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

Actual Data for Fiscal Year 2016

July 2017

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

FORWORD

The Organization for Cross-regional Coordination of Transmission Operators, JAPAN (hereinafter, the Organization) shall prepare and publish its Annual Report according to Article 181 of the Operational Rules regarding the matters specified below.

- Actual data for electricity supply-demand, network system utilization, and network access business up to the previous fiscal year (FY).
- Forecast for future mid to long-term electricity supply-demand according to the aggregated results of electricity supply plans.
- Prospects and issues in the electricity network system.

The Organization publishes the actual data for electricity supply-demand and network system utilization in advance for the Annual Report because of the completion of actual data collection up to FY 2016.

The contents of this report shall be subsequently integrated into the Annual Report.

(Note)

The text of the Operational Rules was obtained from the amended version of April 1, 2017.

CONTENTS

Chapter I. Actual Electricity Supply and Demand

1. Alteration to Publishing Information on Electricity Supply-Demand

The Organization has unified its reporting method of electricity supply-demand submitted by all generation companies to publish information on the electricity supply-demand according to the introduction of a business license system from April 1, 2016. The electricity supply-demand data are reported as "figures measured from the sending end." Therefore, this report includes the actual electricity supply-demand data at the sending end, and excludes the reported "figures measured at the generating and receiving ends" up to fiscal year(FY) 2015.

(The Organization has published its report on the actual electricity supply-demand for "figures measured at the generating and receiving end" from FYs 2010 to 2015 on its website. Please see the report.*)

Table 1-1 defines data measurement, and our calculation of the measurement is shown in Figure1-1.

Table 1-1 Definition of Data Measurement

At the Sending End	Electricity is supplied to the public network system from power plants with energy deducted for station services.
At the Generating and Receiving End	Total electricity supplied to the public network system from the power plants of former vertically-integrated electric power companies (figure measured at the generating end) and those of other electric power companies (figure measured at the receiving end).

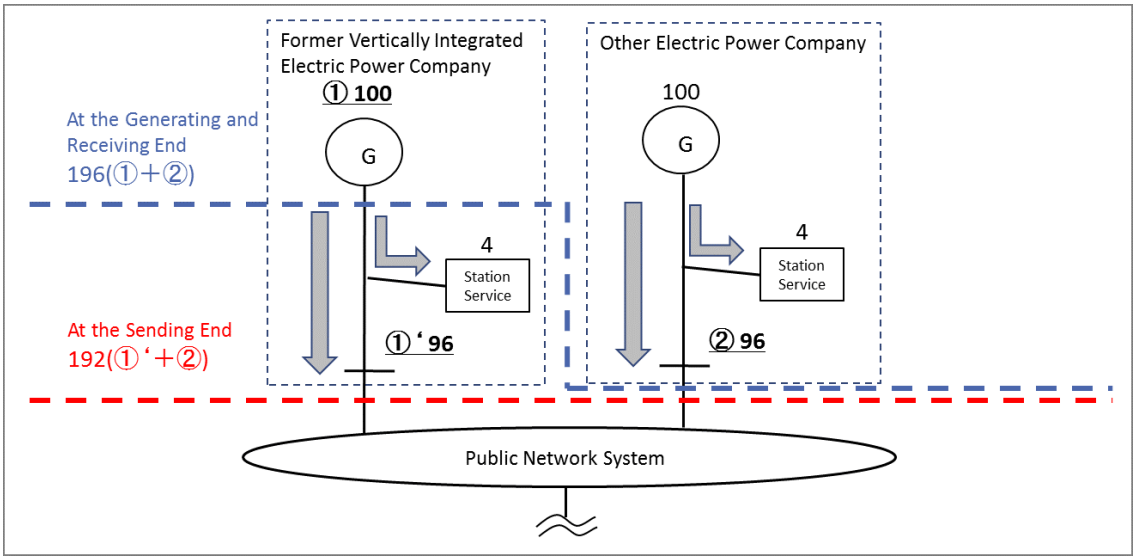


Figure 1-1 Calculation of the Data Measurement

* "Outlook of Electricity Supply-Demand and Cross-regional Interconnection Lines: Actual Data up to Fiscal Year 2015."
http://www.occto.or.jp/en/news/2016/files/161025_outlook_of_electricity.pdf

2. Regional Service Areas of 10 General Transmission and Distribution Companies and 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 company transmits their electricity through cross-regional interconnection lines. Japan is divided into 10 regional service areas as shown in Figure 1-2. Regional service areas served by general transmission and distribution companies other than the Okinawa Electric Power Company (EPCO) are connected by the cross-regional interconnection lines.

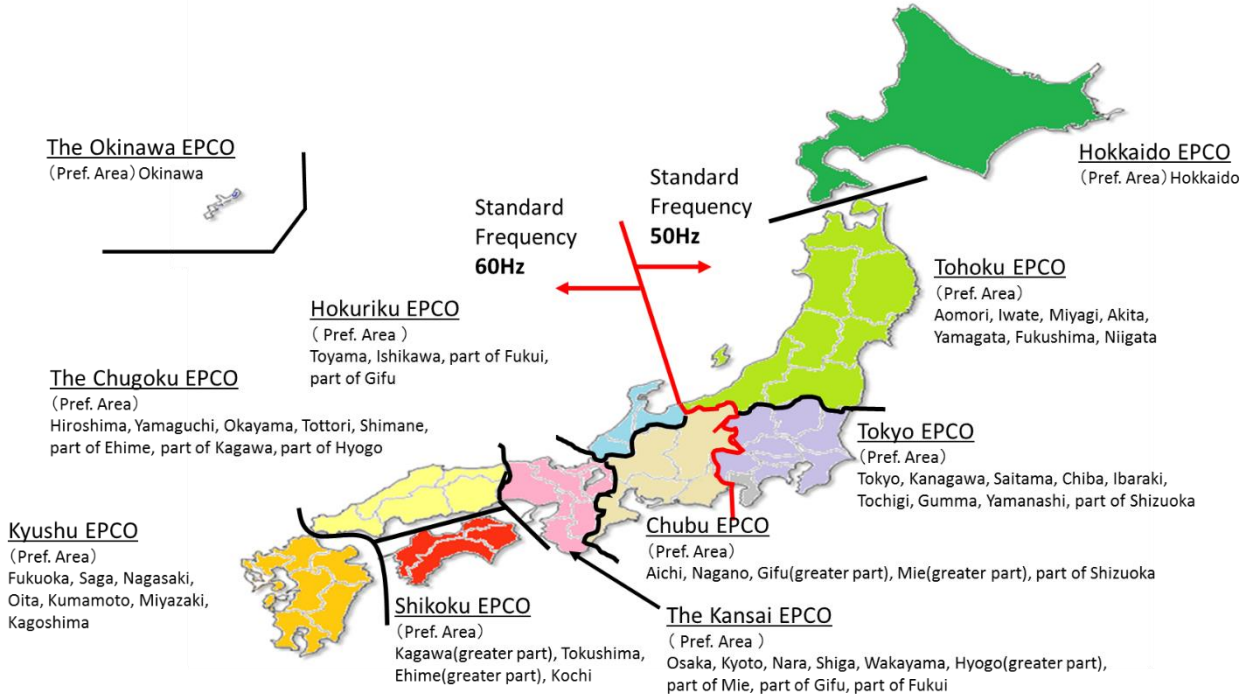


Figure 1-2 The 10 Regional Service Areas in Japan and their Prefectural Distribution

(2) The Definition of Seasons

The report defines the seasons into summer and winter periods. The summer period is defined as July, August, and September. The winter period is defined as December, the following January, and February.

3. Outlook of Actual Weather Nationwide

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

Table 1-2 shows anomalies in the temperature and precipitation ratio from June to August in FY 2016.

- The nationwide seasonal mean temperature was abnormally high because of hot air frequently covering Japan. Particularly in the Okinawa/Amami region, the summer mean temperature was recorded at an all-time high (since 1946 when weather statistics began to be kept) at + 1.1˚C above normal due to the long and intense sunshine.
- In the northern region, rainfall was significant because of low-pressure systems in June, typhoons frequently approaching or landing in August, and the influences of wet weather and rain. In particular, in the northern region's Pacific Sea coast, an all-time high was recorded for summer rainfall (163% above normal).

Table 1-2 Anomalies of Temperature and Rainfall by Weather Region from June to August (FY 2016)

Weather Region	Mean Temperature Anomaly[℃]	Precipitation Ratio[%]
Northern	+0.7	157
Eastern	+0.6	99
Western	+0.7	108
Okinawa/Amami	+1.1	88

* The summer season for the meteorological analysis is the period from June to August.
Source: Japan Meteorological Agency, Tokyo Climate Center.
Seasonal Climate Report over Japan for Summer FY 2016.
http://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=8&year=2016
http://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=8&year=2016

(2) Weather during the Winter Period (December to the Following February)

Table 1-3 shows the anomalies in temperature and the ratios of rainfall and snowfall from December to the following February in FY 2016.

- The winter period of FY 2016 was warm nationwide because of several warm days caused by cold air mass moving south at a weakened pace. The temperature variance was significant for the earlier period of winter in the northern region and the latter period of winter in the western part of the eastern region because of the slow movement southward of the intensely cold air mass.
- The Japan Sea coast of the western region experienced significant snowfall, which led to traffic system disturbances and affected agricultural farms. This was attributable to the southward movement of the intensely cold air mass driven by a stronger winter pressure pattern during mid- to late January and latter part of early to mid-February.
- Snowfall during the winter period on the Japan Sea coast was smaller for the northern region and small in the eastern region, despite being almost normal in the western region where significant snowfall was recorded.

Table 1-3 Anomalies of Temperature, Rainfall, and Snowfall by Weather Region from December to February (FY 2016)

Weather Region	Mean Temperature Anomaly[℃]	Precipitation Ratio[%]	Snowfall Ratio[%]
Northern	+0.5	98	71
Eastern	+0.8	102	42
Western	+0.8	115	70
Okinawa/Amami	+1.1	69	-

Source：Japan Meteorological Agency, Tokyo Climate Center.
Seasonal Climate Report over Japan for Winter FY 2016.
http://ds.data.jma.go.jp/tcc/tcc/products/japan/climate/index.php?kikan=3mon&month=2&year=2017
http://www.data.jma.go.jp/gmd/cpd/cgi-bin/view/kikohyo/en.php?kikan=3mon&month=2&year=2017

4. Actual Nationwide Peak Demand*

Peak demand describes the highest consumption of electricity during a given period, such as day, month, or year. Table 1-4 shows the monthly peak demand for regional service areas in FY 2016. Figures 1-3 and 1-4 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.

Table 1-4 Monthly Peak Demand for Regional Service Areas (FY 2016)

[10^4 kW]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Hokkaido	399	368	369	396	425	419	427	467	501	519	519	447
Tohoku	1,061	998	1,025	1,232	1,286	1,257	1,047	1,213	1,305	1,371	1,370	1,251
Tokyo	3,788	4,018	4,158	4,838	5,332	4,857	4,183	4,768	4,520	4,899	4,957	4,535
Chubu	1,796	1,878	2,035	2,313	2,491	2,302	1,980	1,953	2,087	2,337	2,234	2,077
Hokuriku	373	384	401	471	497	450	394	416	491	515	503	471
Kansai	1,877	1,952	2,085	2,541	2,657	2,498	2,105	2,000	2,234	2,476	2,429	2,141
Chugoku	752	776	837	991	1,058	966	859	833	941	1,031	1,014	904
Shikoku	351	367	413	487	531	457	405	377	422	473	463	410
Kyushu	1,051	1,130	1,229	1,472	1,550	1,318	1,276	1,155	1,303	1,447	1,440	1,261
Okinawa	109	129	144	144	149	142	136	111	98	97	103	95
Nationwide	11,425	11,773	12,326	14,207	15,589	14,316	12,544	13,121	13,796	14,914	14,377	13,233

* "Nationwide Peak Demand" means the maximum of the aggregated demand in a given period for regional service areas of 10 general transmission and distribution companies, not the addition of each regional peak demand.

* The value in red is the maximum monthly peak demand (i.e., the annual peak demand) and the value in blue is the lowest monthly peak demand for each regional service area, respectively.

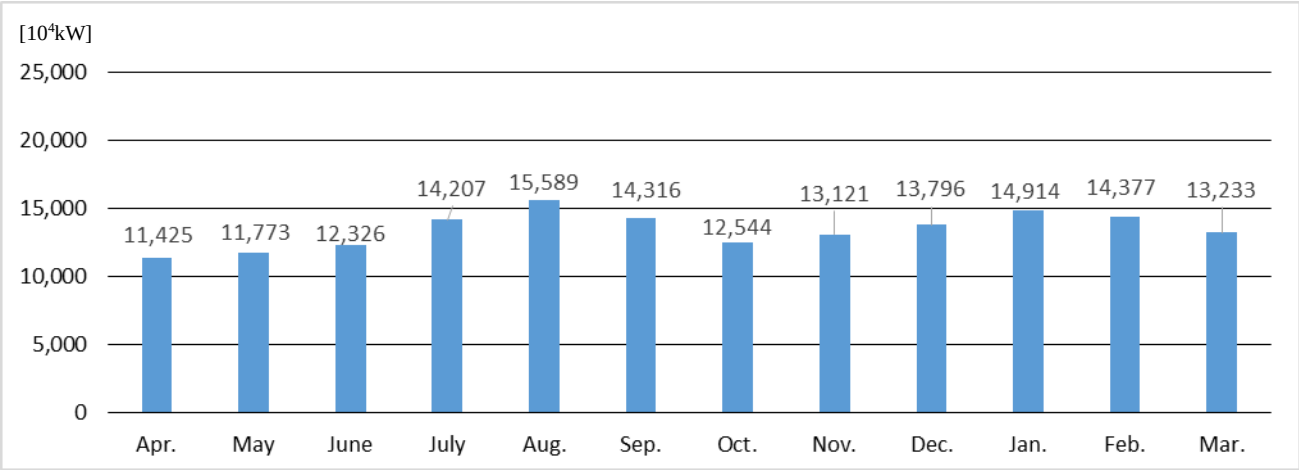


Figure 1-3 Nationwide Monthly Peak Demand (FY 2016)

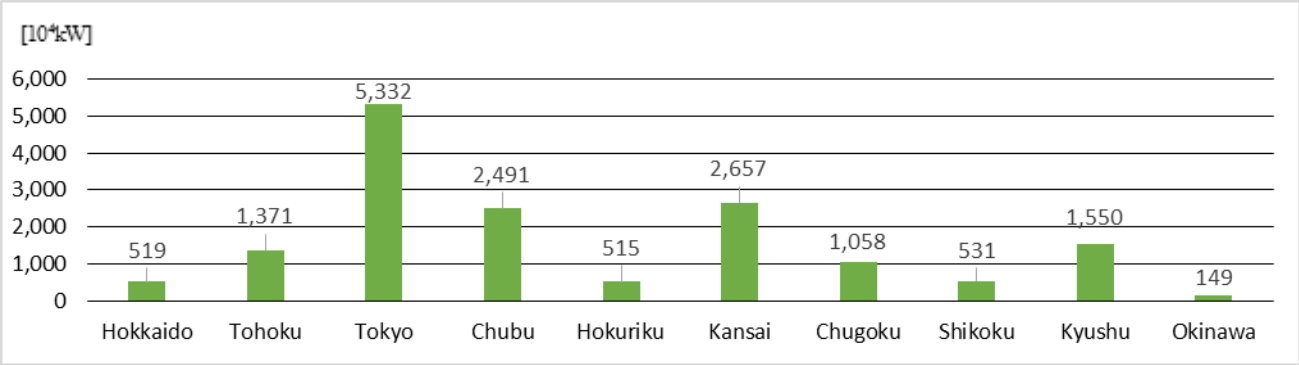


Figure 1-4 Annual Peak Demand for Regional Service Areas (FY 2016)

5. Actual Nationwide Electric Energy Requirements

Table 1-5 shows the monthly electric energy requirements for regional service areas in FY 2016, Figures 1-5 and 1-6 show the nationwide monthly electric energy requirements, and annual electric energy requirements for regional service areas, respectively.

