Report on the Quality of the Electricity Supply

- Data for Fiscal Year 2024 -

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

Introduction

Organization for Cross-regional Coordination of Transmission Operators, Japan (OCCTO) evaluates supply reliability conditions to secure a stable electricity supply. To meet this objective, OCCTO continuously gathers and publishes real data on the electricity supply quality according to the provisions of Article 181 of its Operational Rules.

This report aggregates real data for frequency, voltage, and interruptions in a report titled “Quality of the Electricity Supply” and presents the data evaluation. These data are collected from each regional service area for the 2024 fiscal year (FY 2024). On the basis of these data, OCCTO evaluates and analyzes whether frequencies or voltages have been maintained within certain parameters or whether there have been frequent supply interruptions. Additionally, although the data conditions regarding supply interruption are not uniform, data were compared with the leading states in the United States (U.S.) as a reference.
OCCTO’s goal is to facilitate the use of aggregated data, evaluations, and analyses by the electricity sector as a reference.

The data presented in the report were submitted by general transmission and distribution companies and aggregated by OCCTO according to the provisions of Article 268 of the Network Codes of OCCTO.

SUMMARY

In this report, the quality of the nationwide electricity supply in FY 2024 was reviewed on the basis of the provisions of Article 181 of the Operational Rules of OCCTO.
This report evaluated three aspects of the electricity supply's quality: frequency, standard voltage, and interruption.
Although different indices are available for evaluating each aspect, this report used the same indices published in previous years to allow for historical comparison.

Frequency
The frequency time-kept ratio was used to analyze the frequency, which is the ratio of time that the metered frequency is maintained within a given target control range. Four areas were grouped by synchronized frequency: Hokkaido, Eastern Japan, Central and Western Japan, and Okinawa. Transmission operators in Japan's Eastern and Western areas use 50 and 60 Hz, respectively.
This study reviewed the frequency time-kept ratios in these four synchronized areas, and reported the challenge to the Central and Western areas.

Standard Voltage
The evaluation of the standard voltage considered the points at which the standard voltage did not satisfy the target values, as defined by the enforcement regulations of the Electricity Business Act (hereafter, the Act). The Act sets targets for transmission operators to ensure a standard voltage supply within a certain range.
At the request of OCCTO, the transmission operators submitted their data. Nationwide, there was no violation of standard voltage among 6,686 points for 100 V and 6,561 points for 200 V.

Interruption
Interruptions were monitored from three perspectives: 1) the number of supply disturbances by the place of occurrence, 2) the number of supply disturbances by cause, i.e., beyond the given standards in duration and lost capacity, and 3) system average interruption frequency index (SAIFI) and system average interruption duration index (SAIDI) values for low-voltage (LV) customers.
In the first analysis, the total number of supply disturbances was 14,885, 1.6% lower than the recorded number in the previous fiscal year.
The second analysis categorizes the causes of supply disturbances by two factors: maintenance problems and natural disasters, with the latter being irrelevant to maintenance problems.
These analyses indicate 15 cases of supply disturbances, a decrease of two cases over the previous year. Regarding the causes of disturbances, four cases were triggered by natural disasters, one fewer than the previous year. However, ten disturbances were caused by the fault of the facility or maintenance, such as physical contact, an increase of one case over the previous year. Additionally, the number of supply disturbances above a certain scale for FY 2024 was lower than the 5-year average.

In the final analysis, the SAIFI and SAIDI values were historically monitored. The data for FY 2024 indicates there were 0.13 interruptions of 24 min. per customer. The SAIFI value was lower than the corresponding data from the previous year by 0.02 point, the SAIDI value was 13 min. lower than the previous year.
This report also compares SAIFI and SAIDI values with the major U.S. states, even though the comparison is not direct given that index definitions are not identical between the U.S. states and Japan.

We believe this report will help to understand the quality of Japan's electricity supply.

