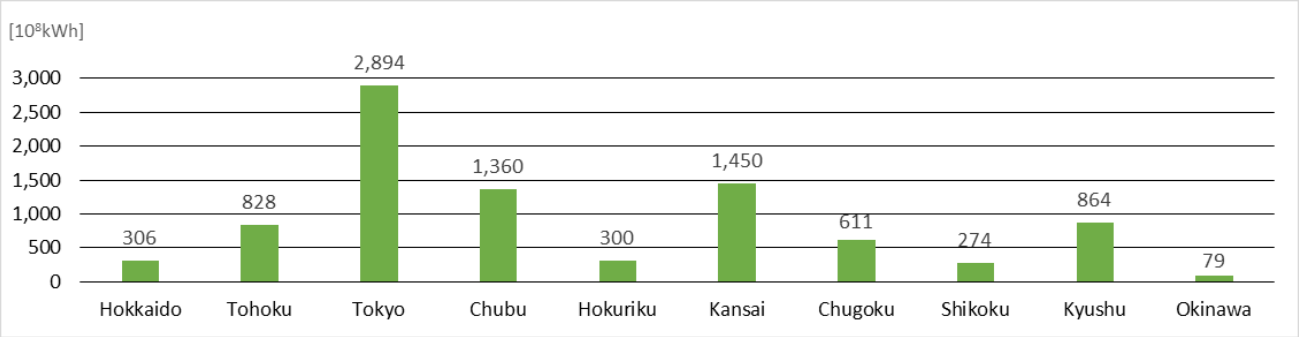

Figure 1-5: Annual Electric Energy Requirements for Regional Service Areas

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 2018, 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[3]

[%]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	**Annual**
Hokkaido	81.4	84.5	83.7	72.8	76.4	80.0	78.5	78.7	83.9	84.4	80.0	86.2	**65.0**
Tohoku	82.6	80.9	73.5	71.7	65.6	72.1	82.1	80.8	81.6	82.3	81.3	82.2	**66.3**
Tokyo	79.3	72.3	66.3	68.5	67.2	66.8	71.8	78.8	73.7	74.7	74.3	74.2	**58.4**
Chubu	77.7	69.8	70.1	67.8	65.5	67.5	74.6	79.4	74.1	71.9	75.9	76.0	**59.2**
Hokuriku	77.8	74.9	71.5	71.2	68.3	69.2	82.5	82.7	79.4	79.2	77.4	80.5	**65.6**
Kansai	79.8	74.2	67.8	67.2	68.1	66.3	75.7	80.3	76.3	74.4	76.7	78.0	**57.8**
Chugoku	81.0	77.9	74.1	69.7	72.3	69.7	80.1	81.5	76.6	77.7	80.0	80.2	**63.1**
Shikoku	83.5	77.1	69.6	66.2	68.3	68.9	77.1	80.6	77.0	76.1	79.4	78.0	**58.3**
Kyushu	80.4	76.4	74.5	70.9	73.7	69.8	75.2	80.8	78.1	79.6	79.3	81.4	**61.6**
Okinawa	76.3	71.2	72.4	75.5	77.3	72.3	74.1	77.2	68.9	79.5	81.9	78.5	**60.1**
Nationwide	**82.9**	**74.9**	**71.3**	**70.6**	**69.4**	**70.8**	**79.6**	**80.8**	**78.4**	**77.9**	**78.1**	**80.9**	**62.1**

The load factors in Hokkaido and Nationwide exclude the period of "energy saving to the maximum extent possible" (September 6–19) after Hokkaido Eastern Iburi Earthquake.[4]

For reference, the load factors that include the above period are:

September: 74.3% in Hokkaido, 70.6% in Nationwide.

Annual: 64.4% in Hokkaido, 62.1% in Nationwide.

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

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

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

[4] Energy saving in Hokkaido moved from "energy saving to the maximum extent possible" to "energy saving as far as is reasonable" after September 20, when Unit #1 of the Tomato-Atsuma Thermal Power Plant confirmed its operation at nameplate-rated capacity. See the press release "Effort to save energy in Hokkaido" by the Agency of Natural Resources and Energy, published on September 21, 2018 (in Japanese only).

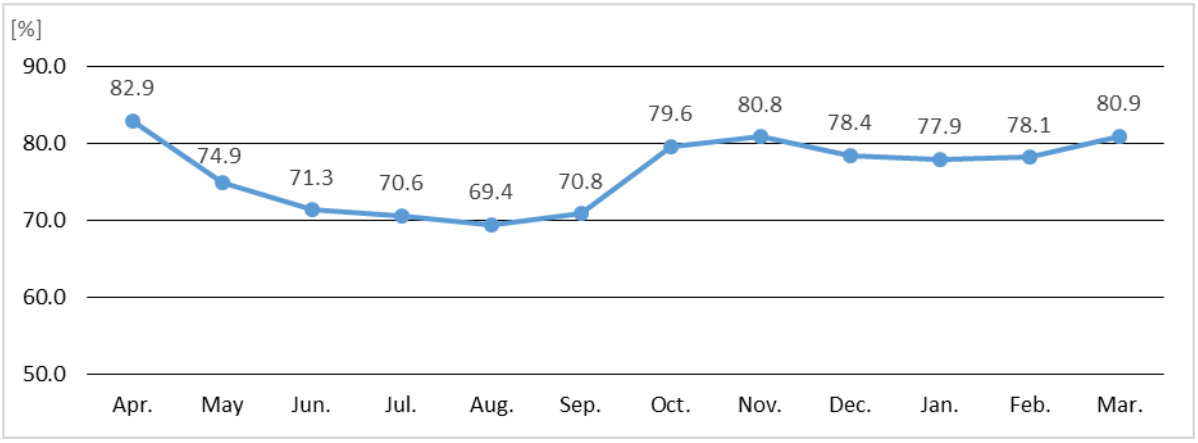

Figure 1-6: Nationwide Monthly Load Factor

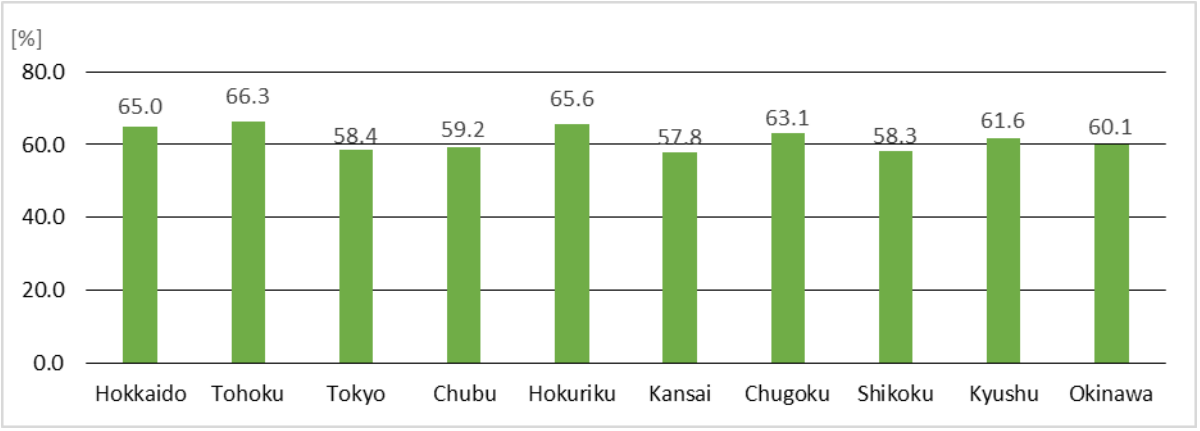

Figure 1-7: Annual Load Factor for Regional Service Areas

6. Nationwide Supply–Demand Status during Peak Demand

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

Table 1-6 shows the supply–demand status during the summer peak demand period for regional service areas in FY 2018.

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 [℃]	Supply Capacity [10^4kW]	Reserve Capacity [10^4kW]	Reserve Margin [%]	Daily Energy Supply [10^4kWh]	Daily Load Facter [%]
Hokkaido	442	7/31	Tue.	17	33.9	561	118	26.8	8,779	82.7%
Tohoku	1,426	8/23	Thur.	15	34.3	1,691	265	18.6	27,301	79.8%
Tokyo	5,653	7/23	Mon.	15	39.0	6,091	438	7.7	107,220	79.0%
Chubu	2,622	8/6	Mon.	15	39.4	2,847	225	8.6	48,120	76.5%
Hokuriku	521	8/22	Wed.	15	39.5	574	53	10.2	10,048	80.4%
Kansai	2,865	7/19	Thur.	17	38.0	3,018	153	5.3	54,187	78.8%
Chugoku	1,106	7/23	Mon.	17	35.4	1,228	122	11.0	20,855	78.6%
Shikoku	536	7/24	Tue.	17	37.7	583	46	8.6	9,820	76.3%
Kyushu	1,601	7/26	Thur.	15	35.3	1,928	327	20.4	31,402	81.7%
Okinawa	151	9/21	Fri.	12	32.1	204	53	35.2	2,900	80.2%
Nationwide	**16,482**	**8/3**	**Fri.**	**15**	-	**18,749**	**2,267**	**13.8**	**315,434**	**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–February)

Table 1-7 shows the supply–demand status during the winter peak demand period for regional service areas in FY 2018.

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	542	2/8	Fri.	10	-11.5	600	58	10.7	12,193	93.7%
Tohoku	1,367	1/24	Thur.	18	0.3	1,616	248	18.2	29,905	91.1%
Tokyo	4,918	1/10	Thur.	19	2.0	5,212	294	6.0	102,477	86.8%
Chubu	2,345	1/10	Thur.	10	1.8	2,440	96	4.1	48,097	85.5%
Hokuriku	503	2/1	Fri.	10	1.2	601	97	19.3	10,700	88.6%
Kansai	2,432	1/10	Thur.	10	4.8	2,536	104	4.3	49,708	85.2%
Chugoku	999	1/10	Thur.	10	4.6	1,065	67	6.7	20,873	87.1%
Shikoku	448	1/10	Thur.	10	5.6	475	26	5.9	9,166	85.2%
Kyushu	1,336	1/17	Thur.	19	6.1	1,451	115	8.6	28,243	88.1%
Okinawa	115	12/4	Tue.	14	24.8	150	35	30.1	2,222	80.4%
Nationwide	**14,603**	**1/10**	**Thur.**	**10**	-	**16,104**	**1,501**	**10.3**	**308,436**	**88.0%**

7. Nationwide Bottom Demand Period

Table 1-8 shows the status of the bottom demand period for regional service areas (FY 2018).

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 (excl. occurrence of earthquake)	246	6/10	Sun.	8	12.5	64,812
Tohoku	632	5/6	Sun.	1	18.1	16,986
Tokyo	1,984	5/6	Sun.	7	21.0	57,874
Chubu	880	5/4	Fri.	2	15.6	23,701
Hokuriku	208	5/6	Sun.	1	19.2	5,590
Kansai	1,053	5/6	Sun.	8	19.3	29,372
Chugoku	439	5/6	Sun.	1	15.7	12,254
Shikoku	195	5/6	Sun.	8	16.7	5,491
Kyushu	653	5/6	Sun.	1	18.2	18,309
Okinawa	45	9/30	Sun.	3	26.3	1,620
Nationwide	**6,496**	**5/6**	**Sun.**	**2**	-	**179,863**

Data for Hokkaido exclude the period during "energy saving to the maximum extent possible" after the Hokkaido Eastern Iburi Earthquake.