Table 1-5 Monthly Electric Energy Requirement for Regional Service Areas (FY 2016)

[TWh]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido	2,378	2,256	2,221	2,361	2,493	2,303	2,438	2,782	3,202	3,293	2,884	2,827	31,440
Tohoku	6,187	5,989	6,048	6,534	6,957	6,323	6,296	6,892	7,638	8,228	7,462	7,633	82,187
Tokyo	20,836	21,119	21,756	24,659	26,002	23,660	21,779	22,935	24,933	26,605	23,993	25,147	283,426
Chubu	9,758	9,801	10,476	11,825	12,178	11,313	10,467	10,540	11,585	12,389	11,577	11,893	133,802
Hokuriku	2,180	2,122	2,221	2,488	2,576	2,336	2,261	2,420	2,688	2,918	2,718	2,728	29,657
Kansai	10,600	10,752	11,200	13,369	14,011	12,175	11,267	11,224	12,643	13,625	12,572	12,665	146,103
Chugoku	4,536	4,573	4,738	5,480	5,692	4,976	4,754	4,865	5,499	5,959	5,432	5,485	61,988
Shikoku	2,080	2,096	2,191	2,599	2,729	2,318	2,176	2,151	2,440	2,615	2,390	2,436	28,219
Kyushu	5,745	6,345	6,789	7,678	8,514	7,061	6,722	6,588	7,462	7,851	7,237	7,443	85,433
Okinawa	591	691	789	874	862	785	778	592	572	574	525	564	8,197
Nationwide	64,893	65,743	68,429	77,866	82,015	73,249	68,940	70,989	78,661	84,057	76,790	78,820	890,451

* The value in red is the maximum monthly energy requirement and the value in blue is the lowest monthly energy requirement for each regional service area, respectively.

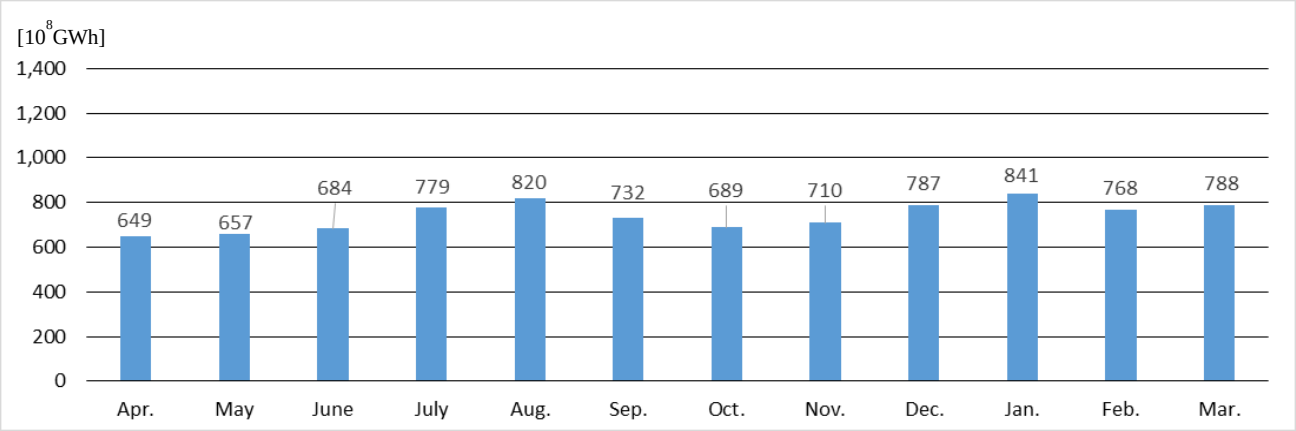


Figure 1-5 Nationwide Monthly Electric Energy Requirements (FY 2016)

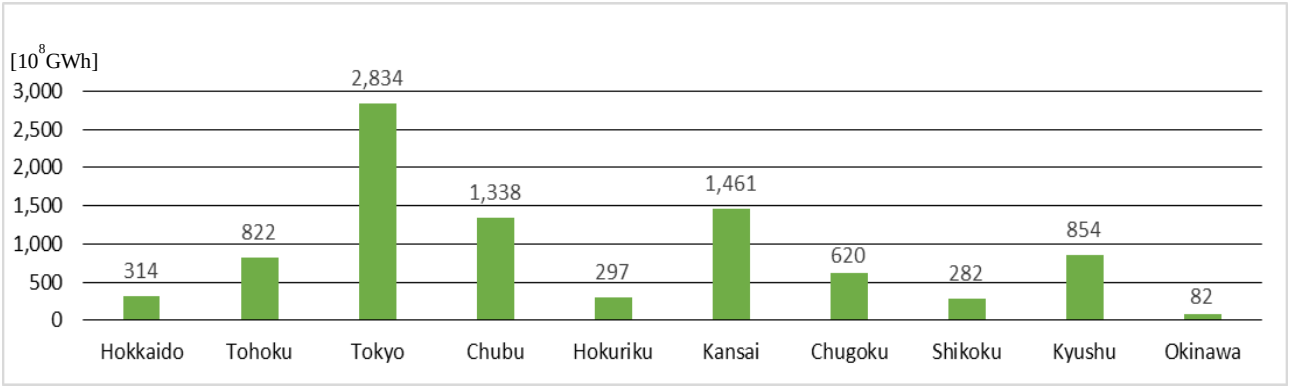


Figure 1-6 Annual Electric Energy Requirements for Regional Service Areas (FY 2016)

6. Nationwide Load Factor*

The load factor describes the ratio of average demand to peak demand in a given period. Table 1-6 shows the monthly load factor for regional service areas in FY 2016, Figures 1-8 and 1-9 show the nationwide monthly load factor, and the annual load factor in regional service areas, respectively.

Table 1-6 Monthly Load Factor in Regional Service Areas (FY 2016)

[%]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido	82.7	82.5	83.6	80.1	78.9	76.4	76.8	82.7	85.9	85.3	82.7	84.9	**69.2**
Tohoku	81.0	80.7	81.9	71.3	72.7	69.9	80.8	78.9	78.7	80.7	81.0	82.0	**68.4**
Tokyo	76.4	70.6	72.7	68.5	65.5	67.7	70.0	66.8	74.1	73.0	72.0	74.5	**60.7**
Chubu	75.4	70.1	71.5	68.7	65.7	68.3	71.1	75.0	74.6	71.2	77.1	77.0	**61.3**
Hokuriku	81.1	74.2	76.9	71.0	69.7	72.1	77.2	80.7	73.7	76.2	80.5	77.8	**65.7**
Kansai	78.4	74.0	74.6	70.7	70.9	67.7	72.0	77.9	76.1	74.0	77.0	79.5	**62.8**
Chugoku	83.7	79.3	78.6	74.4	72.3	71.6	74.4	81.1	78.5	77.7	79.8	81.5	**66.9**
Shikoku	82.3	76.7	73.7	71.7	69.1	70.5	72.2	79.3	77.7	74.4	76.8	79.8	**60.7**
Kyushu	75.9	75.5	76.7	70.1	73.8	74.4	70.8	79.2	77.0	72.9	74.8	79.3	**62.9**
Okinawa	75.3	72.1	75.9	81.5	77.8	76.7	76.7	73.9	78.1	79.9	76.0	79.6	**62.8**
Nationwide	79.5	75.8	77.9	74.3	71.3	71.7	74.6	75.6	77.1	76.3	80.1	83.3	**65.8**

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

* The value in blue is the lowest monthly load factor for each regional service area.

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

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

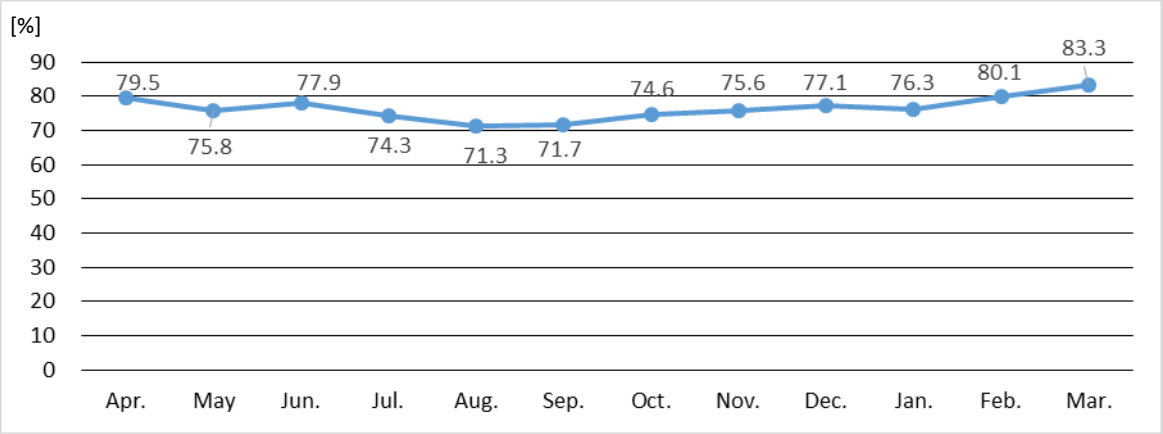


Figure 1-7 Nationwide Monthly Load Factor (FY 2016)

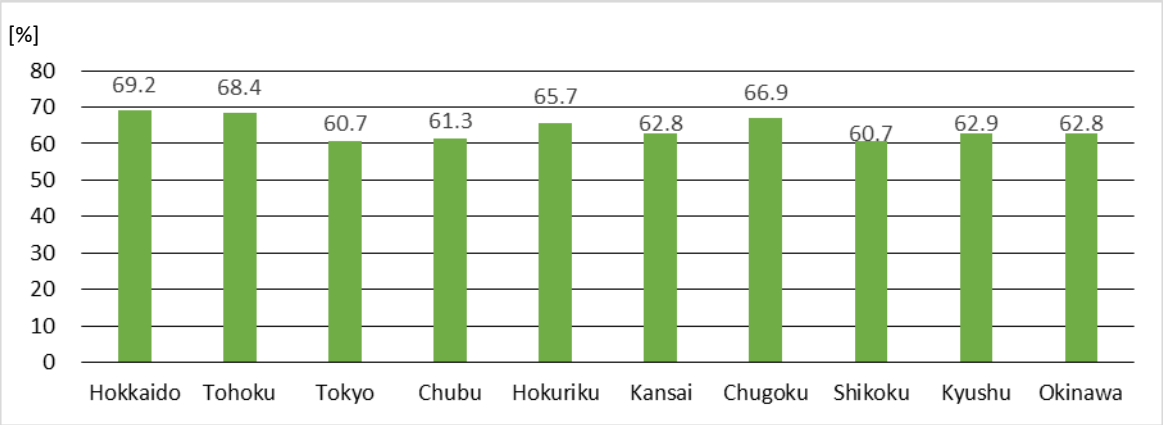


Figure 1-8 Annual Load Factor for Regional Service Areas (FY 2016)

7. Nationwide Supply-Demand Status during Peak Demand

(1) Nationwide Supply-Demand during the Summer Peak Demand (July to September)

Table 1-7 shows the supply-demand status during the summer peak demand period for regional service areas in FY 2016.

Table 1-7 Supply-Demand Status during the Summer Peak Demand Period for Regional Service Areas (FY 2016)

	FY 2016									
	Peak Demand [10^4 kW]	Occurrence date & time			Daily Max. Temperature [°C]	Supply Capacity [10^4 kW]	Reserve Capacity [10^4 kW]	Reserve Margin [%]	Daily Energy Supply [10^4 kWh]	Daily Load Factor [%]
Hokkaido	425	8/8	Mon	17	30.4	520	95	22.4	8,645	84.8
Tohoku	1,286	8/5	Fri	15	33.5	1,606	320	24.8	24,806	80.4
Tokyo	5,332	8/9	Tue	15	37.7	5,985	653	12.2	99,196	77.5
Chubu	2,491	8/8	Mon	15	37.8	2,717	227	9.1	44,498	74.4
Hokuriku	497	8/25	Thu	15	34.2	552	56	11.2	9,559	80.1
Kansai	2,657	8/22	Mon	14	36.3	2,917	260	9.8	49,967	78.4
Chugoku	1,058	8/25	Thu	15	35.2	1,180	122	11.5	20,289	79.9
Shikoku	531	8/22	Mon	15	35.7	606	75	14.2	9,697	76.1
Kyushu	1,550	8/22	Mon	15	34.3	1,738	188	12.1	29,711	79.9
Okinawa	149	8/24	Wed	14	33.5	206	57	38.2	3,022	84.6
Nationwide	15,589	8/9	Tue	15	-	17,764	2,176	14.0	297,969	79.6

* The daily maximum temperatures are provided by the Japan Meteorological Agency based on the data for the cities where the headquarters of general transmission and distribution companies except the Okinawa EPCO are located. (For the regional service area of the Okinawa EPCO, the data for Naha, prefectural capital of Okinawa was 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 1-8 shows the supply-demand status during the winter peak demand period for regional service areas in FY 2016.