CONTENTS

I. Frequency Data

1. Standard Frequency in Japan

There are ten regional service areas (meaning service areas where general transmission and distribution companies [Hokkaido Electric Power Network, Tohoku Electric Power Network, TEPCO Power Grid, Chubu Electric Power Grid, Hokuriku Electric Power Transmission and Distribution, Kansai Transmission and Distribution, Chugoku Electric Power Transmission & Distribution, Shikoku Electric Power Transmission and Distribution, Kyushu Electric Power Transmission and Distribution, and the Okinawa EPCO] provide w ling-services, and these respective service areas are hereinafter simply referred to "Hokkaido," "Tohoku," "Tokyo," "Chubu," "Hokuriku," "Kansai," "Chugoku," "Shikoku," "Kyushu," and "Okinawa") across the nation, and these service areas are divided as shown in Figure 1-1. These regional service areas except for the Okinawa EPCO are connected by cross-regional interconnection lines.

The standard frequency by service area is divided as shown in Figure 1-1. General transmission and distribution companies (GT&D companies) must make an effort to maintain the frequency value of the electricity supply at the levels specified in Paragraph 2 of Article 38 of the Ordinance for Enforcement of the Electricity Business Act (Paragraph 2 of Article 38 of the Ordinance for Enforcement of the Electricity Business Act stipulates that the frequency value defined by the Ordinance of the Ministry of Economy, Trade and Industry shall be the value equal to the standard frequency of electricity the relevant GT&D companies supply) in accordance with the provisions of Article 26 of the Electricity Business Act.

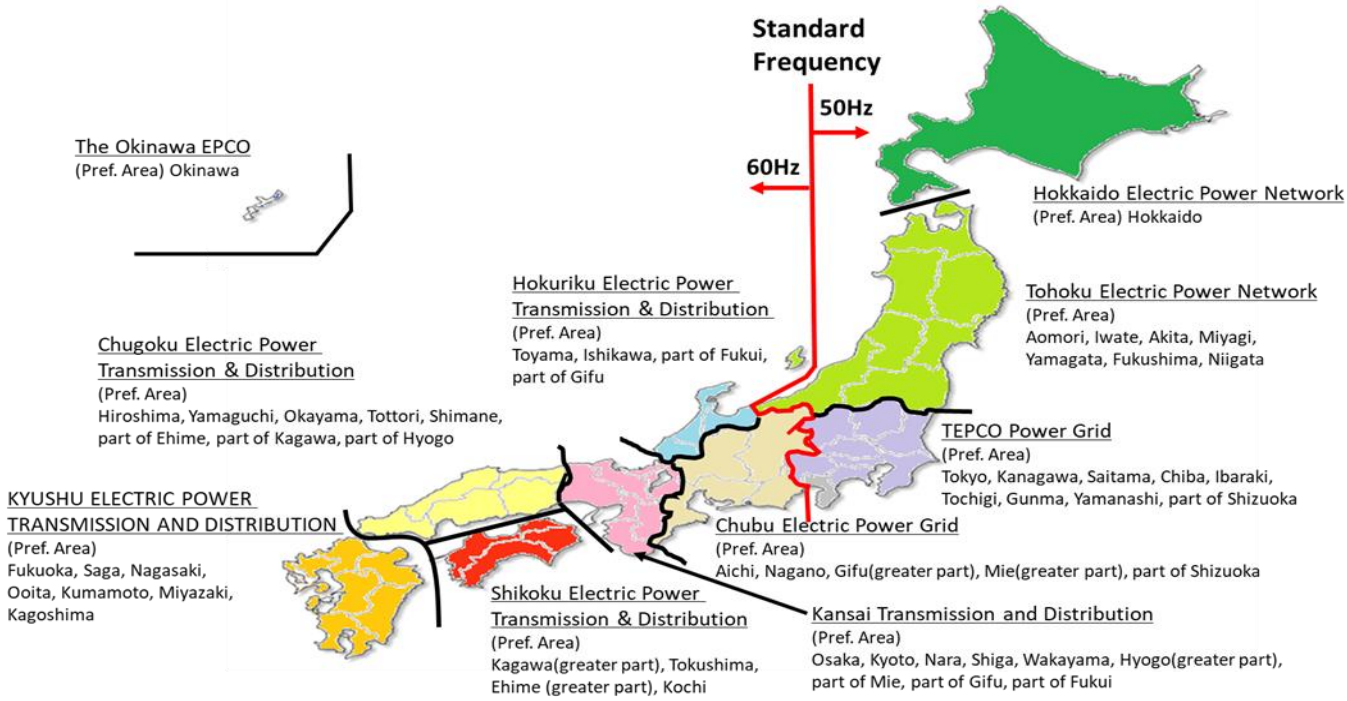

Figure 1-1 Regional Service Areas of 10 GT&D Companies and Their Standard Frequencies