[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 2018 (July–September) and the winter peak daily energy supply for regional service areas in FY 2018 (December–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	8,779	7/31	Tue.	27.9
Tohoku	27,301	8/23	Thur.	28.3
Tokyo	107,652	8/2	Thur.	31.2
Chubu	49,618	7/18	Wed.	32.0
Hokuriku	10,084	8/2	Thur.	30.3
Kansai	54,187	7/19	Thur.	31.9
Chugoku	21,341	7/24	Tue.	32.0
Shikoku	10,110	7/24	Tue.	32.6
Kyushu	31,402	7/26	Thur.	31.0
Okinawa	2,932	7/31	Tue.	29.3
Nationwide	**316,457**	**7/24**	Tue.	-

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	12,193	2/8	Fri.	-11.5
Tohoku	29,931	2/8	Fri.	-0.4
Tokyo	102,477	1/10	Thur.	2.0
Chubu	48,097	1/10	Thur.	1.8
Hokuriku	10,759	2/14	Thur.	0.9
Kansai	49,708	1/10	Thur.	4.8
Chugoku	20,873	1/10	Thur.	4.6
Shikoku	9,175	2/15	Fri.	4.3
Kyushu	28,243	1/17	Thur.	6.1
Okinawa	2,222	12/4	Tue.	24.8
Nationwide	**308,436**	**1/10**	Thur.	-

[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 2018, the Organization required EPCOs 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] on September 30, 2018 for the first time.[11] It was implemented to send surplus electric energy generated from renewable energy-generating facilities in the Kyushu EPCO area to the areas eastward of the Chugoku EPCO 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. Such controls were implemented 56 times in total during FY 2018.

[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] http://www.occto.or.jp/oshirase/sonotaoshirase/2018/181001_sagechouseiryoku_yousei.html (in Japanese only).

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

[1]	Date	July 18, 2018 at 15:41
	Instruction	・TEPCO PG shall supply 70 MW of electricity to the Kansai EPCO from 16:00 till 17:00 on July 18. ・Chubu EPCO shall supply 500 MW of electricity to the Kansai EPCO from 16:00 till 17:00 on July 18. ・Chubu EPCO shall supply 100 MW of electricity to the Kansai EPCO from 16:00 till 17:00 on July 18. ・The Chugoku EPCO shall supply 200 MW of electricity to Kansai EPCO from 16:00 till 17:00 on July 18. ・Shikoku EPCO shall supply 130 MW of electricity to the Kansai EPCO from 16:00 till 17:00 on July 18. ・The Kansai EPCO shall be supplied 1,000 MW of electricity by TEPCO PG, Chubu, Hokuriku, Chugoku and Shikoku EPCO from 16:00 till 17:00 on July 18.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of unexpected demand growth caused by higher temperature.
[2]	Date	September 7, 2018 at 4:44
	Instruction	・Tohoku EPCO shall supply 300 MW of electricity at most to Hokkaido EPCO from 5:30 till 24:00 on September 7. ・TEPCO PG shall supply 100 MW of electricity to Hokkaido EPCO from 15:00 till 17:00 and 22:00 till 24:00, respectively on September 7. ・Hokkaido EPCO shall be supplied 300 MW of electricity at most by Tohoku EPCO, and TEPCO PG from 5:30 till 24:00 on September 7.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[3]	Date	September 7, 2018 at 19:54
	Instruction	・TEPCO PG shall supply 280 MW of electricity at most to Hokkaido EPCO from 21:00 till 24:00 on September 7. ・Hokkaido EPCO shall be supplied 280 MW of electricity at most by TEPCO PG from 21:00 till 24:00 on September 7.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[4]	Date	September 7, 2018 at 22:36
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity to Hokkaido EPCO from 0:00 till 24:00 on September 8. ・TEPCO PG shall supply 400 MW of electricity to Hokkaido EPCO from 0:00 till 24:00 on September 8. ・Hokkaido EPCO shall be supplied 600 MW of electricity by Tohoku EPCO and TEPCO PG from 0:00 till 24:00 on September 8.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.

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

[5]	Date	September 8, 2018 at 20:31
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity to Hokkaido EPCO from 0:00 till 24:00 on September 9. ・TEPCO PG shall supply 400 MW of electricity to Hokkaido EPCO from 0:00 till 24:00 on September 9. ・Hokkaido EPCO shall be supplied 600 MW of electricity by Tohoku EPCO and TEPCO PG from 0:00 till 24:00 on September 9.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[6]	Date	September 9, 2018 at 19:45
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 0:00 till 24:00 on September 10. ・TEPCO PG shall supply 400 MW of electricity at most to Hokkaido EPCO from 0:00 till 24:00 on September 10. ・Hokkaido EPCO shall be supplied 600 MW of electricity at most by Tohoku EPCO and TEPCO PG from 0:00 till 24:00 on September 10.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[7]	Date	September 10, 2018 at 22:20
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 0:00 till 24:00 on September 11. ・TEPCO PG shall supply 400 MW of electricity at most to Hokkaido EPCO from 7:00 till 23:00 on September 11. ・Hokkaido EPCO shall be supplied 600 MW of electricity at most by Tohoku EPCO and TEPCO PG from 0:00 till 24:00 on September 11.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[8]	Date	September 11, 2018 at 19:18
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 3:00 till 24:00 on September 12. ・TEPCO PG shall supply 200 MW of electricity at most to Hokkaido EPCO from 3:00 till 23:00 on September 12. ・Hokkaido EPCO shall be supplied 400 MW of electricity at most by Tohoku EPCO and TEPCO PG from 3:00 till 24:00 on September 12.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.

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

[9]	Date	September 12, 2018 at 19:26
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 0:00 till 24:00 on September 13. ・TEPCO PG shall supply 100 MW of electricity at most to Hokkaido EPCO from 0:00 till 24:00 on September 13. ・Hokkaido EPCO shall be supplied 300 MW of electricity at most by Tohoku EPCO and TEPCO PG from 0:00 till 24:00 on September 13.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[10]	Date	September 13, 2018 at 21:02
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 0:00 till 24:00 on September 14. ・TEPCO PG shall supply 100 MW of electricity at most to Hokkaido EPCO from 14:00 till 22:00 on September 14. ・Hokkaido EPCO shall be supplied 300 MW of electricity at most by Tohoku EPCO and TEPCO PG from 0:00 till 24:00 on September 14.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[11]	Date	September 14, 2018 at 21:20
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 0:00 till 24:00 on September 15. ・TEPCO PG shall supply 100 MW of electricity at most to Hokkaido EPCO from 14:00 till 21:00 on September 15. ・Hokkaido EPCO shall be supplied 300 MW of electricity at most by Tohoku EPCO and TEPCO PG from 0:00 till 24:00 on September 15.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[12]	Date	September 15, 2018 at 18:30
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 0:00 till 24:00 on September 16. ・TEPCO PG shall supply 50 MW of electricity at most to Hokkaido EPCO from 16:00 till 23:00 on September 16. ・Hokkaido EPCO shall be supplied 250 MW of electricity at most by Tohoku EPCO and TEPCO PG from 0:00 till 24:00 on September 16.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[13]	Date	September 16, 2018 at 19:07
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 0:00 till 24:00 on September 17. ・TEPCO PG shall supply 100 MW of electricity at most to Hokkaido EPCO from 15:00 till 22:00 on September 17. ・Hokkaido EPCO shall be supplied 300 MW of electricity at most by Tohoku EPCO and TEPCO PG from 0:00 till 24:00 on September 17.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.

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

[14]	Date	September 17, 2018 at 18:47
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 0:00 till 24:00 on September 18. ・Hokkaido EPCO shall be supplied 200 MW of electricity at most by Tohoku EPCO from 0:00 till 24:00 on September 18.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[15]	Date	September 18, 2018 at 19:52
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 16:00 till 22:00 on September 19. ・Hokkaido EPCO shall be supplied 200 MW of electricity at most by Tohoku EPCO from 16:00 till 22:00 on September 19.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[16]	Date	September 19, 2018 at 19:50
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 16:00 till 22:00 on September 20. ・Hokkaido EPCO shall be supplied 200 MW of electricity at most by Tohoku EPCO from 16:00 till 22:00 on September 20.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[17]	Date	September 20, 2018 at 18:49
	Instruction	・Tohoku EPCO shall supply 200 MW of electricity at most to Hokkaido EPCO from 16:00 till 22:00 on September 21 ・Hokkaido EPCO shall be supplied 200 MW of electricity at most by Tohoku EPCO from 16:00 till 22:00 on September 21.
	Background	To increase supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.
[18] & [19]	Date	October 17, 2018 at 15:38 and 19:30
	Instruction	At 15:38 ・The Kansai EPCO shall supply 600 MW of electricity at most to Shikoku EPCO from 16:30 till 21:00 on October 17. ・Shikoku EPCO shall be supplied 600 MW of electricity at most by the Kansai EPCO from 16:30 till 21:00 on October 17. At 19:30 ・The Kansai EPCO shall supply 600 MW of electricity at most to Shikoku EPCO from 21:00 till 24:00 on October 17. ・Shikoku EPCO shall be supplied 600 MW of electricity at most by the Kansai EPCO from 21:00 till 24:00 on October 17.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of generator shutdown.

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

[20] & [21]	Date	October 17, 2018 at 22:43 and October 18, 2018 at 10:39
	Instruction	At 15:38 ・The Kansai EPCO shall supply 700 MW of electricity at most to Shikoku EPCO from 00:00 till 12:00 on October 18. ・Shikoku EPCO shall be supplied 700 MW of electricity at most by the Kansai EPCO from 00:00 till 12:00 on October 18. At 10:39 ・The Kansai EPCO shall supply 700 MW of electricity at most to Shikoku EPCO from 12:00 till 23:00 on October 18. ・Shikoku EPCO shall be supplied 700 MW of electricity at most by the Kansai EPCO from 12:00 till 23:00 on October 18.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of generator shutdown.
[22]	Date	January 10, 2019 at 8:41
	Instruction	・Tohoku EPCO shall supply 300 MW of electricity to Chubu EPCO from 9:00 till 10:00 on January 10. ・TEPCO PG shall supply 1,000 MW of electricity at most to Chubu EPCO from 9:00 till 12:00 on January 10. ・Hokuriku EPCO shall supply 50 MW of electricity to Chubu EPCO from 9:00 till 12:00 on January 10. ・Chubu EPCO shall be supplied 1,050 MW of electricity by Tohoku EPCO, TEPCO PG, and Hokuriku EPCO from 9:00 till 12:00 on January 10.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of demand growth and decreased solar power output due to bad weather.
[23] [24] & [25]	Date	January 10, 2019 at 12:50, 13:04, and 13:41
	Instruction	At 12:50 ・The Chugoku EPCO shall supply 200 MW of electricity to Chubu EPCO from 13:00 till 13:30 on January 10. ・Chubu EPCO shall be supplied 200 MW of electricity by the Chugoku EPCO from 13:00 till 13:30 on January 10. At 13:04 ・The Chugoku EPCO shall supply 200 MW of electricity to Chubu EPCO from 13:30 till 14:00 on January 10. ・Shikoku EPCO shall supply 300 MW of electricity to Chubu EPCO from 13:30 till 14:00 on January 10. ・Chubu EPCO shall be supplied 500 MW of electricity by the Chugoku, and Shikoku EPCO from 13:30 till 14:00 on January 10. At 13:41 ・Hokkaido EPCO shall supply 100 MW of electricity to Chubu EPCO from 14:00 till 20:00 on January 10. ・Tohoku EPCO shall supply 200 MW of electricity to Chubu EPCO from 17:00 till 20:00 on January 10. ・TEPCO PG shall supply 500 MW of electricity to Chubu EPCO from 14:00 till 20:00 on January 10. ・Hokuriku EPCO shall supply 100 MW of electricity to Chubu EPCO from 14:00 till 20:00 on January 10. ・The Chugoku EPCO shall supply 200 MW of electricity to Chubu EPCO from 14:00 till 17:00 on January 10. ・Shikoku EPCO shall supply 150 MW of electricity at most to Chubu EPCO from 14:00 till 16:00 on January 10. ・Kyushu EPCO shall supply 150 MW of electricity at most to Chubu EPCO from 14:30 till 20:00 on January 10. ・Chubu EPCO shall be supplied 1,050 MW of electricity by Tohoku EPCO, TEPCO PG, Hokuriku, the Chugoku, Shikoku, and Kyushu EPCO from 14:00 till 20:00 on January 10.
	Background	The supply–demand status may degrade without power exchanges through cross-regional interconnection lines because of demand growth and decreased solar power output due to bad weather.