Table 1-8 Supply-Demand Status during the Winter Peak Demand Period for Regional Service Areas (FY 2016)

	FY 2016									
	Peak Demand [10^4 kW]	Occurrence date & time			Daily Mean Temperature [℃]	Supply Capacity [10^4 kW]	Reserve Capacity [10^4 kW]	Reserve Margin [%]	Daily Energy Supply [10^4 kWh]	Daily Load Factor [%]
Hokkaido	519	2/3	Fri	5	-4.6	584	65	12.5	11,365	91.2
Tohoku	1,371	1/24	Tue	18	-2.3	1,576	204	14.9	30,325	92.2
Tokyo	4,957	2/9	Thu	18	2.4	5,230	274	5.5	99,065	83.3
Chubu	2,337	1/16	Mon	10	1.8	2,510	173	7.4	46,268	82.5
Hokuriku	515	1/24	Tue	11	-1.3	565	50	9.7	11,422	92.4
Kansai	2,476	1/23	Mon	18	2.4	2,652	176	7.1	50,822	85.5
Chugoku	1,031	1/17	Tue	10	3.6	1,134	104	10.1	21,332	86.2
Shikoku	473	1/23	Mon	19	3.1	506	34	7.2	9,658	85.2
Kyushu	1,447	1/23	Mon	19	3.2	1,609	162	11.2	29,562	85.1
Okinawa	103	2/11	Sat	20	13.0	143	40	38.9	2,068	83.7
Nationwide	14,914	1/24	Tue	19	-	16,354	1,440	9.7	314,968	88.0

* The daily maximum temperatures are provided by the Japan Meteorological Agency based on the data for the cities where the headquarters of general transmission and distribution companies except the Okinawa EPCO are located. (For the regional service area of the Okinawa EPCO, the data for Naha, prefectural capital of Okinawa was used instead).

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

* Supply capacity in the above table 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 decreases in river flow, and unplanned generator outages.

8. Nationwide Bottom Demand Period

Table 1-9 shows the status of the bottom demand period for regional service areas (FY 2016).

Table 1-9 Bottom Demand Period for Regional Service Areas (FY 2016)

	FY 2016					
	Bottom Demand [10^4 kW]	Occurrence date & time			Daily Mean Temperature [°C]	Daily Energy Requirement [10^4 kWh]
Hokkaido	242	9/19	Mon	2	14.9	6,997
Tohoku	630	5/4	Wed	2	15.7	17,031
Tokyo	2,024	5/6	Fri	2	18.1	65,720
Chubu	869	5/5	Thu	2	20.4	24,765
Hokuriku	202	5/4	Wed	8	20.5	5,430
Kansai	1,031	5/4	Wed	7	20.5	28,768
Chugoku	473	5/2	Mon	1	20.2	13,182
Shikoku	203	5/8	Sun	8	19.3	5,921
Kyushu	528	4/17	Sun	1	17.5	15,163
Okinawa	57	1/2	Mon	7	21.2	1,664
Nationwide	6,516	5/5	Thu	2	-	180,687

* The daily maximum temperatures are provided by the Japan Meteorological Agency based on the data for the cities where the headquarters of general transmission and distribution companies except the Okinawa EPCO are located. (For the regional service area of the Okinawa EPCO, the data for Naha, prefectural capital of Okinawa was used instead).

9. Nationwide Peak Daily Energy Supply

Tables 1-10 and 1-11 show the summer peak daily energy supply for regional service areas in FY 2016(July to September) and the winter peak daily energy supply for regional service areas in FY 2016(December to the following February), respectively.

Table 1-10 Summer Peak Daily Energy Supply for Regional Service Areas (FY 2016)

	FY 2016(at the sending end)			
	Daily Energy Supply [10^4 kWh]	Occurrence Date		Daily Mean Temperature [°C]
Hokkaido	8,695	8/3	Wed	25.0
Tohoku	24,806	8/5	Fri	28.2
Tokyo	99,196	8/9	Tue	31.9
Chubu	45,440	8/9	Tue	30.1
Hokuriku	9,559	8/25	Thu	28.7
Kansai	50,292	8/5	Fri	30.4
Chugoku	20,289	8/25	Thu	30.0
Shikoku	9,749	8/9	Tue	30.6
Kyushu	29,752	8/9	Tue	30.1
Okinawa	3,022	8/24	Wed	30.8
Nationwide	297,969	8/9	Tue	-

Table 1-11 Winter Peak Daily Energy Supply for Regional Service Areas (FY 2016)

	FY 2016(at the sending end)			
	Daily Energy Supply [10^4 kWh]	Occurrence Date		Daily Mean Temperature [°C]
Hokkaido	11,834	1/24	Tue	-9.1
Tohoku	30,325	1/24	Tue	-2.3
Tokyo	100,371	1/20	Fri	3.0
Chubu	47,939	1/24	Tue	1.0
Hokuriku	11,422	1/24	Tue	-1.3
Kansai	51,604	1/24	Tue	2.9
Chugoku	21,796	1/24	Tue	2.1
Shikoku	9,658	1/23	Mon	3.1
Kyushu	30,405	2/10	Fri	3.1
Okinawa	2,068	2/11	Sat	13.0
Nationwide	314,968	1/24	Tue	-

* The daily maximum temperatures are provided by the Japan Meteorological Agency based on the data for the cities where the headquarters of general transmission and distribution companies except the Okinawa EPCO are located. (For the regional service area of the Okinawa EPCO, the data for Naha, prefectural capital of Okinawa was used instead).

10. Actual Power Exchange Instructed by the Organization

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 the 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 the FY 2016, the Organization has required the EPCOs to exchange power twice (Table 1-12) according to items 1 to 3, paragraph 1 of Article 111 of the Operational Rules.

In addition, according to items 4 to 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, there were no actual instructions.

Table 1-12 Actual Power Exchange Instructions by the Organization (FY 2016)

①	Date	September 8, 2016 at 14:27
	Instruction	・TEPCO PG shall supply 1,300 MW of electricity at most to Chubu EPCO from 14:30 till 20:00. ・Hokuriku EPCO shall supply 100MW of electricity at most to Chubu EPCO from 14:30 till 20:00. ・The Kansai EPCO shall supply 1,600MW of electricity at most to Chubu EPCO from 14:30 till 20:00. ・Chubu EPCO shall be supplied 3,000MW of electricity at most by TEPCO PG, Hokuriku, and the Kansai EPCO from 14:30 till 20:00.
	Date	September 8, 2016 at 19:35
	Instruction	・TEPCO PG shall supply 1,000MW of electricity at most to Chubu EPCO from 20:00 till 22:00. ・Hokuriku EPCO shall supply 425MW of electricity at most to Chubu EPCO from 20:00 till 22:00. ・The Kansai EPCO shall supply 1,400MW of electricity at most to Chubu EPCO from 20:00 till 22:00. ・The Chugoku EPCO shall supply340MW of electricity at most to Chubu EPCO from 20:00 till 22:00. ・Chubu EPCO shall be supplied 2,940MW of electricity at most by TEPCO PG, Hokuriku, the Kansai, and the Chugoku EPCO from 20:00 till 22:00.
	Date	September 8, 2016 at 20:20
	Instruction	・TEPCO PG shall supply 735MW of electricity at most to Chubu EPCO from 22:00 till 22:30. ・Chubu EPCO shall be supplied 735MW of electricity at most by TEPCO PG from 22:00 till 22:30.
	Reason	The supply-demand status might degrade without power exchanges through cross-regional interconnection lines because of generator shutdowns due to the outages of Lines No.1 & 2 of the Koda-Hekinan Line in the regional service area of Chubu EPCO.
②	Date	February 21, 2017 at 16:25
	Instruction	・Hokuriku EPCO shall supply 100MW of electricity at most to Chubu EPCO from 17:30 till 19:00. ・The Kansai EPCO shall supply 800MW of electricity at most to Chubu EPCO from 17:00 till 20:00. ・The Chugoku EPCO shall supply 150MW of electricity at most to Chubu EPCO from 17:30 till 19:30. ・Kyushu EPCO shall supply 350MW of electricity at most to Chubu EPCO from 18:00 till 19:00. ・Chubu EPCO shall be supplied 1,400MW of electricity at most by Hokuriku, the Kansai, the Chugoku, and Kyushu EPCO from 17:00 till 20:00.
	Reason	The supply-demand status might degrade without power exchanges through cross-regional interconnection lines because of generator shutdowns due to the outages of Lines No.1 & 2 of Joetsu Thermal Power Line and demand increase in demand because of cold weather in the regional service area of Chubu EPCO.

11. Output Shedding of Renewable Energy-Generating Facilities Operated by the Electric Power Companies other than General Transmission and Distribution Companies

General transmission and distribution companies may order renewable energy generating facilities of other electric power companies to shed their output in case of expected oversupply to the demand for its regional service area after shedding the output of generators other than renewable energy-generating facilities of the general transmission and distribution company according to the provision of the "Ministerial Ordinance of Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electric Utilities."

Table 1-13 shows the actual output shedding of renewable energy-generating facilities in FY 2016.

Table 1-13 Actual Output Shedding of Renewable Energy-Generating Facilities (FY 2016)

Regional Service Area	Output Shedding Period	Total Capacity Shed	Reason
Kyushu EPCO (Iki Island)	Friday, Apr. 15, 2016 from 9:00 till 16:00	250 kW	Possible insufficiency of ability to reduce power supply[*1] is expected.
Kyushu EPCO (Tanegashima Island)	Friday, Apr. 15, 2016 from 9:00 till 16:00	920 kW	
Kyushu EPCO (Tanegashima Island)	Tuesday, Apr. 19, 2016 from 9:00 till 16:00	2,080 kW	
Kyushu EPCO (Tanegashima Island)	Wednesday, Apr. 20, 2016 from 9:00 till 16:00	460 kW	
Kyushu EPCO (Iki Island)	Friday, Apr. 29, 2016 from 9:00 till 16:00	440 kW	
Kyushu EPCO (Tanegashima Island)	Friday, Apr. 29, 2016 from 9:00 till 16:00	2,880 kW	
Kyushu EPCO (Iki Island)	Saturday, Apr. 30, 2016 from 9:00 till 16:00	760 kW	
Kyushu EPCO (Iki Island)	Sunday, May 1, 2016 from 9:00 till 16:00	430 kW	
Kyushu EPCO (Iki Island)	Wednesday, May 4, 2016 from 9:00 till 16:00	1,420 kW	
Kyushu EPCO (Tanegashima Island)	Wednesday, May 4, 2016 from 9:00 till 16:00	2,210 kW	
Kyushu EPCO (Iki Island)	Saturday, May 7, 2016 from 9:00 till 16:00	760 kW	

Table 1-13(continued) Actual Output Shedding of Renewable Energy-Generating Facilities (FY 2016)

Regional Service Area	Output Shedding Period	Total Capacity Shed	Reason
Kyushu EPCO (Tanegashima Island)	Tuesday, Dec. 6, 2016 from 9:00 till 16:00	930 kW	Possible insufficiency of ability to reduce power supply*1 is expected.
Kyushu EPCO (Tanegashima Island)	Saturday, Dec. 10, 2016 from 9:00 till 16:00	1,160 kW	
Kyushu EPCO (Tanegashima Island)	Sunday, Dec. 11, 2016 from 9:00 till 16:00	960 kW	
Kyushu EPCO (Tanegashima Island)	Tuesday, Jan. 3, 2017 from 9:00 till 16:00	980 kW	
Kyushu EPCO (Tanegashima Island)	Wednesday, Jan. 4, 2017 from 9:00 till 16:00	220 kW	
Kyushu EPCO (Tanegashima Island)	Sunday, Jan. 15, 2017 from 9:00 till 16:00	450 kW	
Kyushu EPCO (Tanegashima Island)	Sunday, Feb. 19, 2017 from 9:00 till 16:00	1,040 kW	
Kyushu EPCO (Tanegashima Island)	Saturday, Feb. 25, 2017 from 9:00 till 16:00	360 kW	
Kyushu EPCO (Tanegashima Island)	Saturday, Mar. 11, 2017 from 9:00 till 16:00	1,330 kW	
Kyushu EPCO (Tanegashima Island)	Wednesday, Mar. 15, 2017 from 9:00 till 16:00	590 kW	
Kyushu EPCO (Tanegashima Island)	Friday, Mar. 17, 2017 from 9:00 till 16:00	670 kW	
Kyushu EPCO (Iki Island)	Sunday, Mar. 19, 2017 from 9:00 till 16:00	1,090 kW	
Kyushu EPCO (Tanegashima Island)	Tuesday, Mar. 28, 2017 from 9:00 till 16:00	1,660 kW	

*1 "Insufficient ability to reduce the power supply" describes the case where "balancing capacity for redundancy"*2 becomes insufficient in regional service areas, and members who are general transmission and distribution companies cannot resolve the electricity surplus even by suppressing the output from power generators that are not able to be adjusted online.

*2 "Balancing capacity for redundancy" describes the balancing capacity to suppress supply or increase the demand for electricity when the amount of supply exceeds the demand in regional service areas.

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" describes transmission lines with 250 kV or more and AC/DC convertors that firmly connect the regional service areas of members who are general transmission and distribution companies. Electric power supply outside each service area is made available through the interconnection lines. The Organization shall direct members to supply electricity through the cross-regional interconnection lines and secure the supply-demand balance at the insufficient supply capacity for each regional service area. Figure 2-1 and Table 2-1 show the cross-regional interconnection lines in Japan.

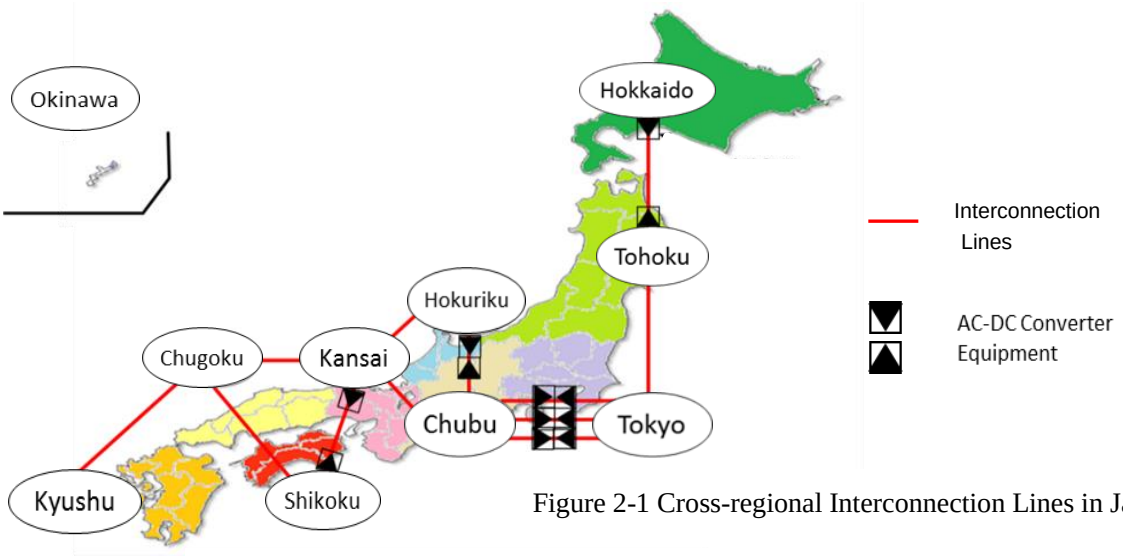


Figure 2-1 Cross-regional Interconnection Lines in Japan

Table 2-1 Summary of Cross-regional Interconnection Lines

Interconnection Lines	Areas・Directions				Corresponding Facilities	AC/DC
Interconnection facilities between Hokkaido and Honshu	Forward	Hokkaido	→	Tohoku	Interconnection facilities between Hokkaido and Honshu AC/DC C.S.	DC
	Counter	Tohoku	→	Hokkaido		
Interconnection line between Tohoku and Tokyo	Forward	Tohoku	→	Tokyo	Soma-Futaba 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 shall manage the interconnection lines according to the Operational Rules using the following procedures.