2. Frequency Time-Kept Ratio

Based on the provisions of Paragraph 2 of Article 38 of the Ordinance for Enforcement of the Electricity Business Act, each GT&D company sets the target control range in its regulations, standards, or manuals as shown in Table 1-1. In addition, in Chubu, Hokuriku, Kansai, Chugoku, Shikoku, and Kyushu, the target frequency time-kept ratio within a variance of ±0.1 Hz is set.

Table 1-1 Frequency Control Rule under Normal Condition for the Regional Service Areas

Areas	Hokkaido	Tohoku, Tokyo	Chubu, Hokuriku, Kansai, Chugoku, Shikoku, Kyushu	Okinawa
Frequency Standard	50 Hz	50 Hz	60 Hz	60 Hz
Control Target(for Standard)	±0.3 Hz	±0.2 Hz	±0.2 Hz	±0.3 Hz
Target Time Kept Ratio within ± 0.1 Hz	—	—	95% over	—

3. Frequency Control Rule

The maintained frequency was examined using the frequency time-kept ratio, which is the ratio of time that the metered frequency is maintained within a given variance of the standard. The following formula calculates the frequency time-kept ratio:

$$\text{Frequency time-kept ratio (\%)} = \frac{\text{time that the metered frequency is maintained within a given variance of the standard}}{\text{total time in a given period}} \times 100$$

4. Frequency time-kept ratio by the Frequency-synchronized Area (FY 2020–2024)

The frequency time-kept ratio by the frequency-synchronized area (Hokkaido, the eastern area,[1] the central and western areas,[2] and Okinawa), and the transition of the frequency time-kept ratio maintaining the frequency within a 0.1 Hz variance for FY 2020–2024 are shown in Tables 1-2–1-5[3] and Figures 1-2–1-5, respectively.

In FY 2024, except for the central and western areas, the frequency was controlled and able to be maintained within the target range of each frequency-synchronized area according to Table 1-1. Meanwhile, with respect to the central and western areas, the frequency during normal times sometimes deviated from the control target range of ±0.2 Hz just like the previous fiscal year. However, the (yearly) frequency time-kept ratio within a ± 0.1 Hz variance in FY 2024 increased from the previous year.

At the 101st meeting of the Study Committee on Regulating and Marginal Supply Capability and Long-Term Supply–Demand Balance Evaluation, it was reported that the (monthly) frequency time-kept ratio within a ± 0.1 Hz variance neared 95.00%, which is the lower limit of the ratio, primarily during the light load period. Based on the above, while the organization will carefully and continuously monitor these conditions regarding the maintaining of the frequency value to ensure a stable supply, it collaborates with GT&D companies to proceed with a study of the situation.

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[1] The eastern area means the Tohoku and Tokyo areas, and the values in the table are data collected from the Tokyo service area.

[2] The central and western areas mean the Chubu, Hokuriku, Kansai, Chugoku, Shikoku, and Kyushu areas, and the values in the table are data collected from the Kansai service area.

[3] Values are rounded up to the nearest hundredth.

<Summary of report at the 101st meeting of the Study Committee on Regulating and Marginal Supply Capability and Long-Term Supply–Demand Balance Evaluation (held on September 30, 2024)[4]>

GT&D companies related to the central and western areas reported that the monthly frequency time-kept ratio sometimes deviated from the control target range of ± 0.2 Hz primarily during the light load period and that the (monthly) target frequency time-kept ratio within a ± 0.1 Hz variance, which is uniquely determined by the area, neared the lower limit, 95.00%, and this trend was apparent during the light load period. These conditions were partly because of the increase in renewable energy sources and the decrease in synchronized generators.