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 2018.[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[13] might become insufficient; the shedding period was from 09:00 to 16:00 in each implementation.

Table 1-12: Actual Output Shedding of Renewable Energy-generating Facilities (April 2018)

Date	Location & Shed Capacity			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
4/1/(Sun)	120	120	-	-
4/2/(Mon)	570	-	-	-
4/3/(Tue)	1,650	-	-	-
4/5/(Thu)	1,160	-	-	-
4/8/(Sun)	1,610	650	-	-
4/9/(Mon)	1,790	-	-	-
4/10/(Tue)	1,580	420	-	-
4/11/(Wed)	840	-	-	-
4/13/(Fri)	2,470	-	-	-
4/15/(Sun)	640	900	-	-
4/16/(Mon)	2,170	-	-	-
4/18/(Wed)	2,510	120	-	-
4/19/(Thu)	3,250	1,220	-	-
4/20/(Fri)	3,560	450	-	-
4/21/(Sat)	3,630	710	-	-
4/22/(Sun)	1,490	-	-	-
4/25/(Wed)	650	-	-	-
4/27/(Fri)	1,490	-	-	-
4/28/(Sat)	4,120	1,160	-	-
4/29/(Sun)	2,570	760	-	-

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

[13] 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."

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Table 1-13: Actual Output Shedding of Renewable Energy-generating Facilities (May 2018)

Date	Location & Shed Capacity			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
5/3/(Thu)	120	1,440	-	-
5/4/(Fri)	3,320	1,450	-	-
5/5/(Sat)	1,140	960	-	-
5/10/(Thu)	2,710	270	-	-
5/11/(Fri)	2,860	-	-	-
5/12/(Sat)	1,520	-	-	-
5/13/(Sun)	500	-	-	-
5/14/(Mon)	2,450	420	-	-
5/15/(Tue)	400	-	-	-

Table 1-14: Actual Output Shedding of Renewable Energy-generating Facilities (June 2018)

Date	Location & Shed Capacity			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
6/2/(Sat)	760	-	-	-
6/12/(Tue)	370	-	-	-

Table 1-15: Actual Output Shedding of Renewable Energy-generating Facilities (October 2018)

Date	Location & Shed Capacity			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
10/13/(Sat)	-	-	-	42.7
10/14/(Sun)	-	-	-	61.8
10/18/(Thu)	210	-	-	-
10/20/(Sat)	-	-	-	70.3
10/21/(Sun)	780	-	-	117.6
10/27/(Sat)	610	-	-	-
10/28/(Sun)	200	-	-	-

Table 1-16: Actual Output Shedding of Renewable Energy-generating Facilities (November 2018)

Date	Location & Shed Capacity			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
11/3/(Sat)	-	-	-	55.1
11/4/(Sun)	-	680	-	120.7
11/10/(Sat)	-	-	-	63.4
11/11/(Sun)	-	-	-	100.2
11/20/(Tue)	700	-	-	-
11/23/(Fri)	400	-	-	-
11/25/(Sun)	410	-	-	-

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

Date	Location & Shed Capacity			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
1/3/(Thu)	1,190	-	-	63.1
1/14/(Mon)	530	-	-	-
1/18/(Fri)	910	-	-	-
1/21/(Mon)	470	-	-	-
1/23/(Wed)	810	-	-	-
1/24/(Thu)	1,540	-	-	-
1/25/(Fri)	100	-	-	-
1/27/(Sun)	1,290	-	-	-
1/29/(Tue)	160	-	-	-

Table 1-18: Actual Output Shedding of Renewable Energy-generating Facilities (February 2019)

Date	Location & Shed Capacity			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
2/2/(Sat)	490	-	-	-
2/4/(Mon)	520	-	-	-
2/6/(Wed)	780	-	-	-
2/24/(Sun)	-	-	-	138.4
2/26/(Tue)	1,880	-	-	-

Table 1-19: Actual Output Shedding of Renewable Energy-generating Facilities (March 2019)

Date	Location & Shed Capacity			
	Tanegashima (island: kW)	Iki (island: kW)	Tokunoshima (island: kW)	Kyushu (mainland: 10^4 kW)
3/1/(Fri)	2,860	-	-	-
3/2/(Sat)	-	-	-	110.6
3/5/(Tue)	2,300	-	-	78.6
3/8/(Fri)	2,290	-	-	124.3
3/11/(Mon)	2,770	-	-	52.7
3/12/(Tue)	2,690	-	-	121.3
3/13/(Wed)	2,890	-	370	104.7
3/14/(Thu)	720	-	-	-
3/15/(Fri)	-	-	-	37.4
3/16/(Sat)	3,520	-	-	125.6
3/17/(Sun)	4,050	750	-	179.8
3/18/(Mon)	780	-	-	-
3/19/(Tue)	-	410	-	-
3/20/(Wed)	1,910	-	-	98.2
3/23/(Sat)	620	-	-	144.4
3/24/(Sun)	4,370	830	-	194.0
3/26/(Tue)	4,120	-	-	132.1
3/27/(Wed)	4,360	-	240	102.4
3/30/(Sat)	-	-	-	75.4
3/31/(Sun)	2,730	340	410	183.2

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.

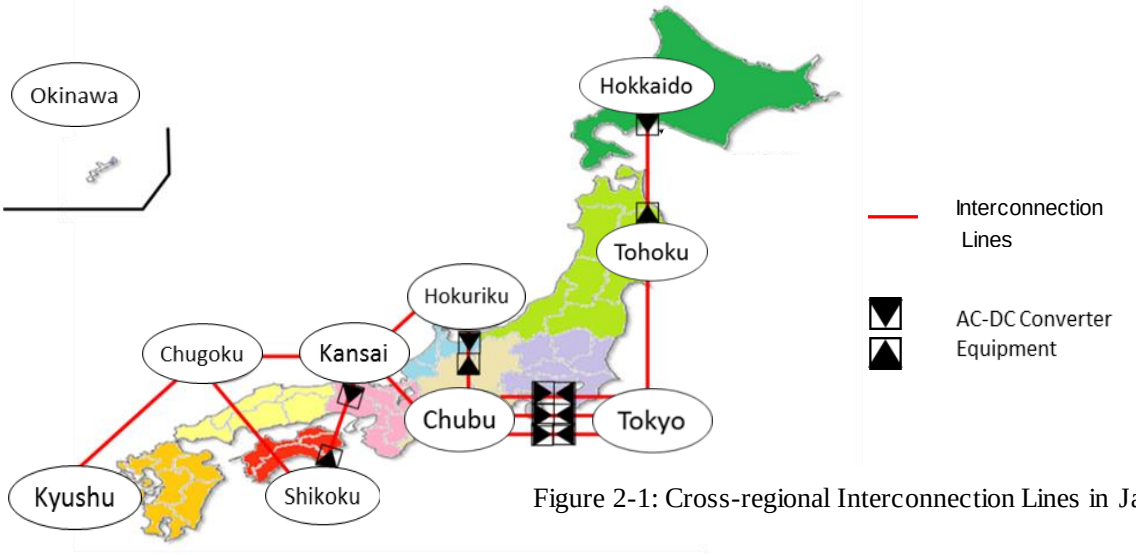

Figure 2-1: Cross-regional Interconnection Lines in Japan

Table 2-1: Summary of Cross-regional Interconnection Lines (at the end of FY 2018)

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 is the one that entirely allocates capabilities of the interconnection lines through the energy trading market, not directly allocating 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.

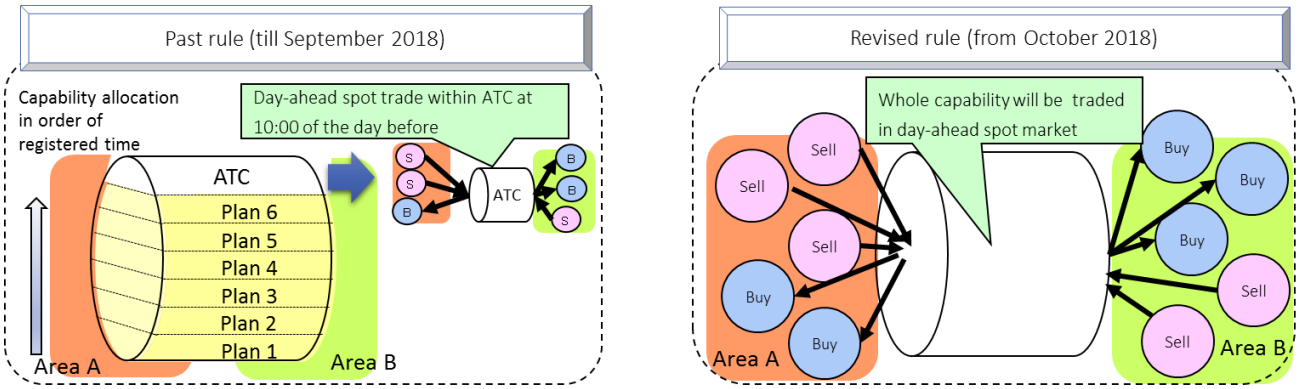


Figure 2-2: Management of Interconnection Lines

[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 2018

Table 2-2 and Figure 2-3 show the monthly utilization of cross-regional interconnection lines for regional service areas in FY 2018.

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)	3	2	3	52	62	6	0	0	0	1	0	1	130
	→Hokkaido (Counter)	79	53	63	69	78	101	66	71	107	110	99	109	1,005
Tohoku-Tokyo	→Tokyo (Forward)	2,294	2,330	2,372	3,143	3,217	2,430	1,679	1,641	1,899	2,237	2,215	1,840	27,298
	→Tohoku (Counter)	428	384	371	583	627	692	8	8	17	8	6	7	3,139
Tokyo-Chubu	→Chubu (Forward)	266	204	258	366	352	155	46	42	8	13	1	0	1,711
	→Tokyo (Counter)	435	376	476	598	627	539	233	208	407	450	404	364	5,116
Chubu-Kansai	→Kansai (Forward)	735	534	444	662	670	474	42	44	21	18	15	15	3,675
	→Chubu (Counter)	663	713	861	1,159	1,131	1,282	786	786	809	667	591	533	9,980
Chubu-Hokuriku	→Hokuriku (Forward)	49	10	26	38	12	0	0	0	0	0	0	0	134
	→Chubu (Counter)	17	17	12	14	6	5	0	0	0	1	1	2	76
Hokuriku - Kanasai	→Kansai (Forward)	263	334	111	311	317	523	70	8	10	17	2	67	2,033
	→Hokuriku (Counter)	117	90	198	132	160	126	249	383	277	347	363	99	2,540
Kansai-Chugoku	→Chugoku (Forward)	1,222	1,014	549	557	815	447	25	11	27	21	23	22	4,734
	→Kansai (Counter)	1,206	1,202	1,182	1,532	1,670	1,393	1,155	1,129	807	876	554	683	13,388
Kansai-Shikoku	→Shikoku (Forward)	17	46	0	1	1	0	17	0	0	0	0	0	82
	→Kansai (Counter)	450	476	475	588	967	939	796	893	971	960	885	441	8,840
Chugoku-Shikoku	→Shikoku (Forward)	364	318	413	525	549	385	6	3	3	6	3	6	2,579
	→Chugoku (Counter)	252	290	324	429	523	601	302	308	300	257	292	146	4,023
Chugoku-Kyushu	→Kyushu (Forward)	565	451	223	180	231	305	3	4	8	15	4	10	1,998
	→Chugoku (Counter)	1,453	1,368	1,553	1,778	1,801	1,714	1,592	1,554	1,616	1,450	1,283	1,117	18,280

* 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 2010–2018

Table 2-3 and Figure 2-4 show the annual utilization of cross-regional interconnection lines for regional service areas for FY 2010–2018.