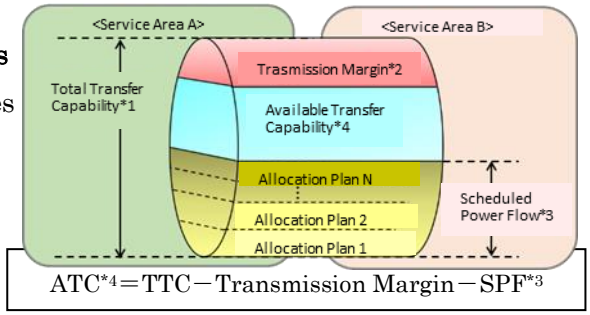


Figure 2-2 Management of Interconnection Lines

(a) Establishing TTC*1 and Transmission Margin*2

(b) Management of SPF of Interconnection Line

i. The Organization shall receive the submission of a plan specifying the capability to utilize the desired interconnection line (hereinafter, "request plan") and deliver them to the general transmission and distribution companies related to the relevant interconnection lines (hereinafter, "relevant general transmission and distribution companies").

ii. The Organization shall judge whether the request plans of the interconnection line are acceptable for registration for the Scheduled Power Flow (such judgment shall be called "determination of transfer capability allocation" hereinafter). There are "forward flows" and "counter flows" in the "capability allocation plan." However, the actual flows on the transmission lines are offset in each direction. Thus, scheduled power flows are the offset figure between forward flows and counter flows, not the simple addition of each direction.

iii. When the Organization determined that the requested plans of the interconnection lines are acceptable for transmission after determining the transfer-capability allocation, it shall register such plans for a scheduled power flow (called "capability registration").

iv. When the Organization conducts capability registration, it shall notify the applicants for interconnection use and the relevant general transmission and distribution companies (requested plan for the interconnected lines on which capability registration was conducted shall be called the "capability allocation plan of the interconnection lines").

(c) Revision and Change in the Capability Allocation Plan

(d) Congestion Management

When congestion occurs on the interconnection line, the Organization shall take steps to dissolve the congestion by following capability allocation plans and the reported figures registered for a scheduled power flow. When the Organization manages the congestion, it shall notify the interconnection line users with a decreased capability allocation plan for the interconnection line or reported figures and the relevant general transmission and distribution companies about the decreased line cross-section and capability.

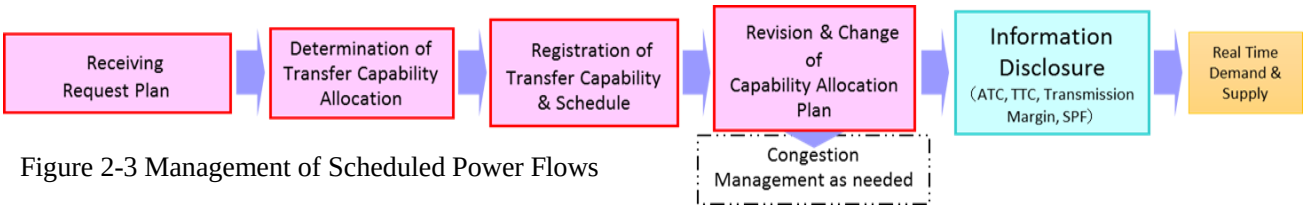


Figure 2-3 Management of Scheduled Power Flows

*1 The "total transfer capability" (TTC) describes the maximum electricity that can be sent to the distribution facilities while securing supply reliability without damaging the transmission and distribution facilities.

*2 The "transmission margin" describes the electricity capability managed by the Organization as a part of the TTC of the interconnection lines to receive electricity from other regional service areas through the interconnection lines under abnormal states of the electric network, supply shortages or other emergent states, to ensure that the electric network remains stabilized, or to develop a market trading environment for electricity.

*3 The "scheduled power flow" describes the electricity capacity managed by the Organization as the total capability registered by interconnection line users.

*4 The "available transfer capability" (ATC) describes the TTC of the interconnection lines managed by the Organization minus the capability secured for transmission margin, scheduled power flow, and cross-regional frequency control.

*5 "Congestion" refers to the condition where the ATC becomes negative.

2. Actual Utilization of Cross-regional Interconnection Lines

The following are the actual utilization of cross-regional interconnection lines that are managed according to the provision of Article 124 of the Operational Rules.

(1) Actual Utilization of Cross-regional Interconnection Lines for FY 2016

Table 2-2 and Figure 2-4 show the monthly utilization of cross-regional interconnection lines for regional service areas in FY 2016.

Table 2-2 Monthly Utilization of Cross-regional Interconnection Lines for Regional Service Areas (FY 2016)

[GWh]

Interconnection/Direction		Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Hokkaido - Honshu	→Tohoku (Forward)	18	21	13	37	48	32	7	7	13	5	8	26	**237**
	→Hokkaido (Counter)	55	50	76	76	91	69	55	99	112	130	112	108	**1,033**
Tohoku-Tokyo	→Tokyo (Forward)	1,631	1,818	1,627	2,175	2,289	2,113	1,829	1,660	1,784	2,174	1,979	2,018	**23,097**
	→Tohoku (Counter)	186	119	191	411	447	404	417	471	485	587	546	396	**4,660**
Tokyo-Chubu	→Chubu (Forward)	44	69	107	107	180	150	166	174	460	396	460	416	**2,729**
	→Tokyo (Counter)	261	353	382	435	492	520	410	407	508	542	485	348	**5,144**
Chubu-Kansai	→Kansai (Forward)	274	407	370	321	450	421	510	324	618	569	667	607	**5,538**
	→Chubu (Counter)	273	311	435	542	606	753	632	685	646	649	582	431	**6,544**
Chubu-Hokuriku	→Hokuriku (Forward)	4	10	3	10	27	4	4	17	21	61	54	28	**241**
	→Chubu (Counter)	23	6	4	10	8	3	0	0	0	0	0	5	**59**
Hokuriku - Kanasai	→Kansai (Forward)	191	218	147	226	199	202	145	98	196	134	151	127	**2,033**
	→Hokuriku (Counter)	30	17	31	46	40	38	58	59	35	77	87	121	**640**
Kansai-Chugoku	→Chugoku (Forward)	10	23	39	56	95	49	56	41	59	61	111	114	**716**
	→Kansai (Counter)	866	727	804	968	1,034	1,365	1,200	1,401	1,337	1,271	1,059	1,146	**13,179**
Kansai-Shikoku	→Shikoku (Forward)	0	1	1	0	0	0	0	0	0	0	0	0	**2**
	→Kansai (Counter)	442	492	477	785	959	952	796	952	787	974	487	753	**8,856**
Chugoku-Shikoku	→Shikoku (Forward)	219	177	230	254	260	298	317	311	324	336	328	240	**3,294**
	→Chugoku (Counter)	240	282	296	390	516	1,002	966	908	863	858	594	724	**7,638**
Chugoku-Kyushu	→Kyushu (Forward)	73	108	133	178	232	190	216	152	180	187	139	149	**1,935**
	→Chugoku (Counter)	1,083	987	1,190	1,282	1,289	1,332	1,354	1,371	1,404	1,466	1,458	1,261	**15,476**

* 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 capabilities and the values in blue are the annual minimum capabilities for each line and direction, respectively.

Figure 2-4 Monthly Utilization of Cross-regional Interconnection Lines for Regional Service Areas (FY 2016)

(2) Actual Utilization of Cross-regional Interconnection Lines for FYs 2010 to 2016

Table 2-3 and Figure 2-5 show the annual utilization of cross-regional interconnection lines for regional service areas for FYs 2010 to 2016.

Table 2-3 Annual Utilization of Cross-regional Interconnection Lines for Regional Service Areas (FYs 2010 to 2016)

[GWh]

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

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

* The value in red is the annual maximum capability and the value in blue is the annual minimum capability in each line and direction for 7 years, respectively.

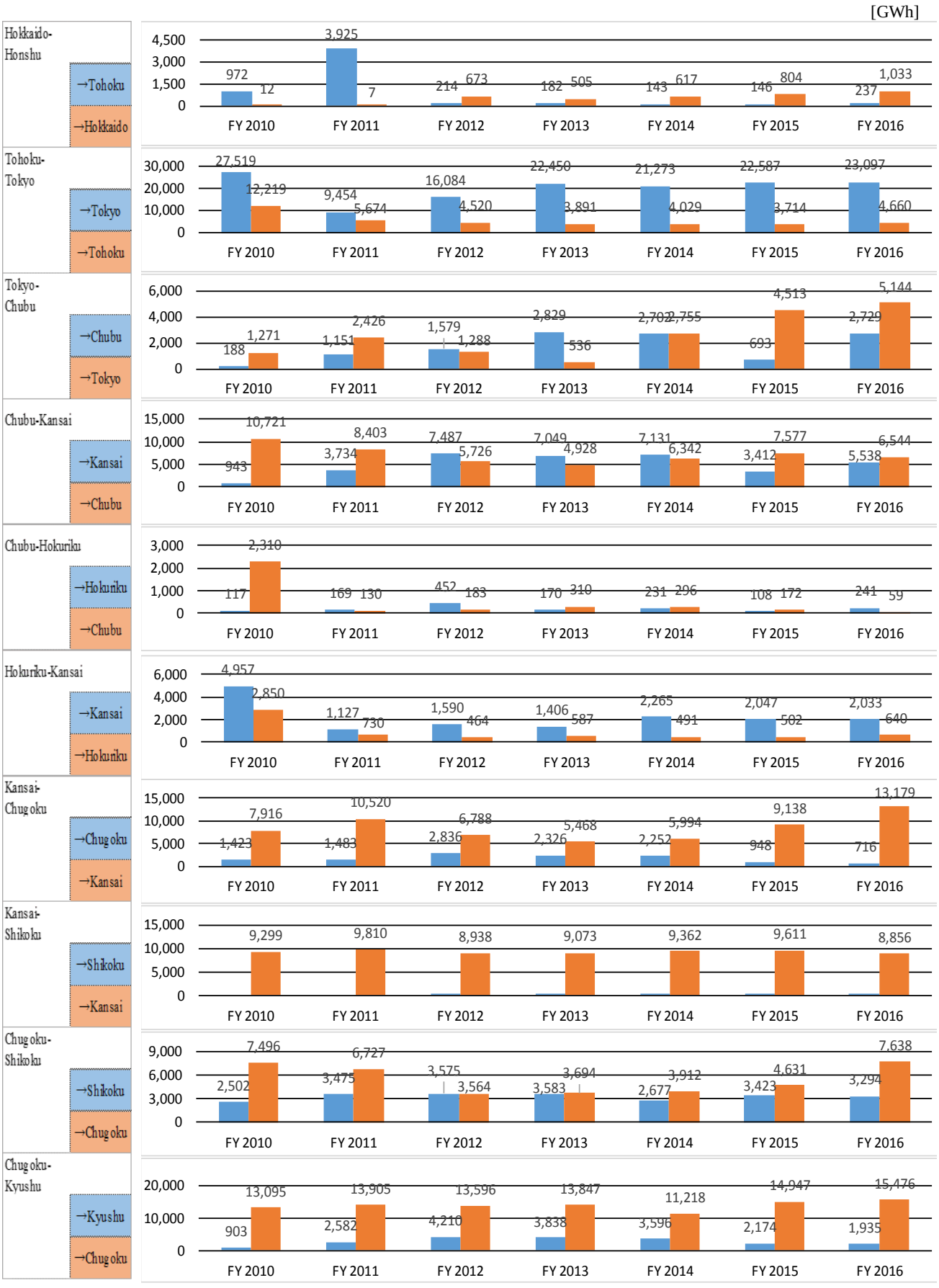


Figure 2-5 Annual Utilization of Cross-regional Interconnection Lines for Regional Service Areas (FYs 2010 to 2016)

(3) Monthly Utilization of Cross-regional Interconnection Lines by Transaction in FY 2016

Table 2-4 shows the monthly utilization of cross-regional interconnection lines by transaction in FY 2016.

Table 2-4 Monthly Utilization of Cross-regional Interconnection Lines by Transaction (FY 2016) [GWh]

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
Bi-lateral	5,011	5,267	5,465	6,900	7,832	8,323	7,588	7,766	7,744	8,480	7,343	7,124	**84,843**
Day-ahead	911	929	877	1,037	1,107	1,266	1,314	1,134	1,684	1,578	1,548	1,433	**14,817**
Hour-ahead	0	0	215	368	323	310	235	239	405	419	416	462	**3,392**

* The values in red are the annual maximum capability and the values in blue are the annual minimum capability, respectively.

(4) Annual Utilization of Cross-regional Interconnection Lines by Transaction for FYs 2010 to 2016

Table 2-5 and Figures 2-6, 2-7, and 2-8 show the annual utilization of cross-regional interconnection lines by transaction for FYs 2010 to 2016.

Table 2-5 Annual Utilization of Cross-regional Interconnection Lines by Transaction (FYs 2010 to 2016) [GWh]

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
Bi-lateral	100,444	79,693	76,328	73,289	71,558	75,947	**84,843**
Day-ahead	6,251	5,718	7,155	11,632	14,174	13,152	**14,817**
Hour-ahead	2	22	493	1,750	1,554	2,050	**3,392**

* "Hour-ahead" describes the transaction that is 4 hours before the gate closure by FY 2015. From FY 2016, the transaction refers to those that are 1 hour ahead before the gate closure.