【Criteria】

Control target ··· 100.00%

Target time-kept ratio within ±0.1 Hz ··· 95.00% Over

Table 1-2 Frequency Time -Kept Ratio (Hokkaido, FY 2020–2024) [%]

Variance	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
Within 0.1 Hz	99.93	99.87	99.90	99.91	99.89
Within 0.2 Hz	100.00	99.99	99.99	99.99	100.00
Within 0.3 Hz	100.00	100.00	100.00	100.00	100.00
Beyond 0.3 Hz	0.00	0.00	0.00	0.00	0.00

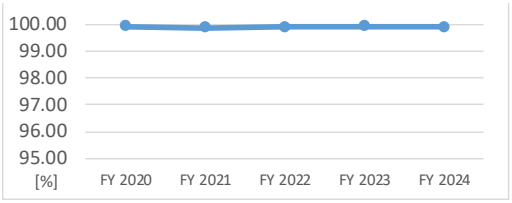

Figure 1-2 Frequency time kept ratio within 0.1 Hz (Hokkaido, FY 2020-2024)

Table 1-3 Frequency Time -Kept Ratio (Eastern area,[3] FY 2020–2024) [%]

Variance	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
Within 0.1 Hz	99.71	99.50	99.43	99.01	99.35
Within 0.2 Hz	100.00	100.00	100.00	100.00	100.00
Within 0.3 Hz	100.00	100.00	100.00	100.00	100.00
Beyond 0.3 Hz	0.00	0.00	0.00	0.00	0.00

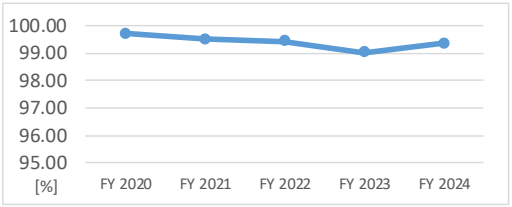

Figure 1-3 Frequency time kept ratio within 0.1 Hz (Eastern area,[3] FY 2020-2024)

Table 1-4 Frequency Time -Kept Ratio (Central & Western area,[4] FY 2020–2024) [%]

Variance	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
Within 0.1 Hz	98.50	98.12	98.46	97.68	97.99
Within 0.2 Hz	100.00	100.00	100.00	99.99	99.99
Within 0.3 Hz	100.00	100.00	100.00	100.00	100.00
Beyond 0.3 Hz	0.00	0.00	0.00	0.00	0.00

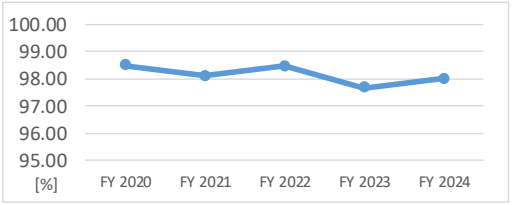

Figure 1-4 Frequency time kept ratio within 0.1 Hz (Central & Western area,[4] FY 2020–2024)

Table 1-5 Frequency Time -Kept Ratio (Okinawa, FY 2020–2024) [%]

Variance	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
Within 0.1 Hz	99.92	99.89	99.98	99.97	99.98
Within 0.2 Hz	100.00	100.00	100.00	100.00	100.00
Within 0.3 Hz	100.00	100.00	100.00	100.00	100.00
Beyond 0.3 Hz	0.00	0.00	0.00	0.00	0.00

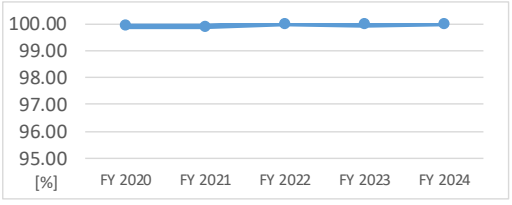

Figure 1-5 Frequency time kept ratio within 0.1 Hz (Okinawa, FY 2020–2024)

[4] https://www.occto.or.jp/iinkai/chousei_jukyu/101.html

II. Voltage Data

1. Japanese Voltage Standard

GT&D companies must endeavor to maintain the voltage value of the electricity supply within the range (Table 2-1) specified in Paragraph 1 of Article 38 of the Ordinance for Enforcement of the Electricity Business Act in accordance with the provisions of Article 26 of the Electricity Business Act.