Table 2-3 Annual Utilization of Cross-regional Interconnection Lines for Regional Service Areas (FY 2010–2018)

[GWh]

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

* 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 2010–2018, respectively.

Figure 2-4: Annual Utilization of Cross-regional Interconnection Lines for Regional Service Areas (FY 2010–2018)

(3) Monthly Utilization of Cross-regional Interconnection Lines by Transaction in FY 2018

Table 2-4 shows the monthly utilization of cross-regional interconnection lines by transaction in FY 2018.

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	8,273	7,952	8,283	10,412	11,604	9,961	38	11	-0	14	16	144	**56,710**
Day-ahead	2,374	2,040	1,425	1,948	1,818	1,819	6,737	6,761	7,087	7,278	6,618	5,215	**51,120**
1 Hour-ahead	232	219	205	357	394	337	298	321	198	161	105	103	**2,932**

* 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 2010–2018

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 2010–2018.

Table 2-5: Annual Utilization of Cross-regional Interconnection Lines by Transaction (FY 2010–2018)

[GWh]

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

* "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.

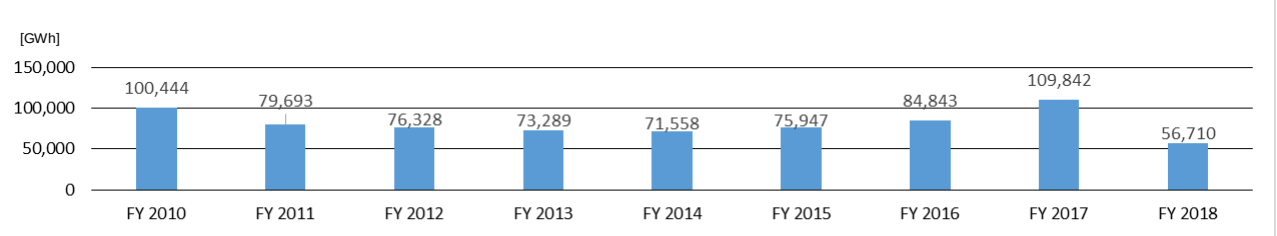


Figure 2-5: Annual Utilization of Cross-regional Interconnection Lines by Bilateral Transaction (FY 2010–2018)

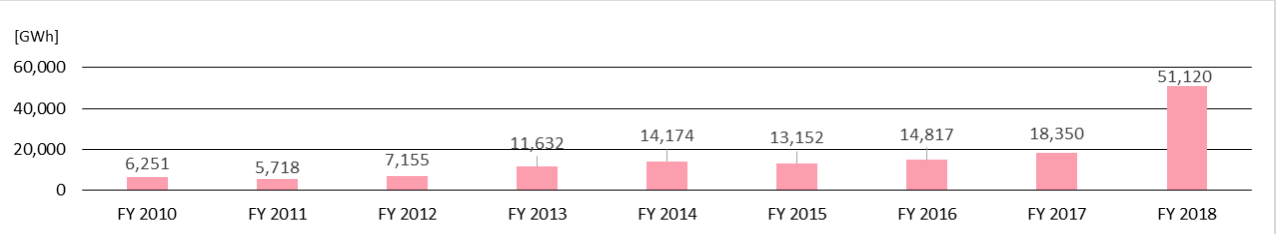


Figure 2-6: Annual Utilization of Cross-regional Interconnection Lines by Day-ahead Transaction (FY 2010–2018)

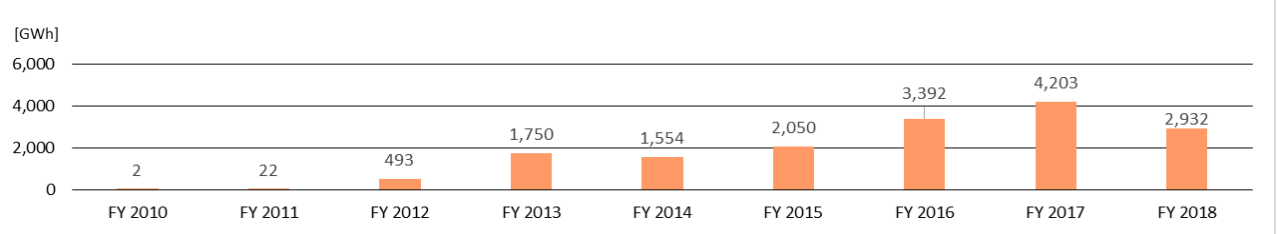


Figure 2-7: Annual Utilization of Cross-regional Interconnection Lines by Hour-ahead Transaction (FY 2010–2018)

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 2018

Table 2-6 shows the monthly congestion management of cross-regional interconnection lines by weekly plan submissions in FY 2018.

Table 2-6: Monthly Congestion Management of Cross-regional Interconnection Lines by Weekly Plan Submissions

[h]

Interconnection	Weekly Plan Submission	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	**Annual**
Hokkaido-Honshu	Total	768	1,608	2,370	1,790	1,576	2,110	0	0	0	0	0	0	**10,222**
	Before Submission	0	864	1,146	942	1,054	622	0	0	0	0	0	0	**4,628**
	After Submission	768	744	1,224	848	522	1,488	0	0	0	0	0	0	**5,594**
Tohoku-Tokyo	Total	24	0	768	0	0	0	0	0	0	0	0	0	**792**
	Before Submission	24	0	130	0	0	0	0	0	0	0	0	0	**154**
	After Submission	0	0	638	0	0	0	0	0	0	0	0	0	**638**
Tokyo-Chubu	Total	3,053	4,099	3,362	3,446	4,441	3,549	0	0	0	0	0	0	**21,949**
	Before Submission	96	1,432	182	0	0	0	0	0	0	0	0	0	**1,710**
	After Submission	2,957	2,667	3,180	3,446	4,441	3,549	0	0	0	0	0	0	**20,239**
Chubu-Kansai	Total	1	0	63	84	1	0	0	0	0	0	0	0	**148**
	Before Submission	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	After Submission	1	0	63	84	1	0	0	0	0	0	0	0	**148**
Chubu-Hokuriku	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**
Hokuriku-Kansai	Total	293	0	0	0	0	0	0	0	0	0	0	0	**293**
	Before Submission	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	After Submission	293	0	0	0	0	0	0	0	0	0	0	0	**293**
Kansai-Chugoku	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**
Kansai-Shikoku	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**
Chugoku-Shikoku	Total	105	82	0	0	0	0	0	0	0	0	0	0	**187**
	Before Submission	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	After Submission	105	82	0	0	0	0	0	0	0	0	0	0	**187**
Chugoku-Kyushu	Total	868	889	1,203	1,715	1,535	2,315	0	0	0	0	0	0	**8,524**
	Before Submission	852	748	712	1,054	1,334	2,130	0	0	0	0	0	0	**6,830**
	After Submission	16	141	491	661	201	185	0	0	0	0	0	0	**1,694**
Nationwide		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**

* The managed hours are collected as 30 minutes and rounded up to 1 hour.
* The total number of hours of allocation plans that managed to mitigate congestion.
* There were zero hours with congestion after the introduction of the implicit auction scheme in October 2018.

(2) Annual Congestion Management of Cross-regional Interconnection Lines by Weekly Plan Submission for FY 2010–2018

Table 2-7 and Figure 2-8 show the annual congestion management of cross-regional interconnection lines by weekly plan submissions for FY 2010–2018.

Table 2-7: Annual Congestion Management of Cross-regional Interconnection Lines by Weekly Plan Submissions (FY 2010–2018)

[h]

	Weekly Plan Submission	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
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.

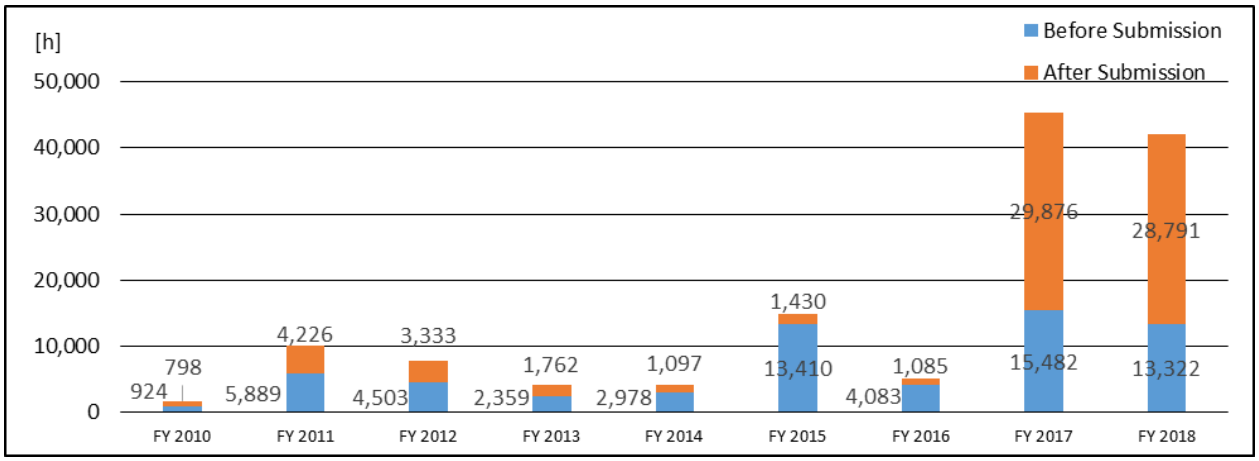


Figure 2-8: Annual Congestion Management of Cross-regional Interconnection Lines by Weekly Plan Submissions (FY 2010–2018)

(3) Monthly Congestion Management of Cross-regional Interconnection Lines by Constraints in FY 2018

Table 2-8 shows the monthly congestion management of cross-regional interconnection lines by constraints in FY 2018.

Table 2-8: Monthly Congestion Management of Cross-regional Interconnection Lines by Constraints

[h]

Interconnection	Constraints	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	**Annual**
Hokkaido-Honshu	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**
Tohoku-Tokyo	Total	24	0	768	0	0	0	0	0	0	0	0	0	**792**
	Over Capability	24	0	768	0	0	0	0	0	0	0	0	0	**792**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Tokyo-Chubu	Total	3,053	4,099	3,362	3,446	4,441	3,549	0	0	0	0	0	0	**21,949**
	Over Capability	3,053	4,099	3,362	3,446	4,441	3,549	0	0	0	0	0	0	**21,949**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Chubu-Kansai	Total	1	0	63	84	1	0	0	0	0	0	0	0	**148**
	Over Capability	1	0	63	84	1	0	0	0	0	0	0	0	**148**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Chubu-Hokuriku	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**
Hokuriku-Kansai	Total	293	0	0	0	0	0	0	0	0	0	0	0	**293**
	Over Capability	293	0	0	0	0	0	0	0	0	0	0	0	**293**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Kansai-Chugoku	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**
Kansai-Shikoku	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**
Chugoku-Shikoku	Total	105	82	0	0	0	0	0	0	0	0	0	0	**187**
	Over Capability	105	82	0	0	0	0	0	0	0	0	0	0	**187**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Chugoku-Kyushu	Total	868	889	1,203	1,715	1,535	2,315	0	0	0	0	0	0	**8,524**
	Over Capability	868	889	1,203	1,715	1,535	2,315	0	0	0	0	0	0	**8,524**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Nationwide		5,111	6,677	7,765	7,035	7,553	7,973	0	0	0	0	0	0	**42,113**
	Over Capability	5,111	6,677	7,765	7,035	7,553	7,973	0	0	0	0	0	0	**42,113**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**

* 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.
* "Congestion management for over capability" means the management implemented when the scheduled power flow reaches the maximum of available transfer capability of the interconnection line.
* "Congestion management for minimum flow" means the management implemented when the scheduled power flow goes below the minimum setting value of commutating facilities at the interconnection line.