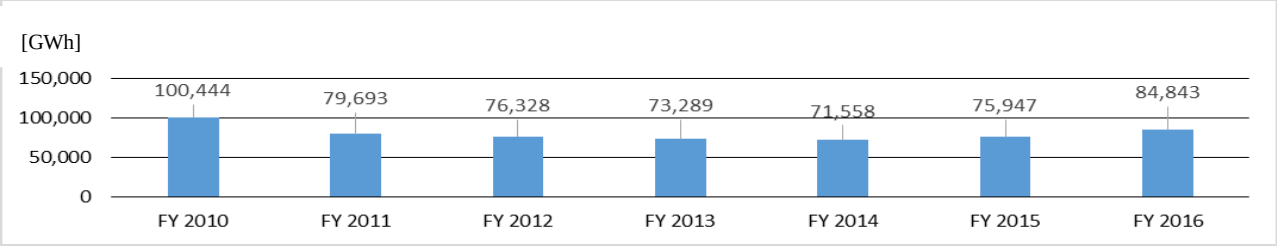


Figure 2-6 Annual Utilization of Cross-regional Interconnection Lines by Bilateral Transaction (FYs 2010 to 2016)

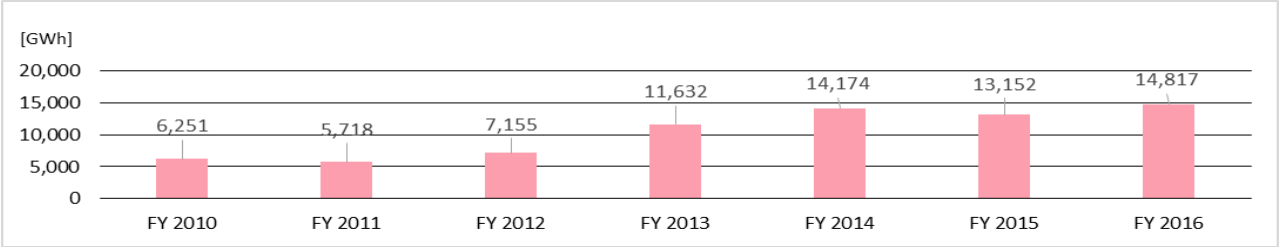


Figure 2-7 Annual Utilization of Cross-regional Interconnection Lines by Day-ahead Transaction (FYs 2010 to 2016)

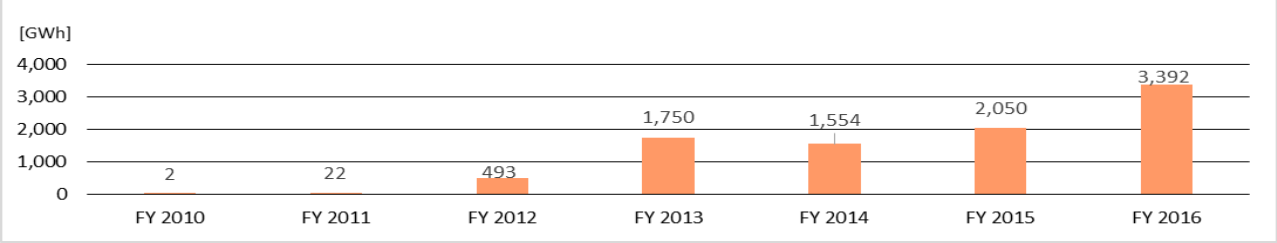


Figure 2-8 Annual Utilization of Cross-regional Interconnection Lines by Hour-ahead Transaction (FYs 2010 to 2016)

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

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

(1) Monthly Congestion Management of Cross-regional Interconnection Lines by Weekly Plan Submission in FY 2016

Table 2-6 shows the monthly congestion management of cross-regional interconnection lines by the timing of weekly plan submissions in FY 2016.

Table 2-6 Monthly Congestion Management of Cross-regional Interconnection Lines by the Timing of Weekly Plan Submissions (FY 2016)

[h]

Interconnection	Weekly Plan Submission	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	**Annual**
Hokkaido-Honshu	Total	0	431	65	33	6	123	340	228	423	0	2	0	**1,650**
	Before Submission	0	252	0	0	0	70	288	0	420	0	0	0	**1,030**
	After Submission	0	179	65	33	6	53	52	228	3	0	2	0	**620**
Tohoku-Tokyo	Total	0	0	0	0	0	0	0	0	0	0	0	6	**6**
	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	6	**6**
Tokyo-Chubu	Total	275	239	58	43	0	59	209	225	76	498	10	531	**2,221**
	Before Submission	275	179	0	0	0	0	140	194	56	496	0	431	**1,771**
	After Submission	0	60	58	43	0	59	69	31	20	2	10	100	**450**
Chubu-Kansai	Total	118	154	0	0	0	0	0	0	0	0	0	4	**276**
	Before Submission	118	150	0	0	0	0	0	0	0	0	0	0	**268**
	After Submission	0	4	0	0	0	0	0	0	0	0	0	4	**8**
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	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-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	24	120	0	0	0	0	0	0	0	**144**
	Before Submission	0	0	0	24	120	0	0	0	0	0	0	0	**144**
	After Submission	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Chugoku-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-Kyushu	Total	140	182	0	121	10	240	154	14	0	10	0	0	**871**
	Before Submission	140	182	0	120	10	240	154	14	0	10	0	0	**870**
	After Submission	0	0	0	1	0	0	0	0	0	0	0	0	**1**
Nationwide		**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

* Total hours for allocation plans that managed to mitigate congestion.
* The managed hours are collected as 30 minutes and rounded up to an hour.

(2) Annual Congestion Management of Cross-regional Interconnection Lines by Weekly Plan Submission for FYs 2010 to 2016

Table 2-7 and Figure 2-9 show the annual congestion management of cross-regional interconnection lines by the timing of weekly plan submissions for FYs 2010 to 2016.

Table 2-7 Annual Congestion Management of Cross-regional Interconnection Lines by the Timing of Weekly Plan Submissions (FYs 2010 to 2016) [h]

		Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
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 value in red is the annual maximum capability.
* The managed hours are collected as 30 minutes and rounded up to an hour.
* Total hours of utilization plans that managed to mitigate congestion.

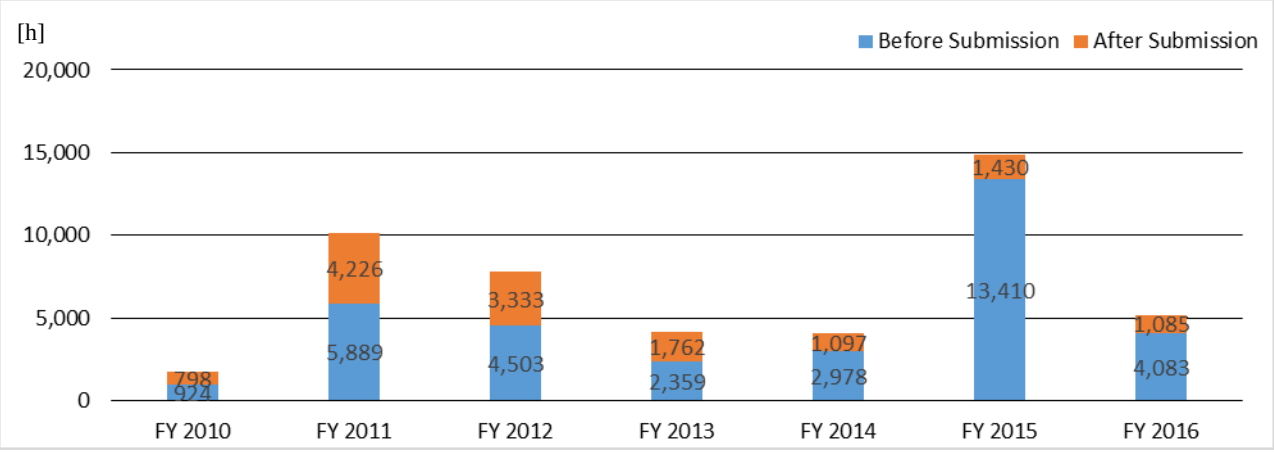


Figure 2-9 Annual Congestion Management of Cross-regional Interconnection Lines by the Timing of Weekly Plan Submissions (FYs 2010 to 2016)

(3) Monthly Congestion Management of Cross-regional Interconnection Lines by Constraints in FY 2016

Table 2-8 shows the monthly congestion management of cross-regional interconnection lines by the constraints for FY 2016.

Table 2-8 Monthly Congestion Management of Cross-regional Interconnection Lines by the Constraints (FY 2016)

[h]

Interconnection	Constraints	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	**Annual**
Hokkaido-Honshu	Total	0	431	65	33	6	123	340	228	423	0	2	0	**1,650**
	Over Capability	0	431	65	33	6	123	340	228	423	0	2	0	**1,650**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Tohoku-Tokyo	Total	0	0	0	0	0	0	0	0	0	0	0	6	**6**
	Over Capability	0	0	0	0	0	0	0	0	0	0	0	6	**6**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Tokyo-Chubu	Total	275	239	58	43	0	59	209	225	76	498	10	531	**2,221**
	Over Capability	275	239	58	43	0	59	209	225	76	498	10	531	**2,221**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Chubu-Kansai	Total	118	154	0	0	0	0	0	0	0	0	0	4	**276**
	Over Capability	118	154	0	0	0	0	0	0	0	0	0	4	**276**
	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	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-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	24	120	0	0	0	0	0	0	0	**144**
	Over Capability	0	0	0	24	120	0	0	0	0	0	0	0	**144**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Chugoku-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-Kyushu	Total	140	182	0	121	10	240	154	14	0	10	0	0	**871**
	Over Capability	140	182	0	121	10	240	154	14	0	10	0	0	**871**
	Minimum Flow	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Nationwide		**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**

* Total hours of capability allocation plans that were managed to mitigate congestion.
* The managed hours are collected as 30 minutes and rounded up to an hour.

(4) Annual Congestion Management of Cross-regional Interconnection Lines by the Constraints for FYs 2010 to 2016

Table 2-9 and Figure 2-10 show the annual congestion management of cross-regional interconnection lines by the constraints for FYs 2010 to 2016.

Table 2-9 Annual Congestion Management of Cross-regional Interconnection Lines by the Constraints (FYs 2010 to 2016)

[h]

		Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
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 value in red is the annual maximum capability.
* The managed hours are collected as 30 minutes and rounded up to an hour.
* The total hours of capability allocation plans that managed to mitigate congestion.

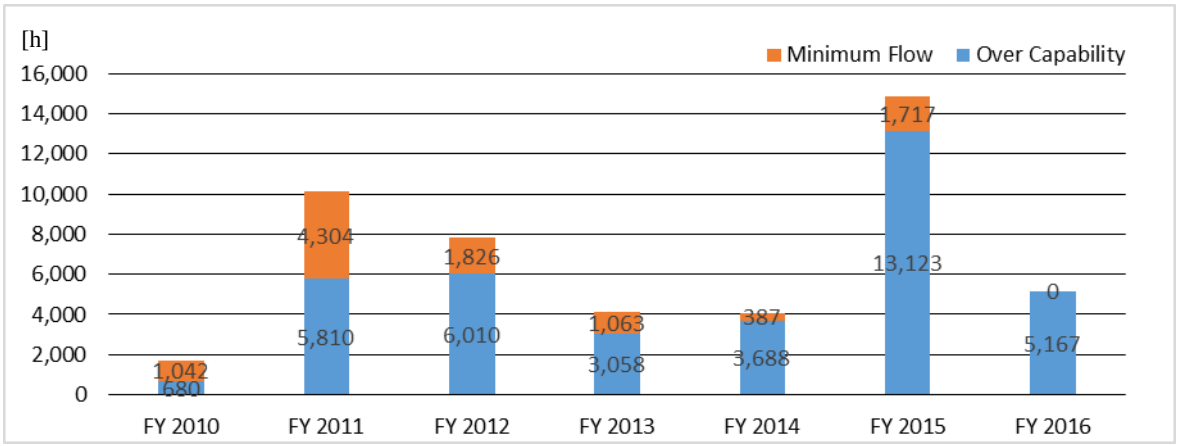


Figure 2-10 Annual Congestion Management of Cross-regional Interconnection Lines by the Constraints (FYs 2010 to 2016)

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

The following are the actual maintenance work of cross-regional interconnection lines as reported by the general transmission and distribution companies according to the provision of Article 167 of the Operational Rules.

(1) Actual Monthly Maintenance Work of Cross-regional Interconnection Lines in FY 2016

Table 2-10 shows the monthly maintenance work of cross-regional interconnection lines in FY 2016, and Figure 2-11 shows the nationwide monthly planned outage rate for FY 2016.

Table 2-10 Monthly Maintenance Work of Cross-regional Interconnection Lines (FY 2016)

Interconnection	Corresponding Facilities	Apr.		May		Jun.		Jul.		Aug.		Sep.		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		**Annual**	
		No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	**No.**	**Days**
Hokkaido-Honshu	Hokkaido and Honshu AC/DC C.S.	11	13	4	1					1	1			16	13											**32**	**28**
Tohoku-Tokyo	Soma-Futaba bulk line															8	9									**8**	**9**
Tokyo-Chubu	Sakuma FC C.S.																					1	2	1	5	**2**	**7**
	Shin Shinano FC C.S.	3	14	1	2	1	1			1	1			2	10	5	13			1	1					**14**	**42**
	Higashi Shimizu FC C.S.			2	1																			4	14	**6**	**15**
Chubu-Kansai	Mie-Higashi Omi line	9	8	6	8																			2	1	**17**	**17**
Chubu-Hokuriku	Minami Fukumitsu HVDC BTB C.S.and Minami Fukumitsu Substation	2	4									6	10	9	22											**17**	**36**
Hokuriku-Kansai	Echizen-Reinan line			3	23	3	12					8	4													**14**	**39**
Kansai-Chugoku	Seiban-Higashi Okayama line, Yamazaki-Chizu line	2	2	1	23	3	23					19	23	1	1	14	17	6	8							**46**	**97**
Kansai-Shikoku	Kihoku and Anan AC/DC C.S.	6	5											7	8					1	1	1	3	18	13	**33**	**30**
Chugoku-Shikoku	Honshi interconnection line	2	24	2	31	2	10							2	2									4	4	**12**	**71**
Chugoku-Kyushu	Kanmon interconnection line	6	30	7	22											4	8									**17**	**60**
Nationwide (Cumulative works for the same facilities deducted)		**41**	**100**	**26**	**111**	**9**	**46**	**0**	**0**	**2**	**2**	**33**	**37**	**37**	**56**	**31**	**47**	**6**	**8**	**2**	**2**	**2**	**5**	**29**	**37**	**218**	**451**

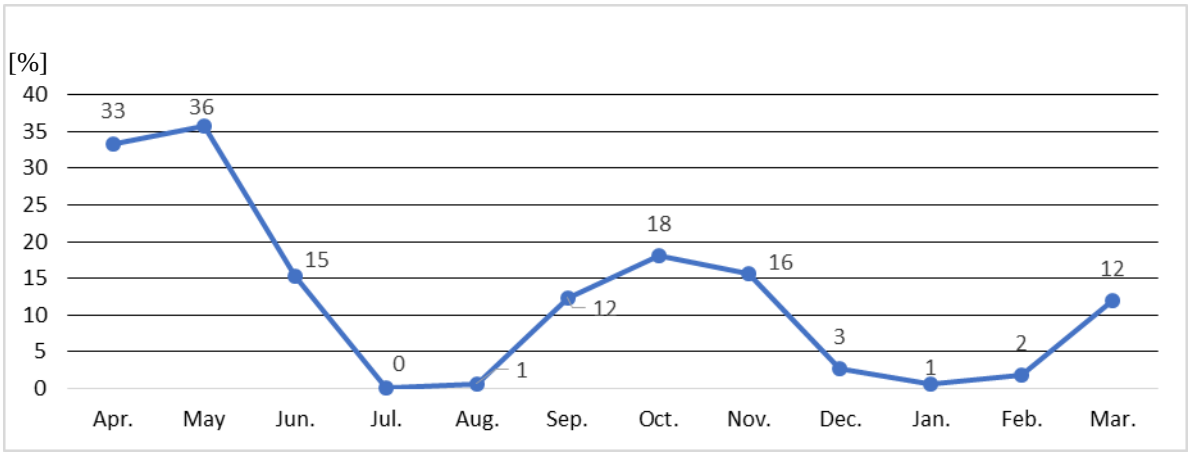


Figure 2-11 Nationwide Monthly Planned Outage Rate (FY 2016)

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

(2) Annual Maintenance Work for Cross-regional Interconnection Lines for FYs 2010 to 2016

Table 2-11 shows the annual maintenance work of cross-regional interconnection lines for FYs 2010 to 2016.