Table 2-1 Voltage Standard and Target Voltage Control

Voltage Standard	Target Voltage Control
100 V	within ±6 V of 101 V
200 V	within ±20 V of 202 V

2. Voltage Measurements

According to the provisions of Item 1 of Paragraph 1 of Article 39 of the Ordinance for Enforcement of the Electricity Business Act, GT&D companies should measure voltage at the measuring points selected by themselves once a year for 24 consecutive hours during the period designated by the director general of the Regional Bureau of Economy, Trade, and Industry (including the director general of the Chubu Bureau of Economy, Trade, and Industry, Electricity and Gas Industry Department Hokuriku) who administers regional service areas or supply points in accordance with the provisions of Item 2 of the same paragraph.

Furthermore, GT&D companies calculate the 30-minute average of the measured voltage (maximum and minimum values) and record the value by measuring the point in accordance with the provisions of Items 1 and 2 of Paragraph 1 and Paragraph 3 of the same article.

3. Nationwide Voltage Deviation Ratio (FY 2020–2024)

With respect to the nationwide data on measured voltage for FY 2020–2024, in accordance with the provision of Item 2 of Paragraph 1 of Article 268 of the Network Codes, the total measured points and the total deviated measured points reported from GT&D companies are shown in Table 2-2. In FY 2024, there was no deviation from the voltage range that should be maintained in all the area.

Table 2-2 Voltage Deviation Measurement (Nationwide, FY 2020–2024)

Voltage		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
100V	Total measured points	6,562	6,589	6,578	6,681	6,686
	Deviated points	0	0	0	0	0
200V	Total measured points	6,413	6,383	6,459	6,459	6,581
	Deviated points	0	0	0	0	0

III. Interruption Data

1. Data on the Number of Supply Disturbances from which Interruption Originated

(1) Indices and Definitions of Supply Disturbances

The criteria for supply interruption include the number of supply disturbances where the interruption originated, indicating where and how many supply disturbances occurred, according to the electric facilities in the system.

A "supply disturbance[5]" is defined as an interruption in the electricity supply or an emergency restriction of electricity use due to damage, accident, or misuse of the electric facilities,[6] except for the case where the electricity supply is resumed by the automatic reclosing of the electrical circuit.[7]

[5] It shall comply with the definition of "supply disturbance" defined in item 7 of Paragraph 2 of Article 1 of the Reporting Rules of the Electricity Business.

[6] Electric facilities include machinery, apparatus, dams, conduits, reservoirs, electric lines, and other facilities installed for the generation, storage, transformation, transmission, distribution, or consumption of electricity as defined by the provisions of Item 18 of Paragraph 1 of Article 2 of the Electricity Business Act.

[7] It means that the electricity supply is resumed by re-switching the circuit breaker after a given period following the time when an accident, such as a lightning strike, occurs on the transmission or distribution line and a fault section is isolated by opening the circuit breaker because of the operation of a protective relay.

(2) Data on Number of Supply Disturbances Nationwide and by Regional Service Area (FY 2020–2024)

In accordance with the provision of Item 3 of Paragraph 1 of Article 268 of the Network Codes, with respect to the number of supply disturbances for FY 2020–2024, Table 3-1 and Figure 3-1 show the nationwide data, and Tables 3-2 to 3-11 and Figures 3-2 to 3-11 show the data by service area by using the data on the number of supply disturbances by point where the interruptions originated, which was received from GT&D companies.[8]

The total number of nationwide supply disturbances in FY 2024 was 14,885, which was 247 or 1.6% fewer than the previous fiscal year. As for the number of supply disturbances by service area, the number decreased from the previous fiscal year by 505 or 50.1% in Hokuriku, 474 or 24.1% in Kansai, and 341 or 43.5% in Okinawa. Meanwhile, the number of supply disturbances increased from the previous fiscal year by 622 or 35.1% in Kyushu, and 312 or 29.6% in Chugoku because of the damage from the Typhoon No. 10 in August 2024. In addition, the number of supply disturbances increased by 301 or 9.5% in Tokyo from the previous fiscal year because of the damage from the heavy rain in July 2024,[9] which was designated a severe disaster.[10]