(4) Annual Congestion Management of Cross-regional Interconnection Lines by Constraints for FY 2010–2018

Table 2-9 and Figure 2-9 show the annual congestion management of cross-regional interconnection lines by constraints for FY 2010–2018.

Table 2-9 Annual Congestion Management of Cross-regional Interconnection Lines by Constraints (FY 2010–2018)

[h]

	Constraints	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	**Annual**
FY 2018	**Total**	5,111	6,677	7,765	7,035	7,553	7,973	0	0	0	0	0	0	**42,113**
	Over Capability	5,111	6,677	7,765	7,035	7,553	7,973	0	0	0	0	0	0	**42,113**
	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.

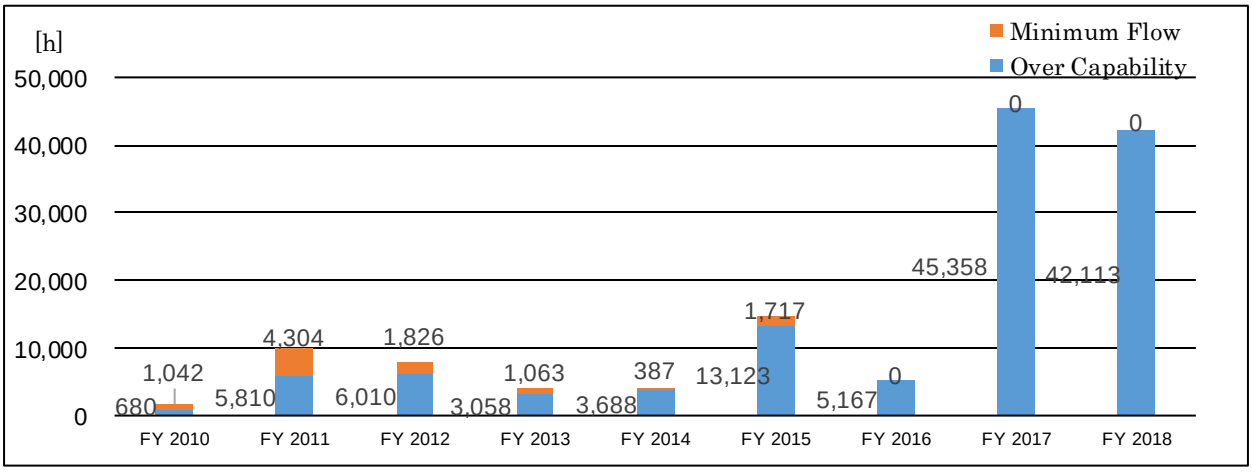


Figure 2-9: Annual Congestion Management of Cross-regional Interconnection Lines by Constraints (FY 2010–2018)

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 2018

Table 2-10 shows the monthly maintenance work on cross-regional interconnection lines in FY 2018, and Figure 2-10 shows the nationwide monthly planned outage rate in FY 2018.

Table 2-10: 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			12	8							2	3			1	2			3	2					18	15
Tohoku-Tokyo	Soma-Futaba bulk line, Iwaki bulk line					15	11																	4	7	19	18
Tokyo-Chubu	Sakuma FC C.S.	4	4	2	2									2	12	5	30	2	5							15	53
	Shin Shinano FC C.S.	2	2	2	10	3	8			1	3			4	13	1	2	2	2							15	40
	Higashi Shimizu FC C.S.	1	1																					8	12	9	13
Chubu-Kansai	Mie-Higashi Omi line					1	1																	2	1	3	2
Chubu-Hokuriku	Minami Fukumitsu HVDC BTB C.S., Minami Fukumitsu Substation											8	19													8	19
Hokuriku-Kansai	Echizen-Reinan line	6	13	7	26	1	4									1	1									15	44
Kansai-Chugoku	Seiban-Higashi Okayama line, Yamazaki-Chizu line			13	30	6	25					13	25	7	23	1	1	1	1							41	105
Kansai-Shikoku	Kihoku and Anan AC/DC C.S.	9	18			3	3	1	2			1	1	6	11									4	16	24	51
Chugoku-Shikoku	Honshi interconnection line	5	12	5	29									2	2									5	14	17	57
Chugoku-Kyushu	Kanmon interconnection line													5	10	13	17			2	1	1	1			21	29
Nationwide (Cumulative works for the same facilities deducted)		27	50	41	105	29	52	1	2	1	3	24	48	26	71	22	53	5	8	5	3	1	1	23	50	205	446

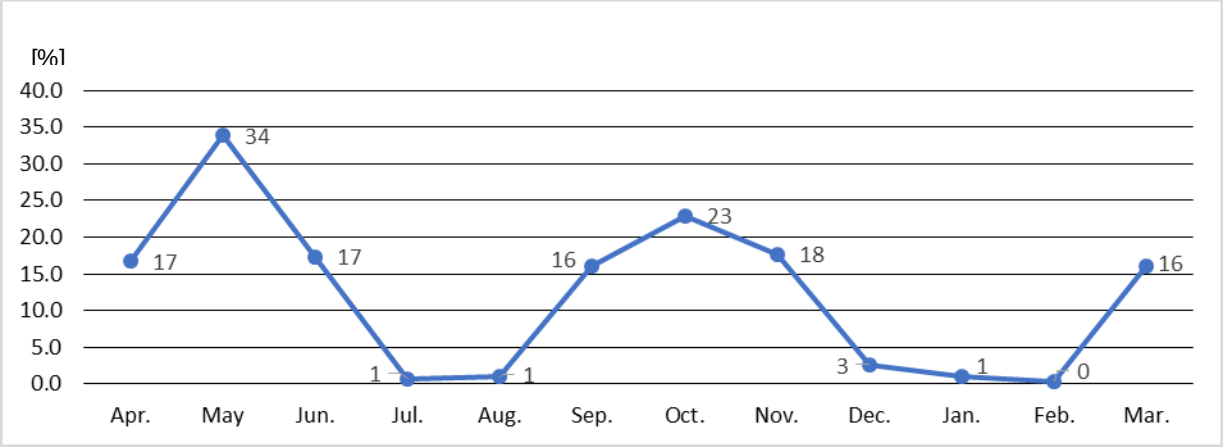


Figure 2-10: Nationwide Monthly Planned Outage Rate

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

(2) Annual Maintenance Work on Cross-regional Interconnection Lines for FY 2010–2018

Table 2-11 shows the annual maintenance work on cross-regional interconnection lines for FY 2010–2018.

Table 2-11: Annual Maintenance Work on Cross-regional Interconnection Lines (FY 2010–2018)

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	Total	9-years Average
Number	64	56	58	38	63	91	218	267	205	1,060	118

* 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 2018

Table 2-12 shows the unplanned outage of cross-regional interconnection lines in FY 2018.

Table 2-12: Unplanned Outage of Cross-regional Interconnection Lines

Date	Facility	Background
Aug. 27	Shin Shinano FC unit No.2	Malfunction of thyristor valve
Sep. 4	Kihoku and Anan AC/DC C.S.	Unknown
Sep. 6	Hokkaido-Honshu HVDC Link	Secondary accident of network due to Hokkaido Eastern Iburi Earthquake
Sep. 10	Shin Shinano FC unit No.2	Secondary accident of network
Sep. 30	Sakuma FC	Fallen tree
Oct. 1	Shin Shinano FC unit No.2	Secondary accident of network

* The unplanned outage affecting TTC is described.

(2) Annual Unplanned Outage of Cross-regional Interconnection Lines for FY 2010–2018

Table 2-13 shows the annual unplanned outage of cross-regional interconnection lines for FY 2010–2018.

Table 2-13: Annual Unplanned Outage of Cross-regional Interconnection Lines (FY 2010–2018)

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	Total	9-years Average
Number	9	5	6	9	1	3	3	3	6	45	5

6. Actual Utilization of the Transmission Margin

The “utilization of the transmission margin” describes the supply of electricity by GT&D companies utilizing part of their transmission margin when there is no ATC on the interconnection lines that applicants for capability allocation wish to use. There was no actual utilization of the transmission margin in FY 2018 according to the provisions of Article 151 of the Operational Rules.

From the next report, the actual utilization of transmission margin will not be reported due to the introduction of the implicit auction scheme; there are no allocation plans for bilateral contracts that may cause congestions.

7. 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 2-14 shows the actual employment of the transmission margin for FY 2018 according to the provisions of Article 152 of the Operational Rules.

Table 2-14: Actual Employment of the Transmission Margin

Date	Facility	Background
From Sep. 6 to 21	Hokkaido-Honshu HVDC Link (Flow from Honshu to Hokkaido)	To fulfill instructed amount of power exchange with the need of increasing supply capacity by cross-regional power transfer against decreasing supply capacity in Hokkaido EPCO area due to Hokkaido Eastern Iburi Earthquake.

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

The actual ATC values calculated and published are shown in Figures 2-13 to 2-22. Figures 2-11 and 2-12 detail how to interpret the ATC graph.