Table 2-11 Annual Maintenance Work of Cross-regional Interconnection Lines (FYs 2010 to 2016)

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	Total	7 Years Average
Nos.	64	56	58	38	63	91	218	588	84

5. Unplanned Outage of Cross-regional Interconnection Lines

(1) Unplanned Outage of Cross-regional Interconnection Lines in FY 2016

Table 2-12 shows the unplanned outage of cross-regional interconnection lines in FY 2016.

Table 2-12 Unplanned Outage of Cross-regional Interconnection Lines (FY 2016)

Date	Facility	Cause
Jul. 29	No.2 Pole of Hokkaido and Honshu AC/DC C.S.	No.2 pole has tripped due to the decrease in feed water for cooling; opening operation for the valves were insufficient at the switching operation of heat exchanger for thyristor valve cooling water (from No.2 to No.1) in the periodical maintenace work.
Aug. 3	Shin Shinano FC unit No.1	Analog input substrate failure in the over voltage relay for 50Hz network system
Oct.20	Minami Fukumitsu HVDC BTB C.S.	Contact of small animal to the voltage detecting substrate in the thyristor valve

* The unplanned outage affecting TTC is described.

(2) Annual Unplanned Outage of Cross-regional Interconnection Lines for FYs 2010 to 2016

Table 2-13 shows the annual unplanned outage of cross-regional interconnection lines for FYs 2010 to 2016.

Table 2-13 Annual Unplanned Outage of Cross-regional Interconnection Lines (FYs 2010 to 2016)

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	Total	7 Years Average
Nos.	9	5	6	9	1	3	3	36	5

6. Actual Utilization* of Transmission Margin

The “utilization of transmission margin” describes the supply of electricity by general transmission and distribution 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 transmission margin according to the provision of Article 151 of the Operational Rules in FY 2016.

7. Actual Employment* of Transmission Margin

The “employment of transmission margin” describes the supply of electricity by general transmission and distribution companies who employ there transmission margin allocated to interconnection lines where the supply-demand balance is restricted or insufficient to reduce power supply, or such possibilities exist. Table 2-14 shows the actual employment of transmission margin in FY 2016 according to the provision of Article 152 of the Operational Rules.

Table 2-14 Actual Employment of Transmission Margin (FY 2016)

Date	Facility	Cause
Sep. 8	Interconnection Facilities between Tokyo and Chubu (Forward flow)	Insufficient ATC for the interconnection lines at the power exchange instruction for the improvement of supply-demand state due to unplanned outage of Line No.1 & 2 of Koda-Hekinan Line

8. Actual ATC of Each Cross-regional Interconnection Line

The actual available transfer capabilities calculated and published according to Article 133 of the Operational Rules are shown in the following pages.

- How to read the graphs of actual ATC

  Interconnection line is utilized according to the procedures described in 1(2) of Chapter II.

  [① Calculation of TTC]→[② Calculation of Margin]→[③ Registration of SPF]→[④ Calculation of ATC]

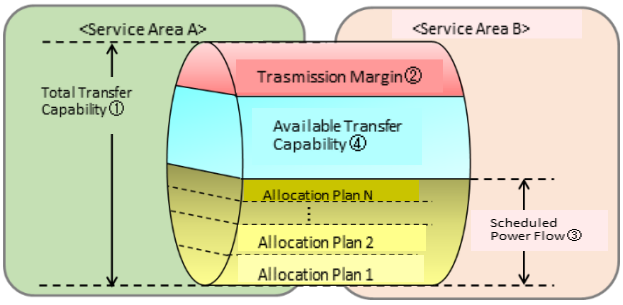


Figure 2-12 Concept of the Utilization of Cross-regional Interconnection Lines

Graphs for the actual ATC of each interconnection line for FY 2016 are presented on the following pages based on the above concept. How to read the ATC graph is described as below according to procedures ① to ④.

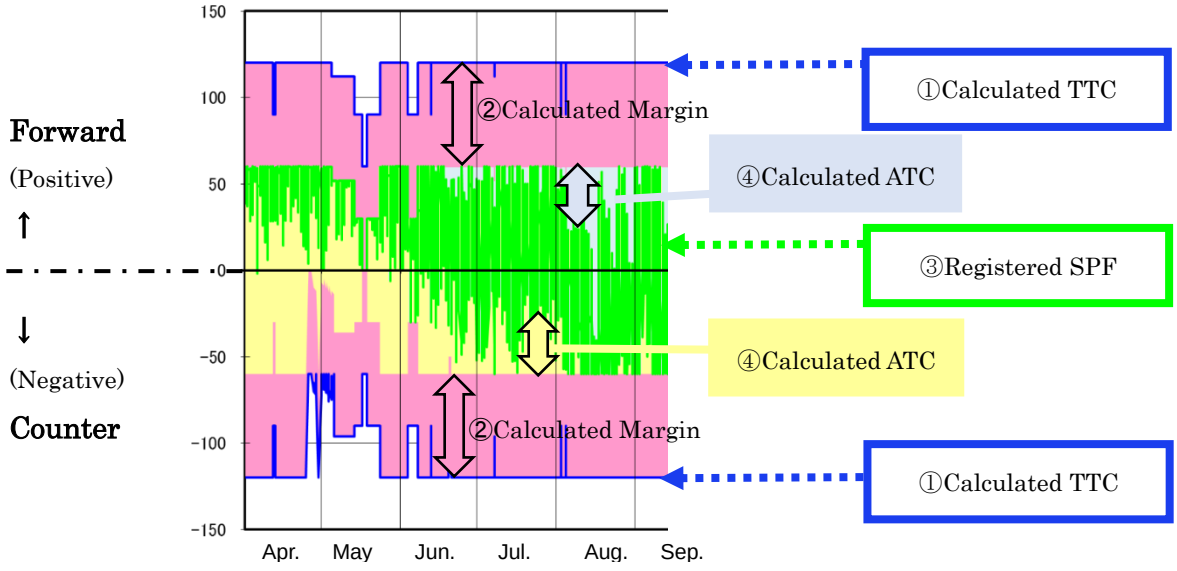


Figure 2-13 How to Read the Graph of the Actual Available Transfer Capability

*Scheduled power flow

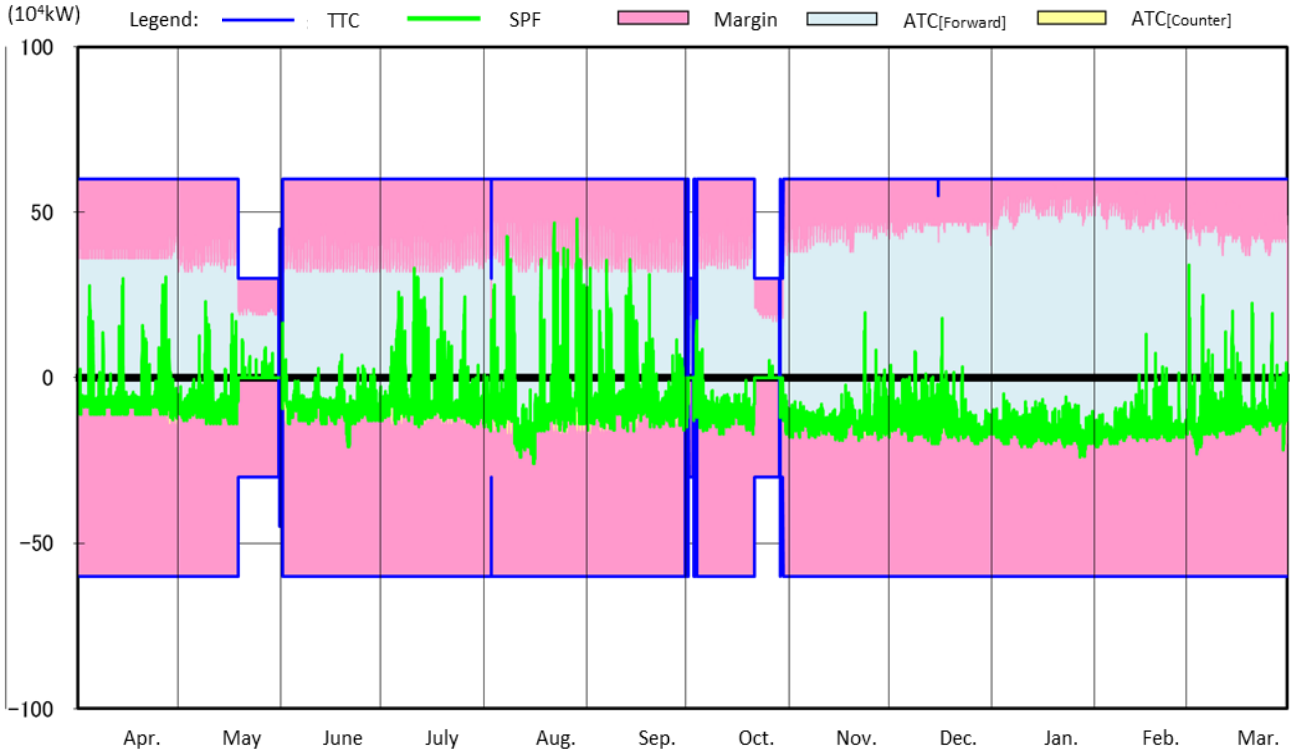
The actual flows on the transmission lines are offset in each direction. Therefore, the scheduled power flow is the offset figure between forward and counter flows, not the simple addition of each direction. In addition, offset figures on the graphs are observed as SPF, not observing the capacity of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

【Reference】Publishing actual ATC

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

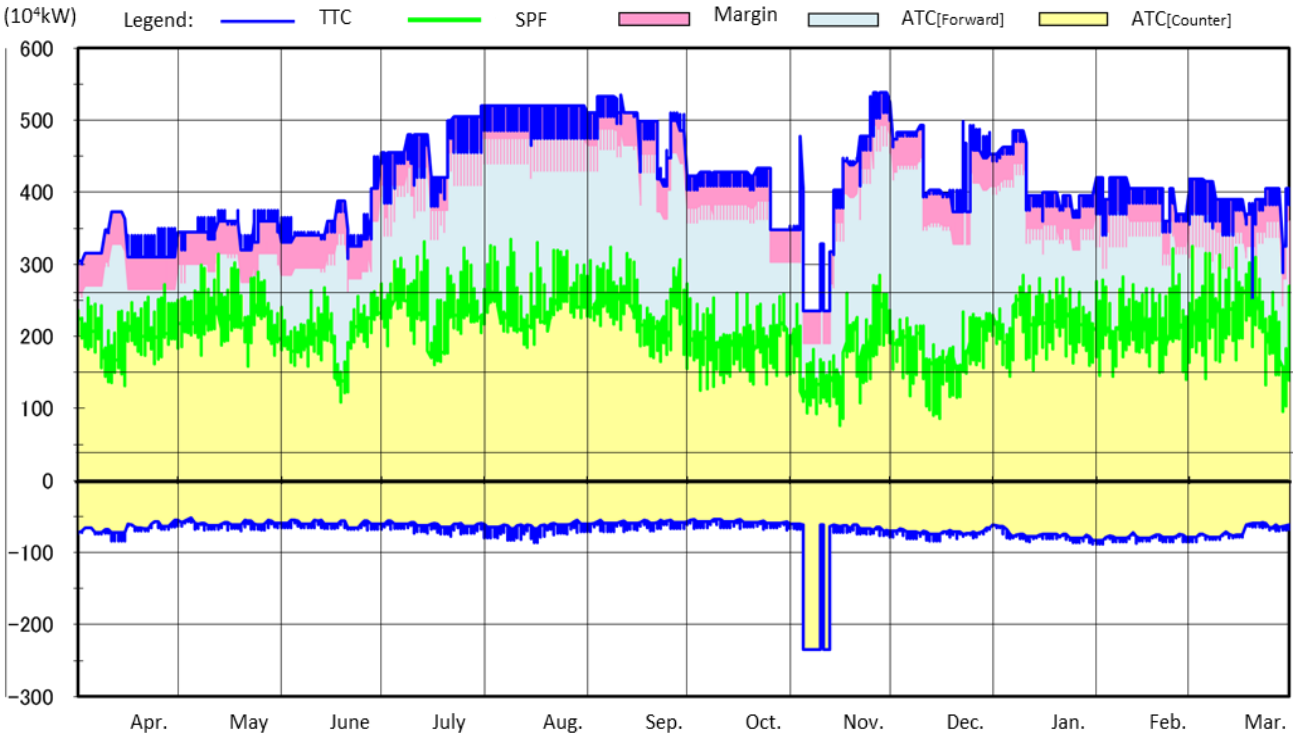
URL http://occtonet.occto.or.jp/public/dfw/RP11/OCCTO/SD/LOGIN_login#

Figure 2-14 Actual ATC of Interconnection Facilities between Hokkaido and Honshu (FY 2016)
[Hokkaido and Honshu AC/DC CS]



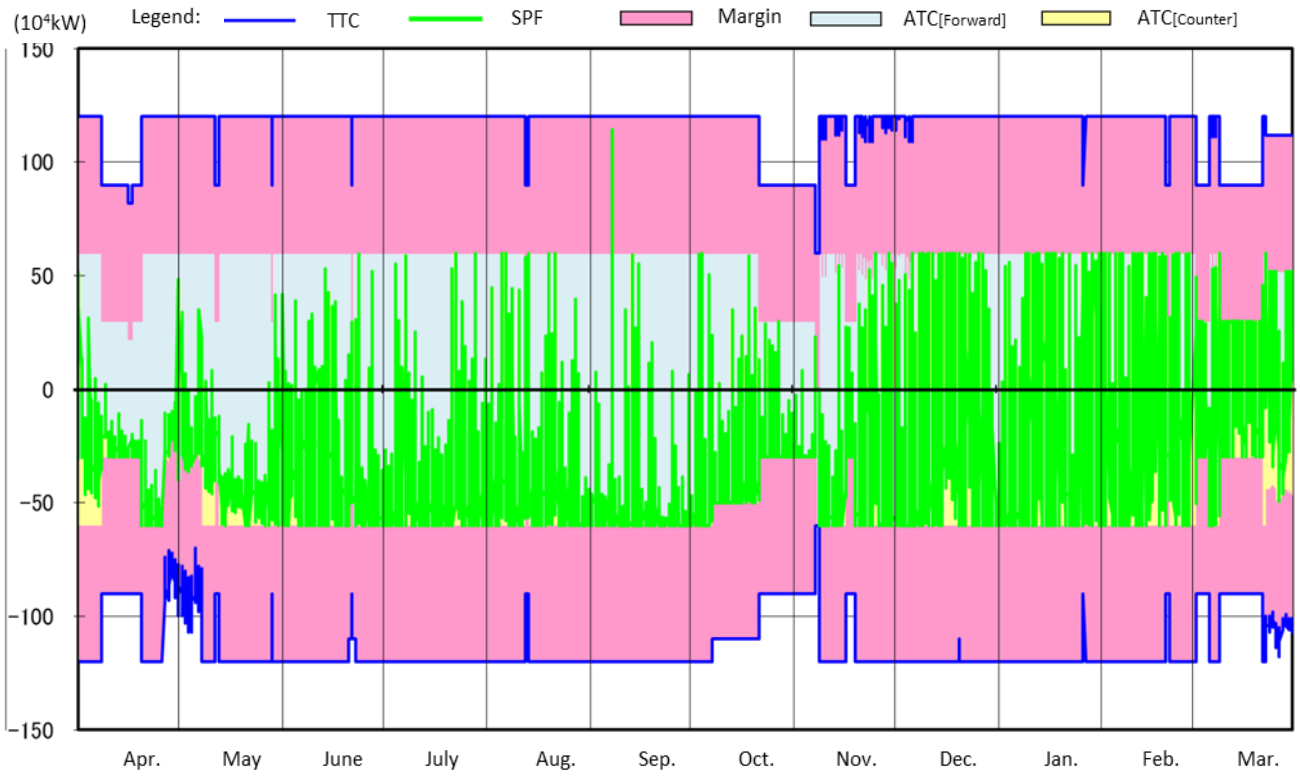
Note: Hokkaido to Tohoku as forward (positive) flow, Tohoku to Hokkaido as counter (negative) flow.