Table 3-1 Number of Supply Disturbances where Interruption Originated (Nationwide, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		48	65	57	65	54	57.8
Transmission lines & Extra High Voltage Lines	Overhead	274	260	308	312	347	300.2
	Underground	9	17	9	7	13	11.0
	Total	283	277	317	319	360	311.2
High Voltage Lines	Overhead	13,539	10,775	13,847	14,152	13,916	13,245.8
	Underground	201	201	210	187	195	198.8
	Total	13,740	10,976	14,057	14,339	14,111	13,444.6
Low Voltage Lines						1	0.2
Demand Facilities				1			0.2
Involved Accidents		277	245	361	409	359	330.2
Total Disturbances		14,348	11,563	14,793	15,132	14,885	14,144.2

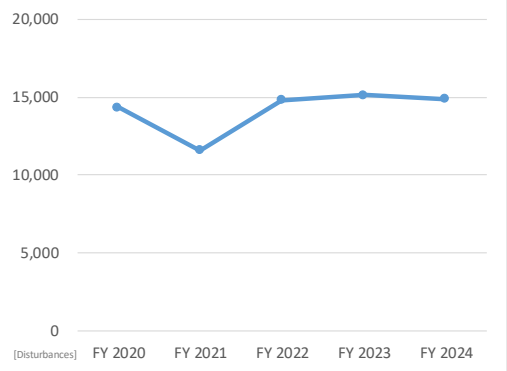

Figure 3-1 Transition of Supply Disturbances (Nationwide, FY 2020–2024)

[8] "Involved Accidents" in the tables show the number of supply disturbances that occurred in each service area due to the ripple effect of an accident on facilities other than those of the relevant GT&D companies of such service area. The table columns are left blank if the corresponding data are not available.

[9] According to the status of the designation as a severe disaster on the Cabinet Office website https://www.bousai.go.jp/taisaku/gekijinhukko/status.html
Regarding the Cabinet Order for the partial revision of the Cabinet Order on the designation of severe disaster and measures to apply to the disaster caused by torrential rain during the period from Jun 8 to July 30, 2024.

[10] According to the disaster information in 2024 on the Cabinet Office website.
https://www.bousai.go.jp/updates/#r6
Tokyo area: damage situation related to the heavy rain during the period from July 25, 2024 (situation of supply interruption).
Chugoku and Kyushu areas: damage situation due to the Typhoon No. 10 in 2024 (situation of supply interruption).

Table 3-2 Number of Supply Disturbances where Interruption Originated (Hokkaido, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		2	3	3	3	1	2.4
Transmission lines & Extra High Voltage Lines	Overhead	21	20	20	13	8	16.4
	Underground	1				1	0.4
	Total	22	20	20	13	9	16.8
High Voltage Lines	Overhead	801	848	973	859	637	823.6
	Underground	15	12	15	18	14	14.8
	Total	816	860	988	877	651	838.4
Low Voltage Lines							
Demand Facilities							
Involved Accidents		10	14	16	18	10	13.6
Total Disturbances		850	897	1,027	911	671	871.2

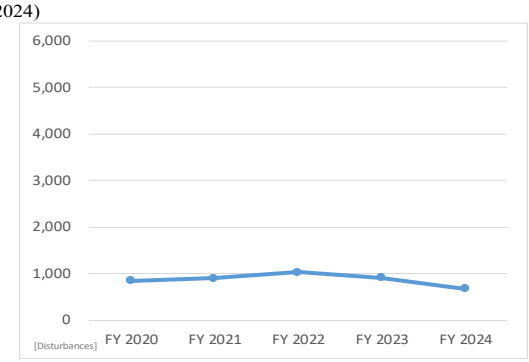

Figure 3-2 Transition of Supply Disturbances (Hokkaido, FY 2020–2024)

Table 3-3 Number of Supply Disturbances where Interruption Originated (Tohoku, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		9	9	8	17	7	10.0
Transmission lines & Extra High Voltage Lines	Overhead	31	31	20	10	16	21.6
	Underground						
	Total	31	31	20	10	16	21.6
High Voltage Lines	Overhead	2,528	1,686	2,036	1,855	2,049	2,030.8
	Underground	13	7	19	11	7	11.4
	Total	2,541	1,693	2,055	1,866	2,056	2,042.2
Low Voltage Lines							
Demand Facilities				1			0.2
Involved Accidents		17	18	27	35	18	23.0
Total Disturbances		2,598	1,751	2,111	1,928	2,097	2,097.0