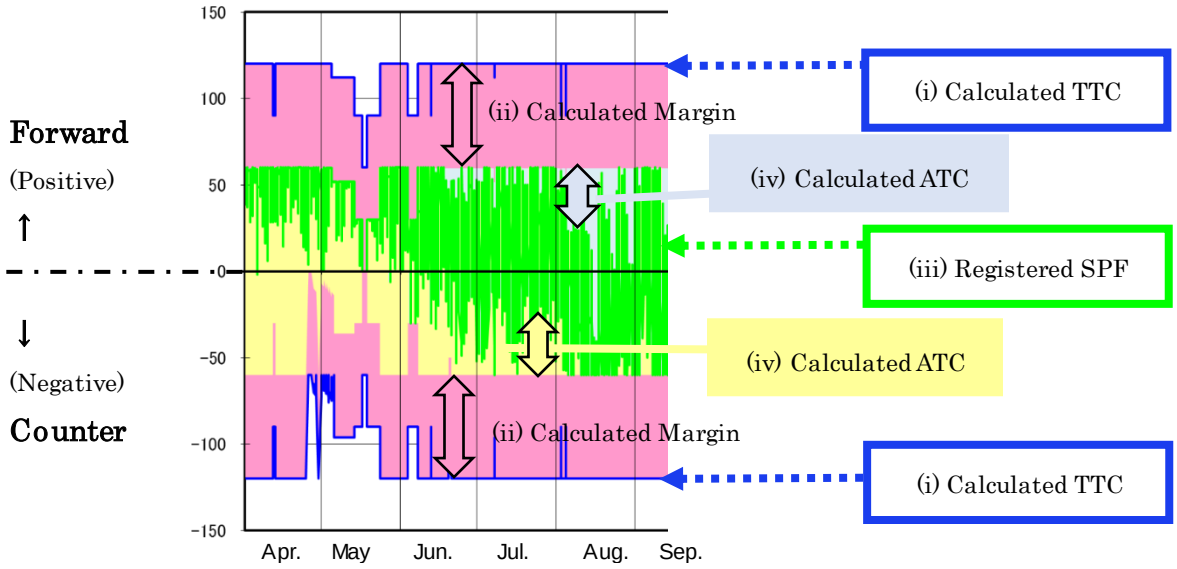


Figure 2-11: How to Interpret the ATC graphs

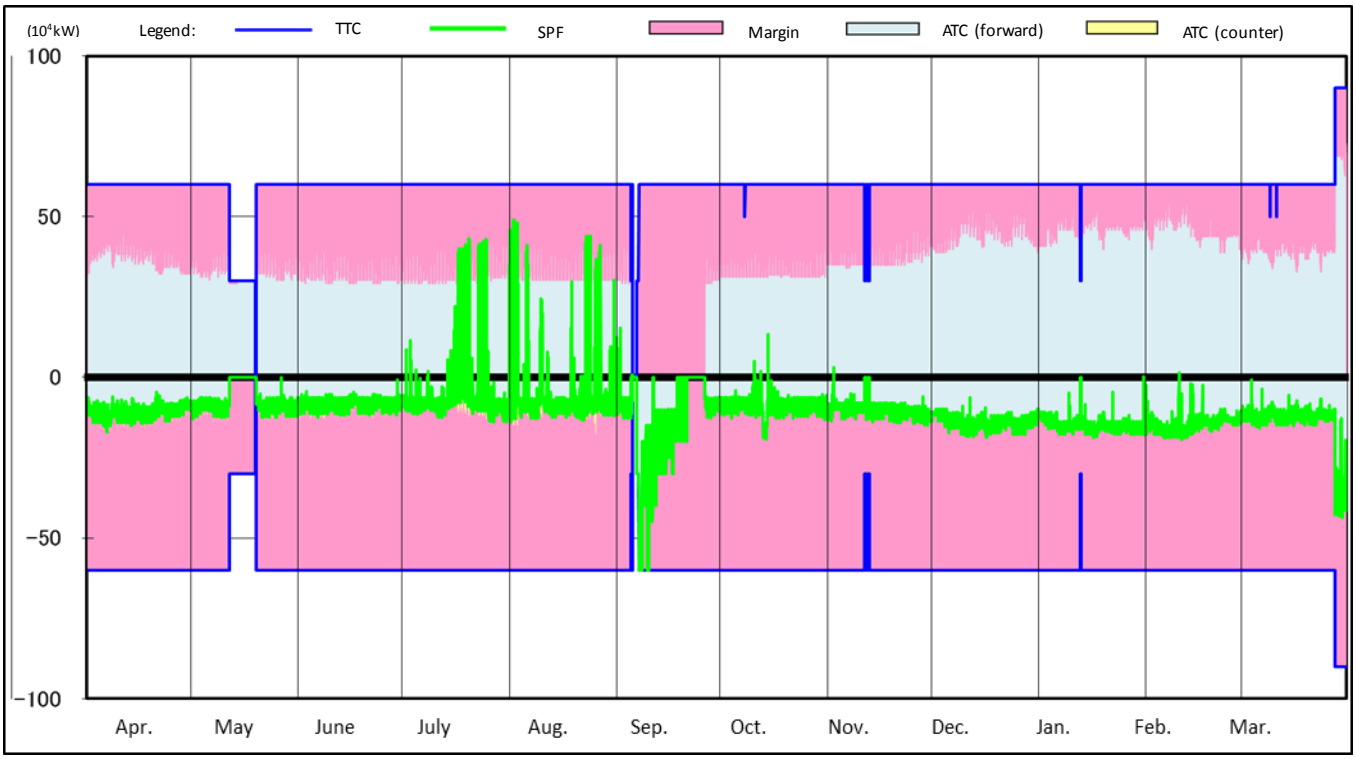
	By the end of September, 20118	After October, 2018 (introduction of implicit auction scheme)
(i) Calculated TTC	The maximum electricity that can be sent to the distribution facilities while securing supply reliability without damaging the transmission and distribution facilities	The same as the left
(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

Figure 2-12: Explanations of ATC graphs components

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.

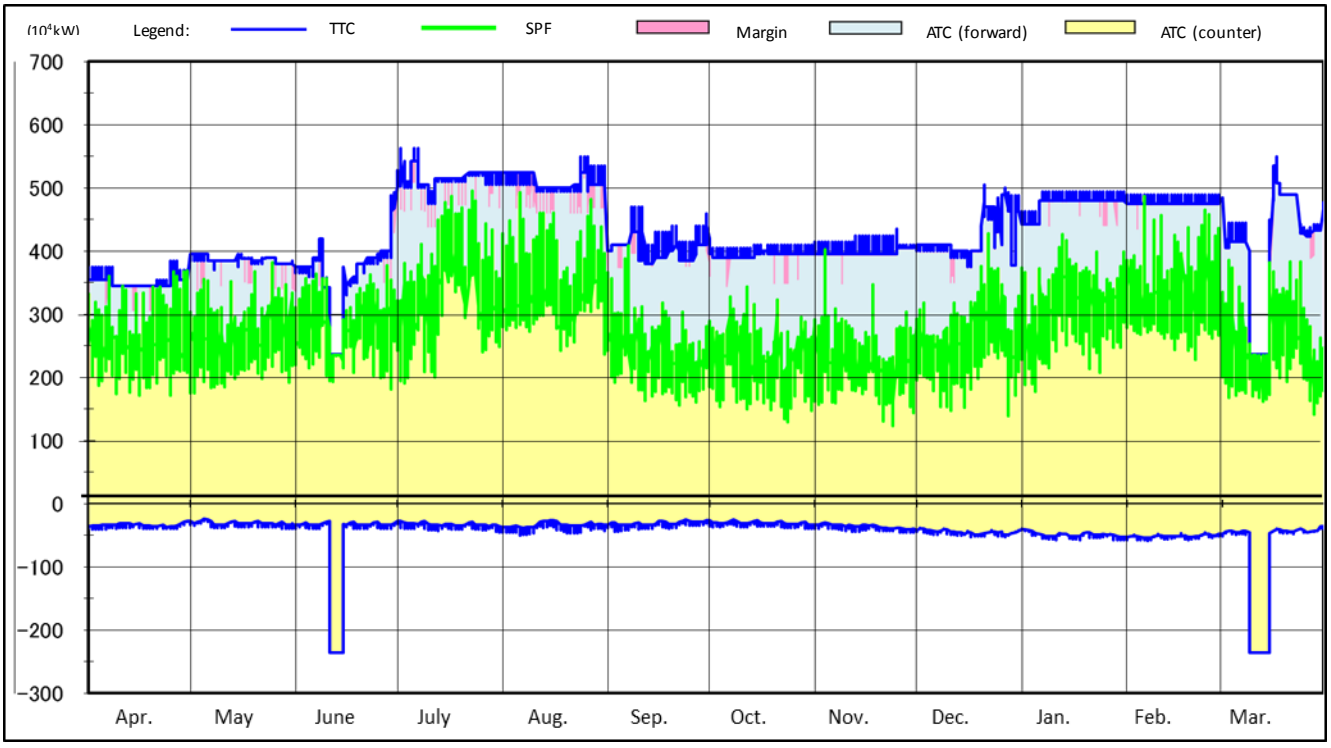
(Reference) Publishing actual ATC
Detailed network system information including actual ATC is available at the URL below.
URL http://occtonet.occto.or.jp/public/dfw/RP11/OCCTO/SD/LOGIN_login#

Figure 2-13: Actual ATC of Interconnection Facilities between Hokkaido and Honshu
(Hokkaido–Honshu HVDC Link, and the New Hokkaido–Honshu HVDC Link)



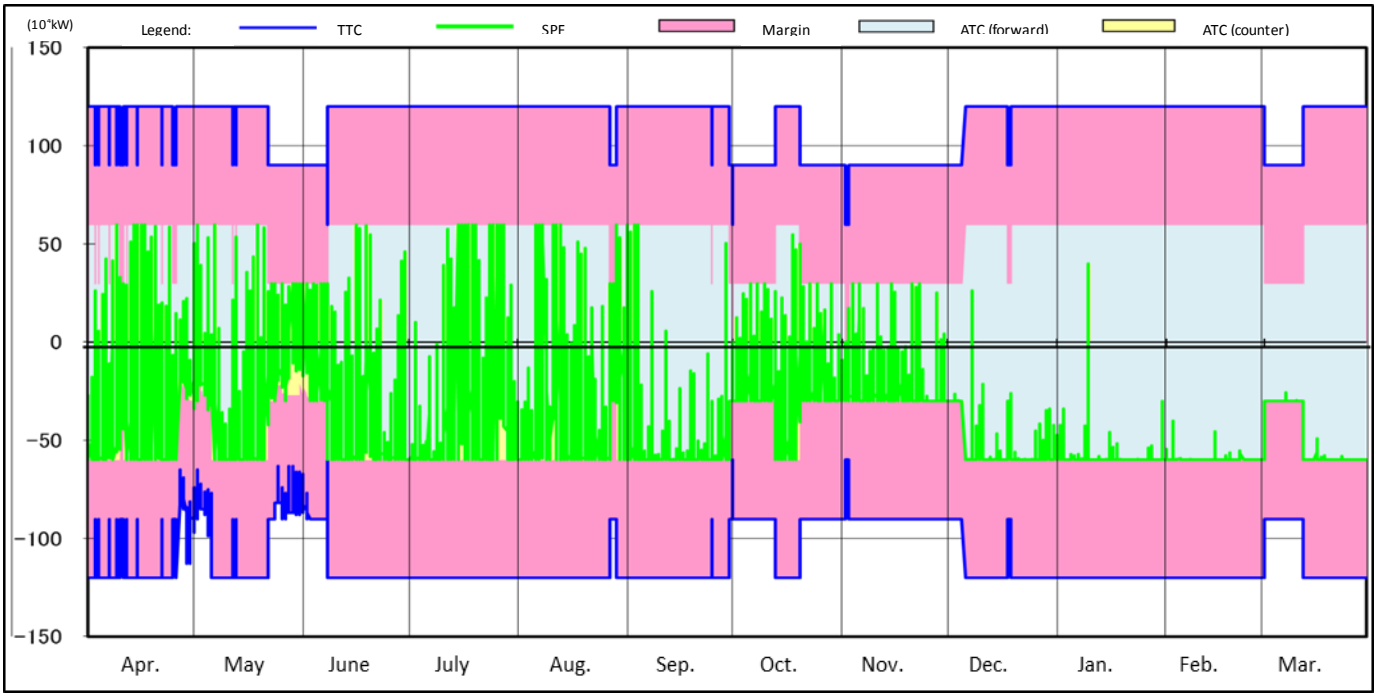
Note: Hokkaido to Tohoku as forward (positive) flow, Tohoku to Hokkaido as counter (negative) flow.

Figure 2-14: Actual ATC of Interconnection Lines between Tohoku and Tokyo
(Soma-Futaba Bulk Line and Iwaki Bulk Line)