Figure 2-15 Actual ATC of Interconnection Line between Tohoku and Tokyo (FY 2016) [Soma-Futaba Bulk Line]



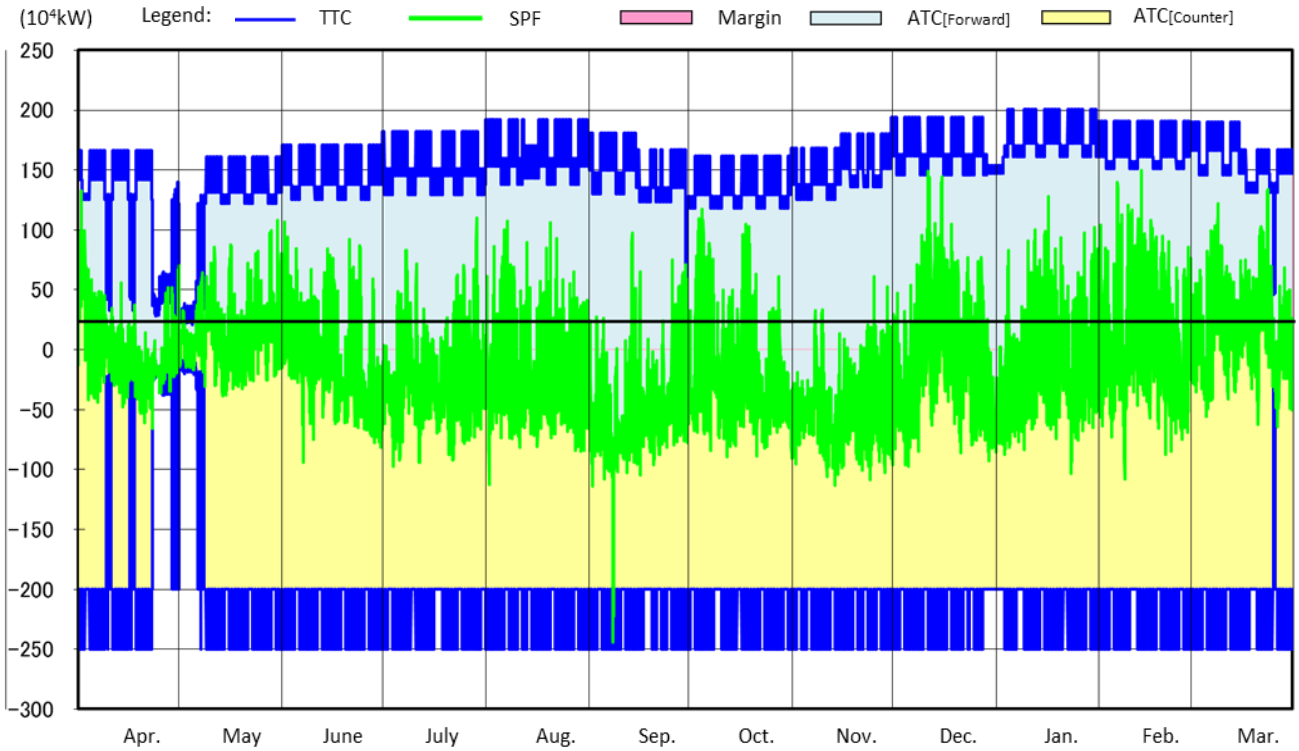
Note: Tohoku to Tokyo as forward (positive) flow, Tokyo to Tohoku as counter (negative) flow.

Figure 2-16 Actual ATC of Interconnection Facilities between Tokyo and Chubu (FY 2016)
[Sakuma, Shin-Shinano & Higashi Shimizu FC]



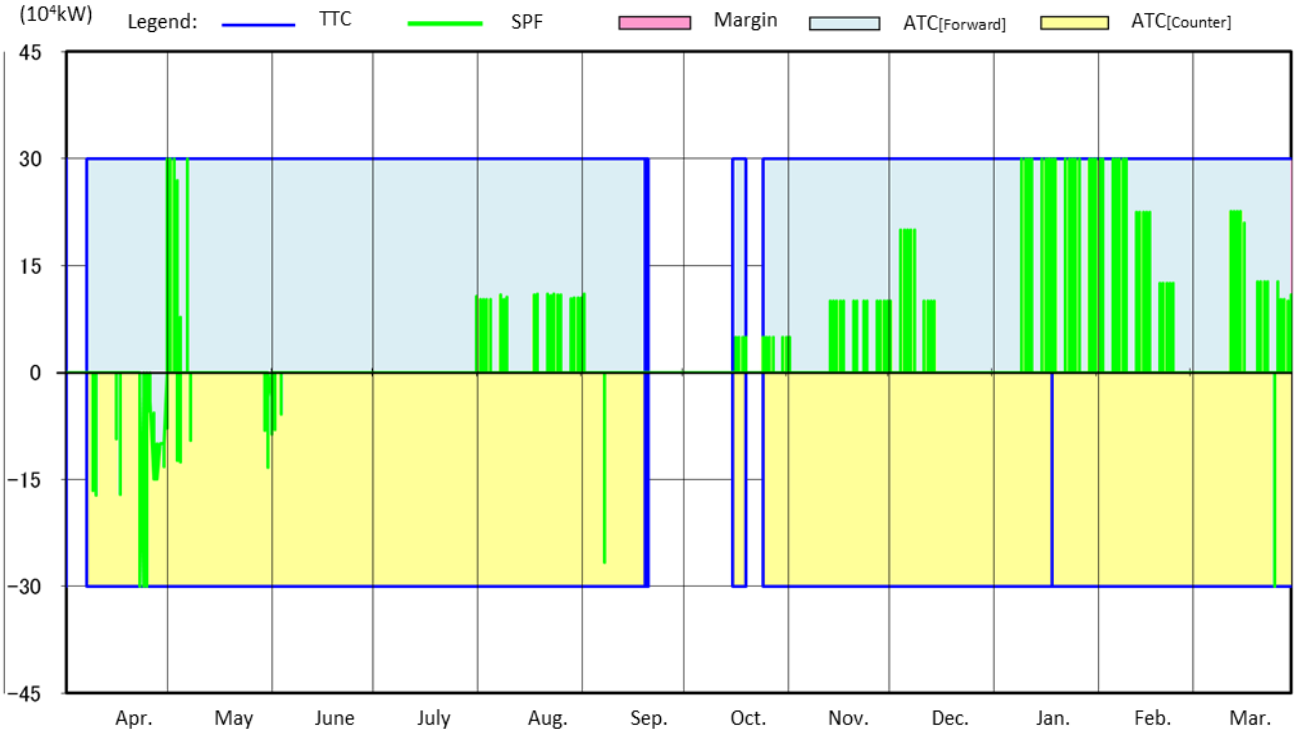
Note: Tokyo to Chubu as forward (positive) flow, Chubu to Tokyo as counter (negative) flow.

Figure 2-17 Actual ATC of Interconnection Line between Chubu and Kansai (FY 2016) [Mie-Higashi Omi Line]



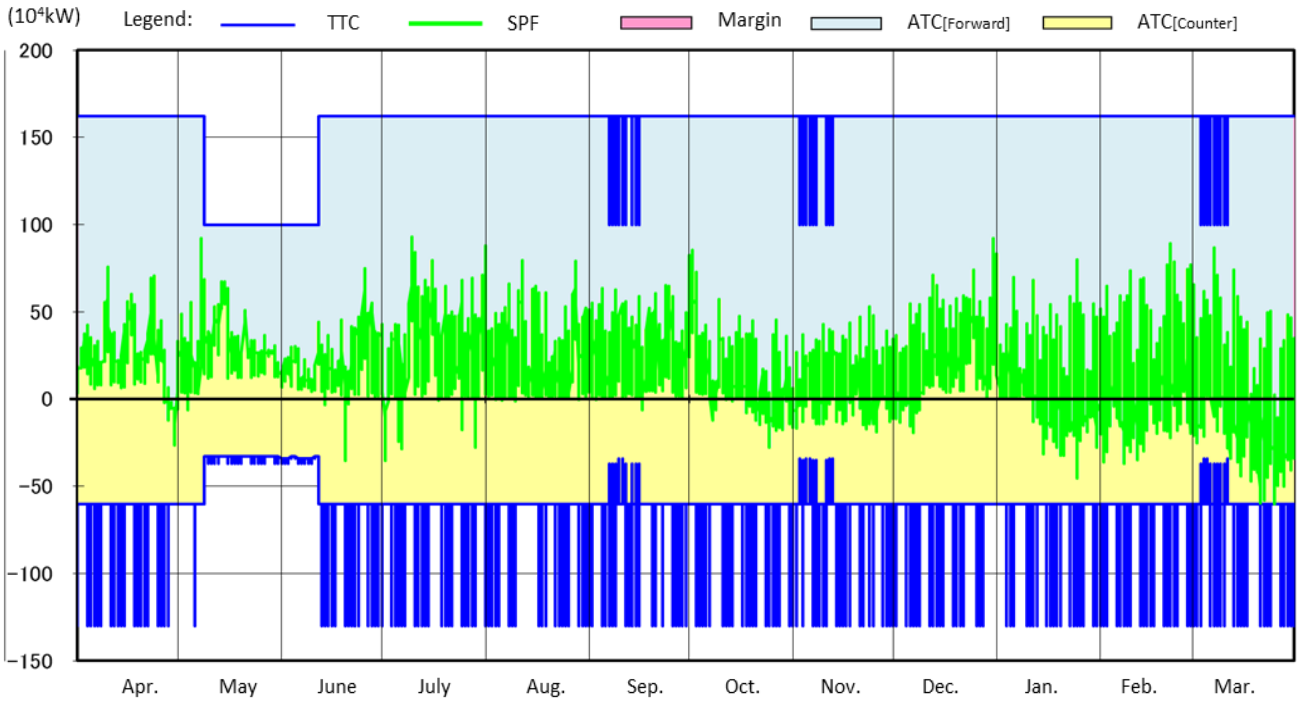
Note: Chubu to Kansai as forward (positive) flow, Kansai to Chubu as counter (negative) flow.

Figure 2-18 Actual ATC of Interconnection Facilities between Chubu and Hokuriku (FY 2016)
[Minami Fukumitsu HVDC BTB CS and Minami Fukumitsu Substation]



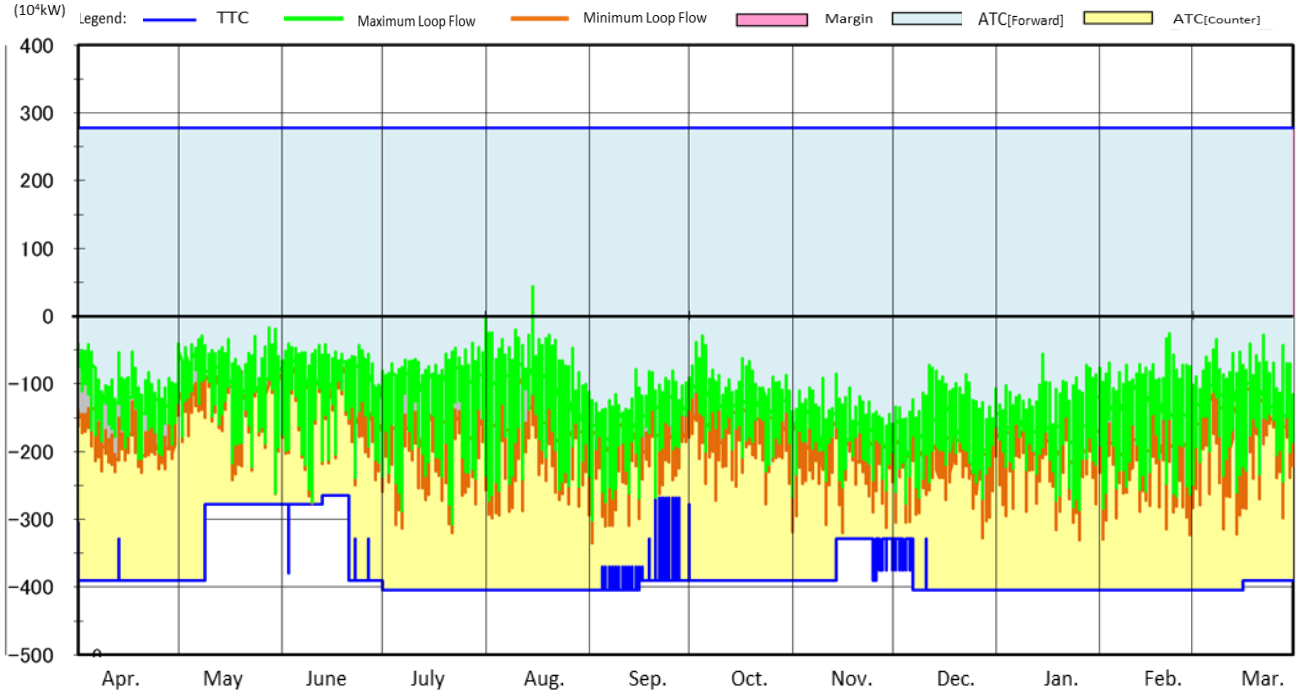
Note: Chubu to Hokuriku as forward (positive) flow, Hokuriku to Chubu as counter (negative) flow.