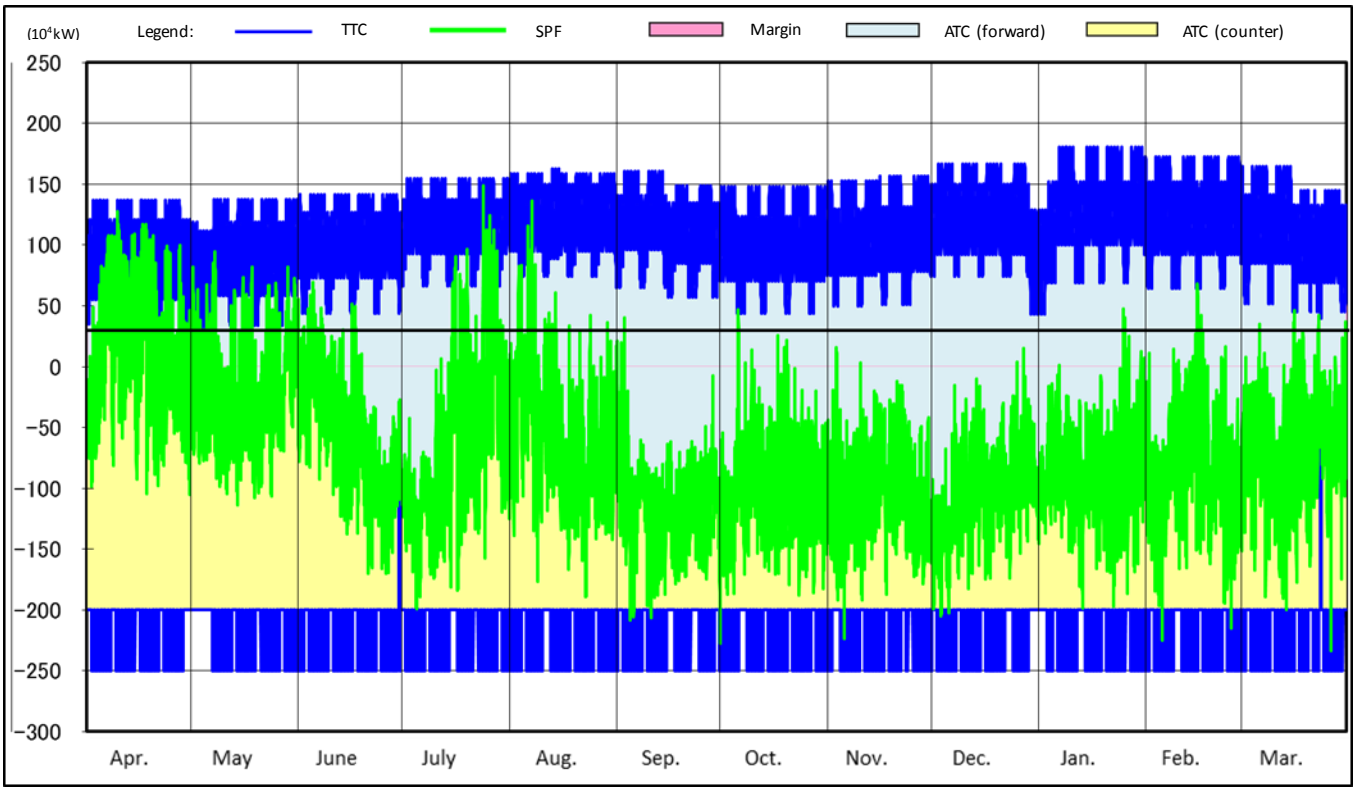
Note: Tohoku to Tokyo as forward (positive) flow, Tokyo to Tohoku as counter (negative) flow.

Figure 2-15: Actual ATC of Interconnection Facilities between Tokyo and Chubu
(Sakuma, Shin-Shinano and Higashi Shimizu F.C.)



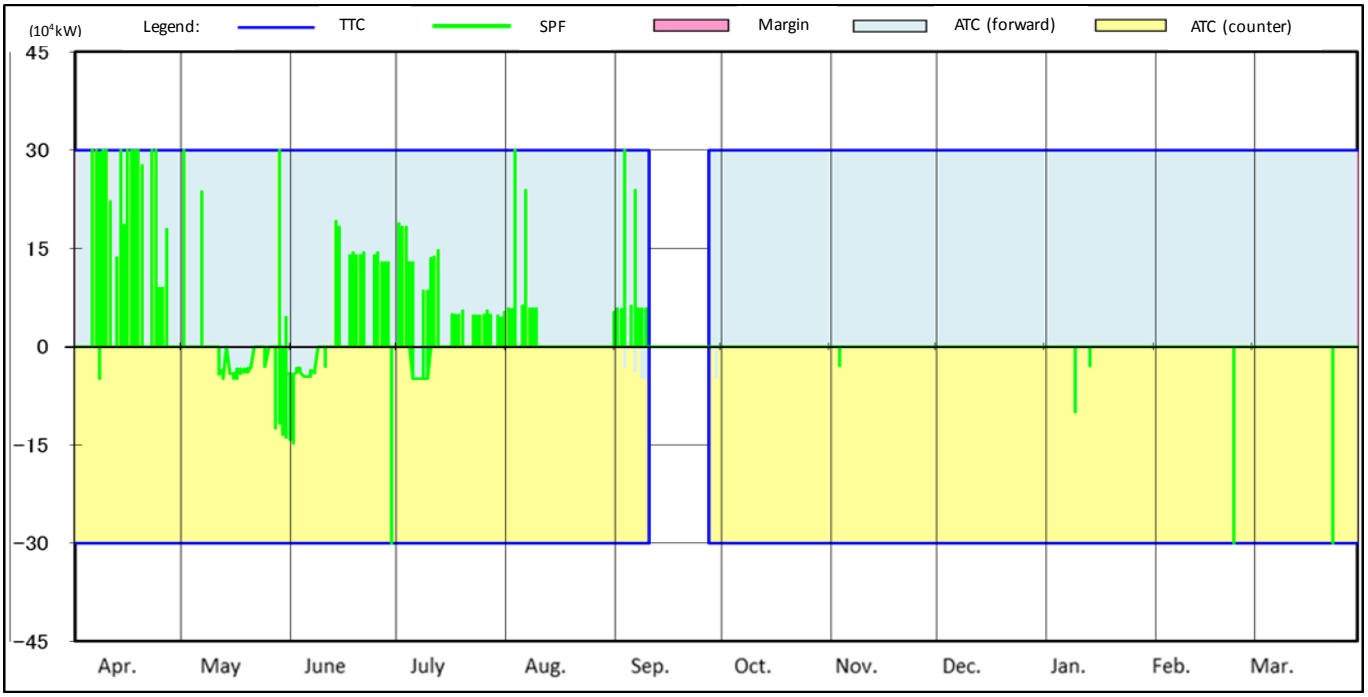
Note: Tokyo to Chubu as forward (positive) flow, Chubu to Tokyo as counter (negative) flow.

Figure 2-16: Actual ATC of the Interconnection Line between Chubu and Kansai (Mie-Higashi Omi Line)



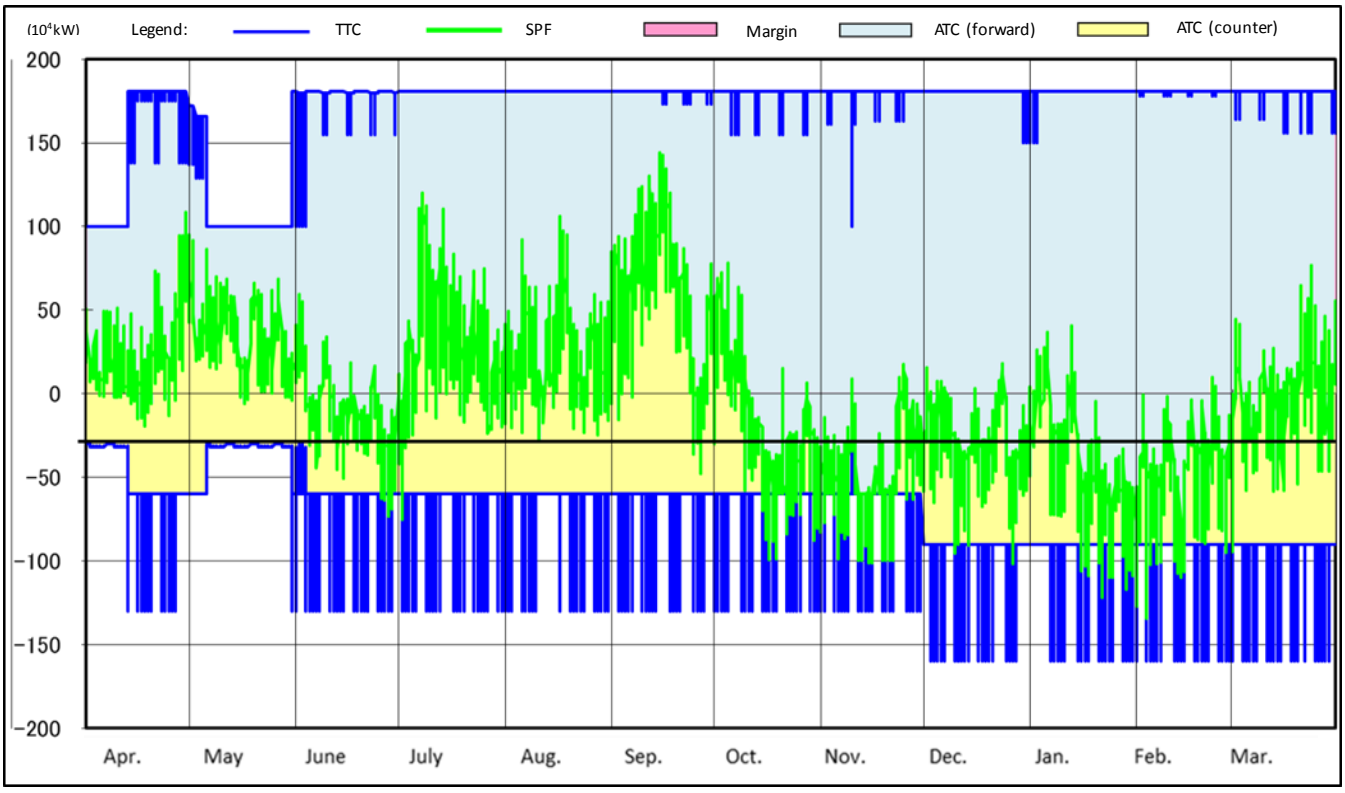
Note: Chubu to Kansai as forward (positive) flow, Kansai to Chubu as counter (negative) flow.

Figure 2-17: Actual ATC of Interconnection Facilities between Chubu and Hokuriku
(Minami Fukumitsu HVDC BTB C.S. and Minami Fukumitsu Substation)



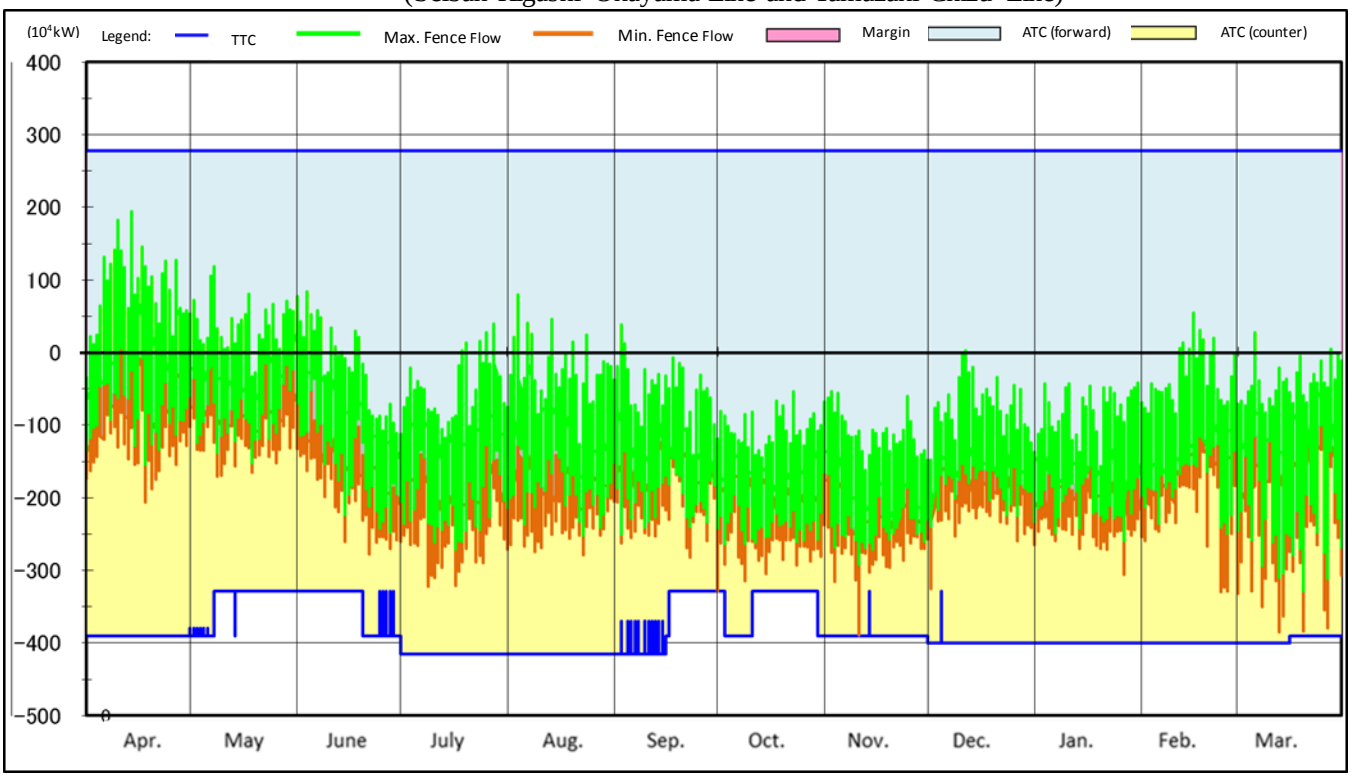
Note: Chubu to Hokuriku as forward (positive) flow, Hokuriku to Chubu as counter (negative) flow.

Figure 2-18: Actual ATC of the Interconnection Line between Hokuriku and Kansai (Echizen-Reinan Line)



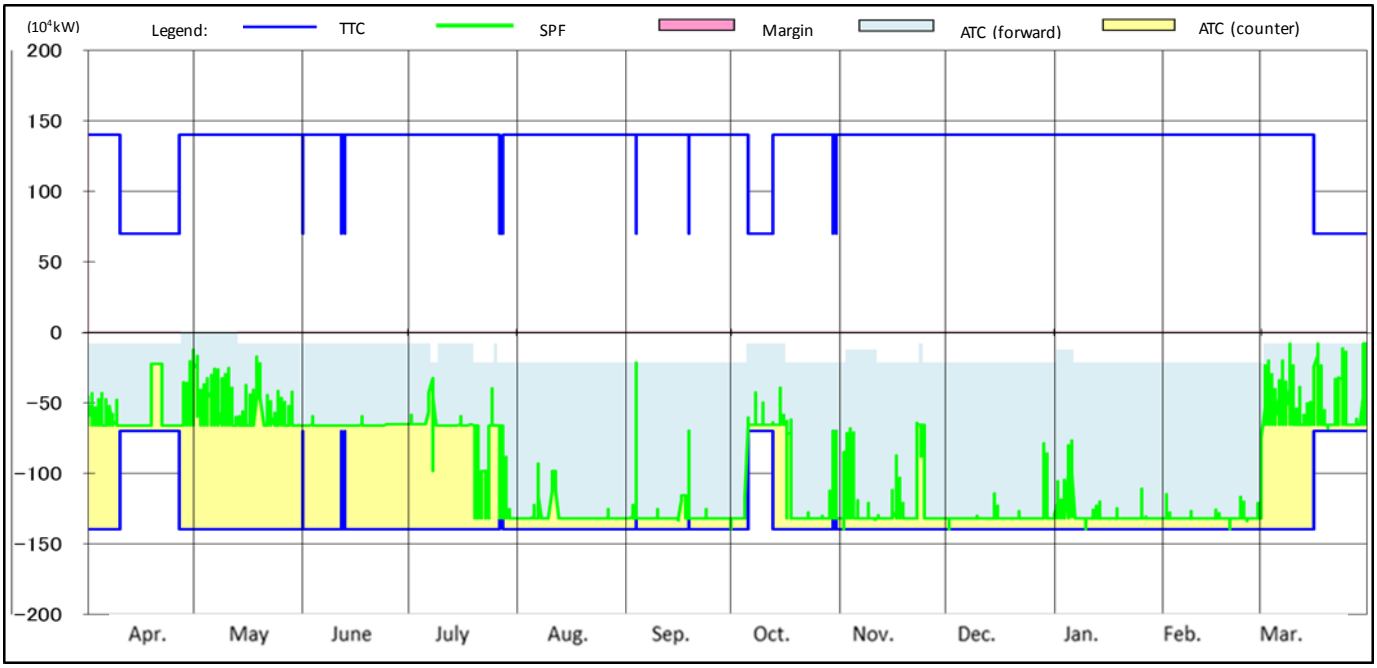
Note: Hokuriku to Kansai as forward (positive) flow, Kansai to Hokuriku as counter (negative) flow.

Figure 2-19: 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.

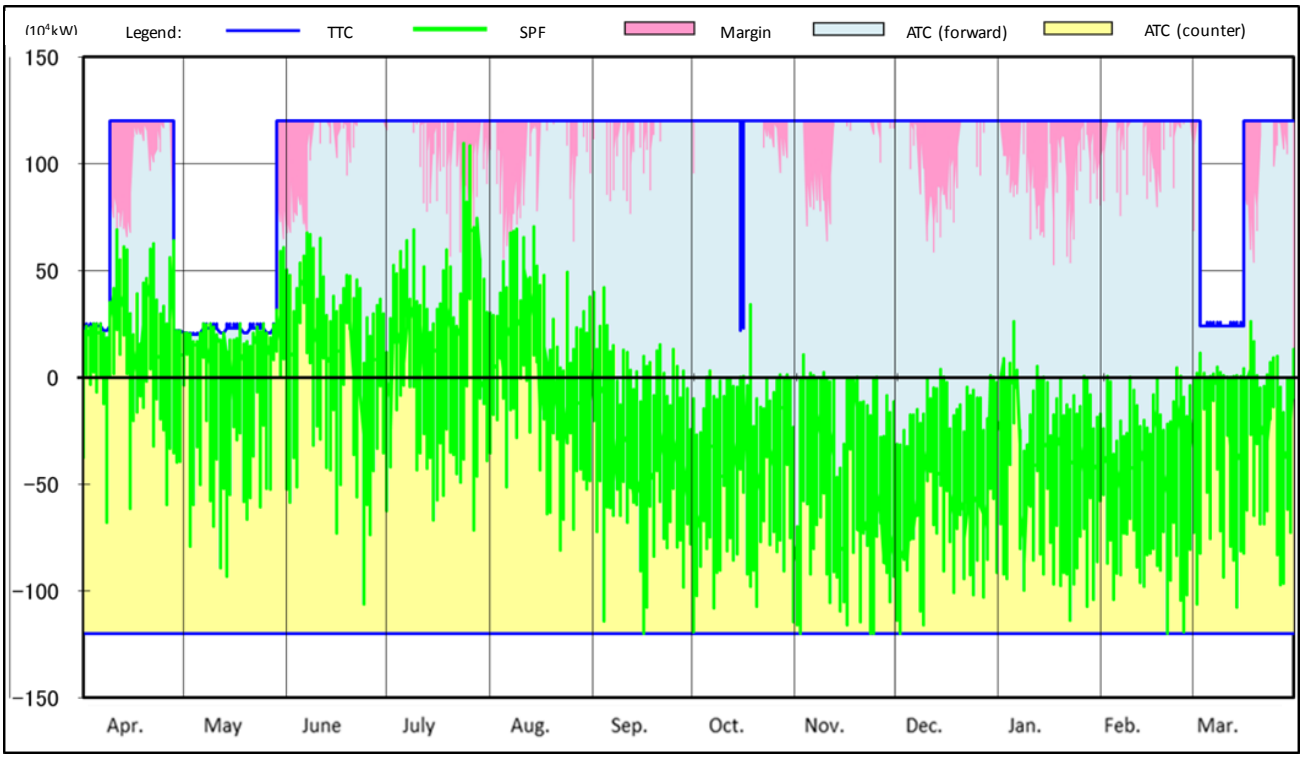
Figure 2-20: Actual ATC of Interconnection Facilities between Kansai and Shikoku
(Interconnection facilities between Kihoku and Anan AC/DC C.S.)



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

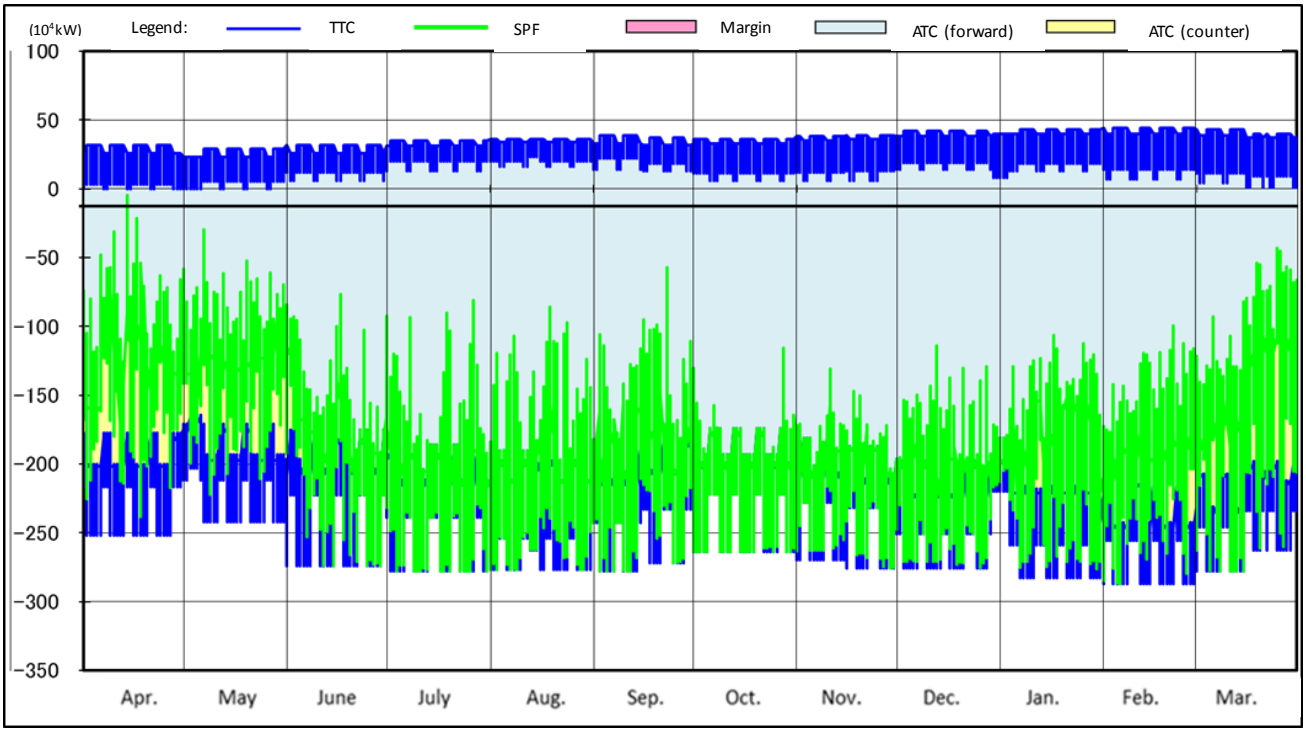
* ATC on forward flow is calculated and chosen from the smaller value from the following.
・TTC－transfer margin－SPF.
・TTC of Minami Awa Bulk Line－(Supply Capacity of Tachibanawan Thermal Power Station－SPF of Anan-Kihoku DC Bulk Line).

Figure 2-21: 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 2-22: 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.

9. 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 Company : http://www.hepco.co.jp/corporate/con_service/bid_info.html
Tohoku Electric Power Company : http://www.tohoku-epco.co.jp/jiyuka/04.htm
Tokyo Electric Power Company : http://www.tepco.co.jp/pg/consignment/system/index-j.html
Chubu Electric Power Company : http://www.chuden.co.jp/corporate/study/free/rule/map/index.html
Hokuriku Electric Power Company : http://www.rikuden.co.jp/rule/U_154seiyaku.html
The Kansai Electric Power Company : http://www.kepco.co.jp/corporate/takusou/disclosure/ryutusetsubi.html
The Chugoku Electric Power Company : http://www.energia.co.jp/retailer/keitou/access.html
Shikoku Electric Power Company : http://www.yonden.co.jp/business/jiyuuka/tender/index.html
Kyushu Electric Power Company : http://www.kyuden.co.jp/wheeling_disclosure
The Okinawa Electric Power Company : 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, utilization and 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