Figure 2-19 Actual ATC of Interconnection Line between Hokuriku and Kansai (FY 2016) [Echizen-Reinan Line]



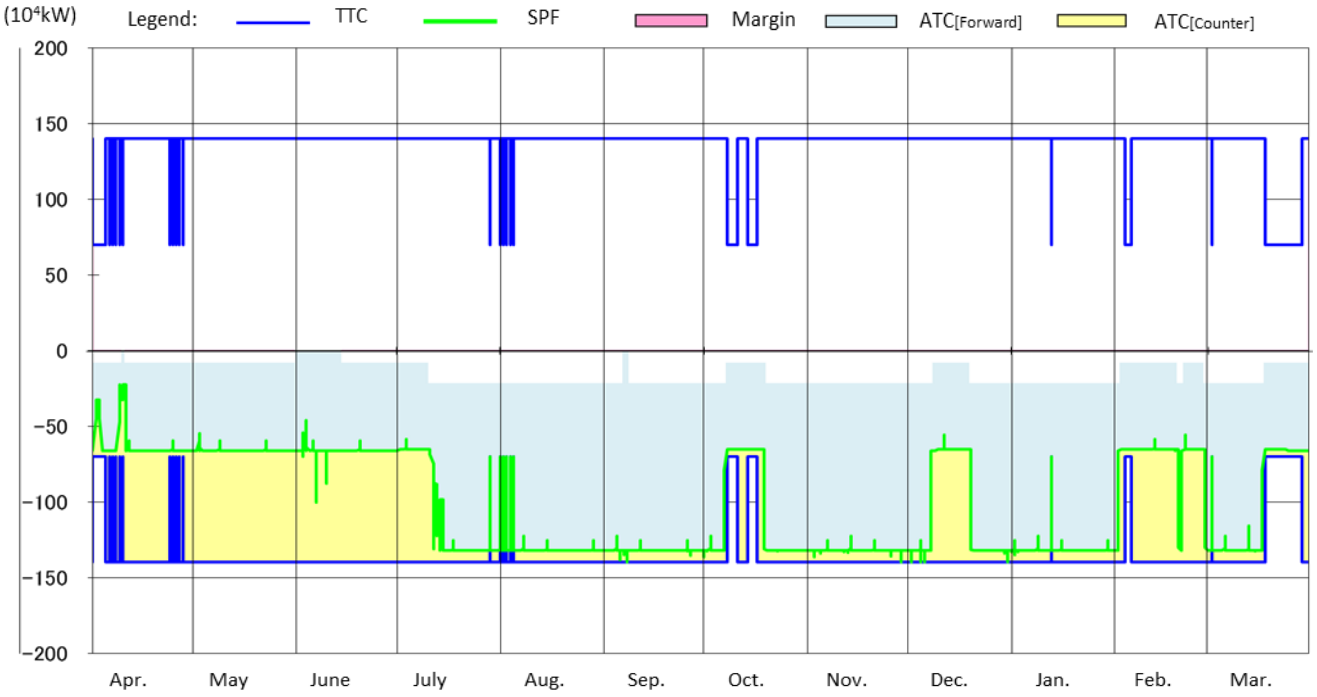
Note: Hokuriku to Kansai as forward (positive) flow, Kansai to Hokuriku as counter (negative) flow.

Figure 2-20 Actual ATC of Interconnection Lines between Kansai and Chugoku (FY 2016)
[Seiban-Higashi Okayama Line, Yamazaki-Chizu Line]



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

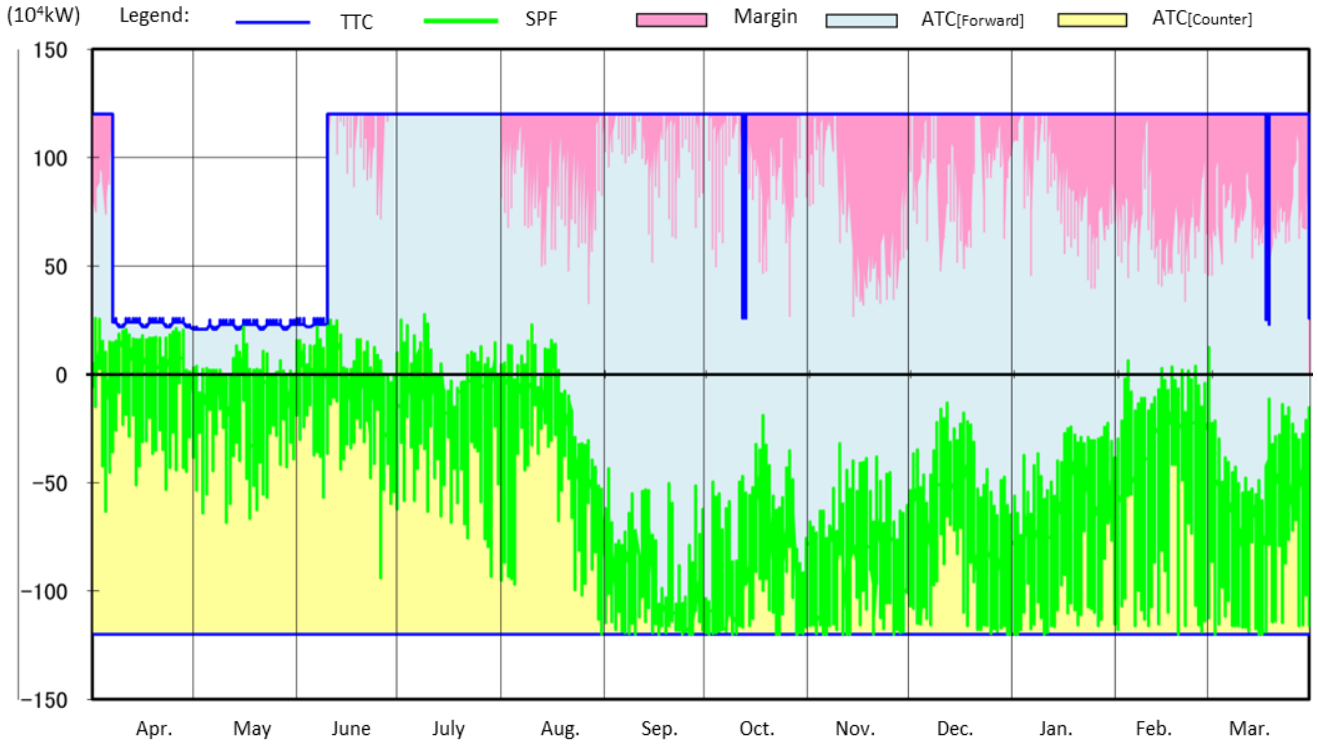
Figure 2-21 Actual ATC of Interconnection Facilities between Kansai and Shikoku (FY 2016)
[Kihoku and Anan AC/DC CS]



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

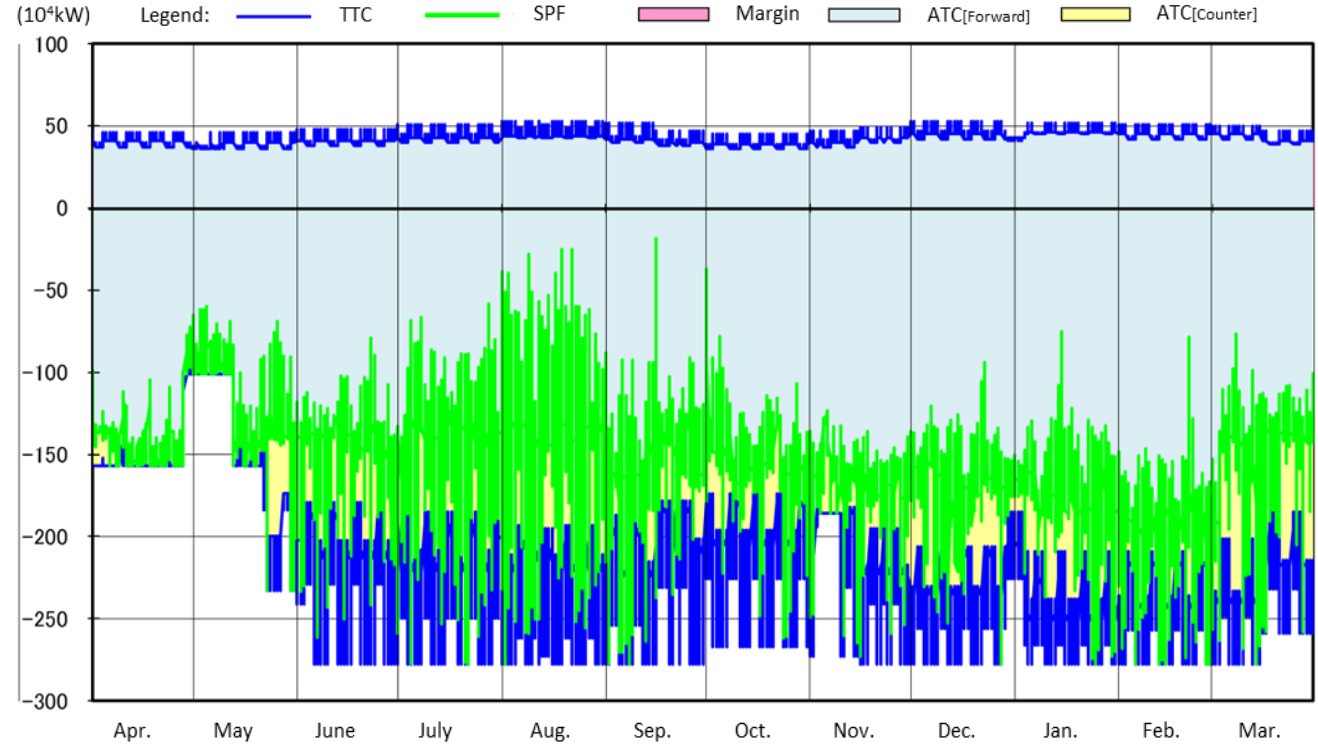
* ATC on forward flow is calculated and chosen from the smaller of the two.
・TTC－transfer margin－SPF
・TTC of Minami Awa bulk line － (Supply Capacity of Tachibanawan Thermal Power Station－SPF of Anan-Kihoku DC bulk line)

Figure 2-22 Actual ATC of Interconnection Line between Chugoku and Shikoku (FY 2016)
[Honshi Interconnection Line]



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

Figure 2-23 Actual ATC of Interconnection Line between Chugoku and Kyushu (FY 2016**)**
[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

Figure 2-24 shows the actual constraints on cross-regional interconnection lines nationwide. The constraint data are published at the end of May, reported to the Organization by general transmission and distribution companies, and compiled into a nationwide map by the Organization. Constraints on the subordinate lines are not shown in the map.

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* The map on the following page is prepared from the data posted 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

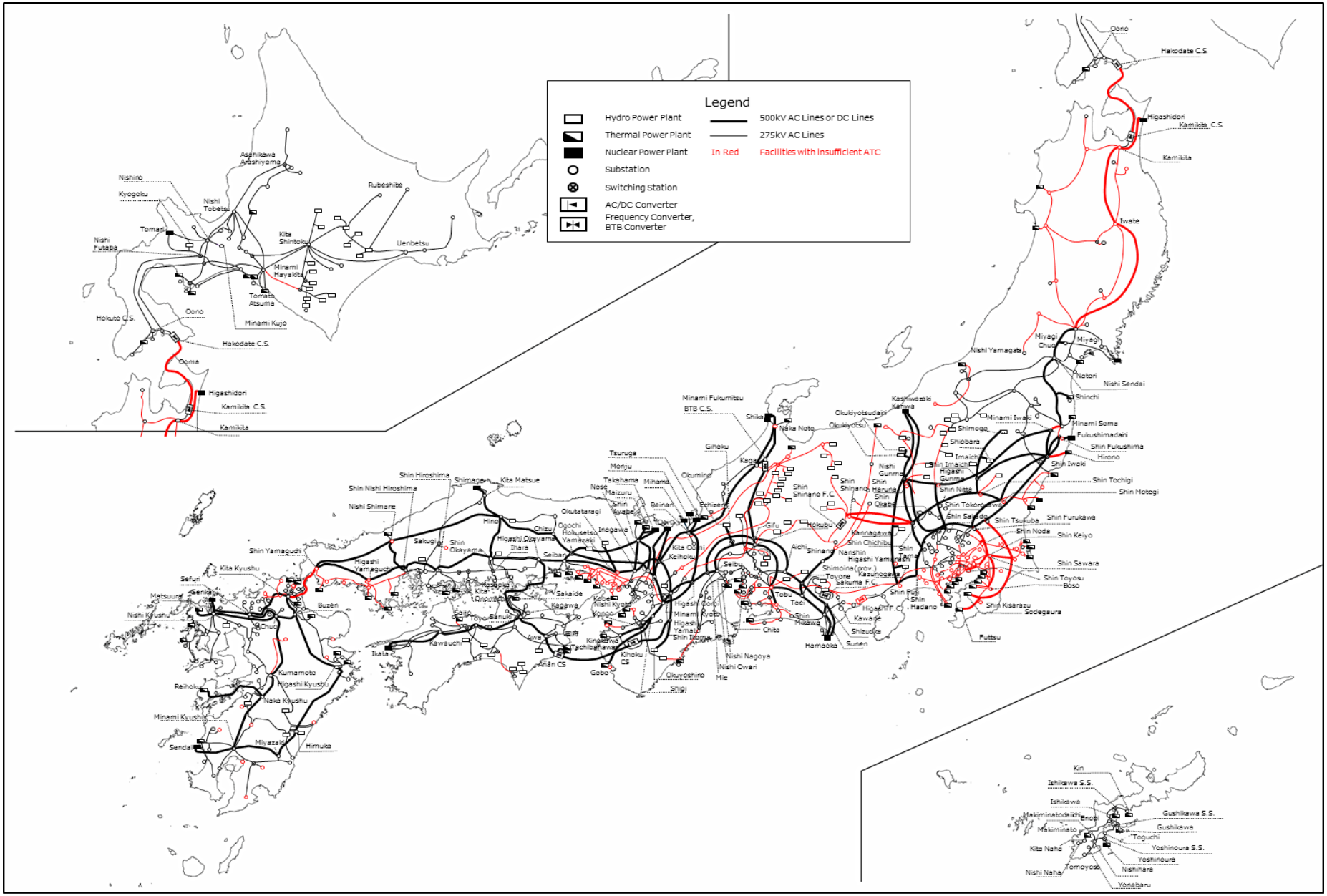

Figure 2-24 Actual Constraints on Cross-regional Interconnection Lines Nationwide (prepared from data provided by general t&d companies published at the end of May, 2017)

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