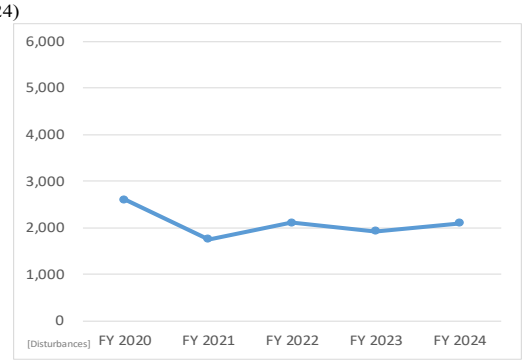

Figure 3-3 Transition of Supply Disturbances (Tohoku, FY 2020–2024)

Table 3-4 Number of Supply Disturbances where Interruption Originated (Tokyo, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		5	10	8	12	15	10.0
Transmission lines & Extra High Voltage Lines	Overhead	10	10	20	24	24	17.6
	Underground	3	5	3	1	8	4.0
	Total	13	15	23	25	32	21.6
High Voltage Lines	Overhead	2,472	2,316	2,309	2,994	3,260	2,670.2
	Underground	75	87	73	61	78	74.8
	Total	2,547	2,403	2,382	3,055	3,338	2,745.0
Low Voltage Lines							
Demand Facilities							
Involved Accidents		74		67	81	89	62.2
Total Disturbances		2,639	2,428	2,480	3,173	3,474	2,838.8

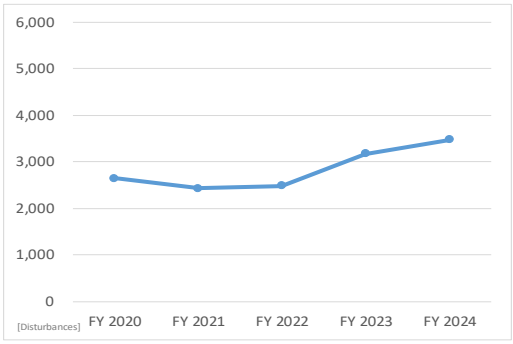

Figure 3-4 Transition of Supply Disturbances (Tokyo, FY 2020–2024)

Table 3-5 Number of Supply Disturbances where Interruption Originated (Chubu, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		4	7	7	5	6	5.8
Transmission lines & Extra High Voltage Lines	Overhead	15	9	13	23	27	17.4
	Underground	1		1	2		1.0
	Total	16	9	14	25	27	18.2
High Voltage Lines	Overhead	1,359	1,338	1,397	1,914	1,807	1,563.0
	Underground	4	10	9	5	10	7.6
	Total	1,363	1,348	1,406	1,919	1,817	1,570.6
Low Voltage Lines						1	0.2
Demand Facilities							
Involved Accidents		71	64	69	76	85	73.0
Total Disturbances		1,454	1,428	1,496	2,025	1,936	1,667.8

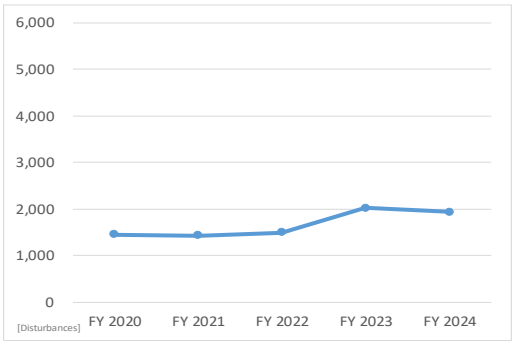

Figure 3-5 Transition of Supply Disturbances (Chubu, FY 2020–2024)

Table 3-6 Number of Supply Disturbances where Interruption Originated (Hokuriku, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		3	4	2	8	5	4.4
Transmission lines & Extra High Voltage Lines	Overhead	3		5	11	10	5.8
	Underground						
	Total	3		5	11	10	5.8
High Voltage Lines	Overhead	444	215	567	962	456	528.8
	Underground	4	1	2	8	8	4.6
	Total	448	216	569	970	464	533.4
Low Voltage Lines							
Demand Facilities							
Involved Accidents		10	14	16	18	23	16.2
Total Disturbances		464	234	592	1,007	502	559.8

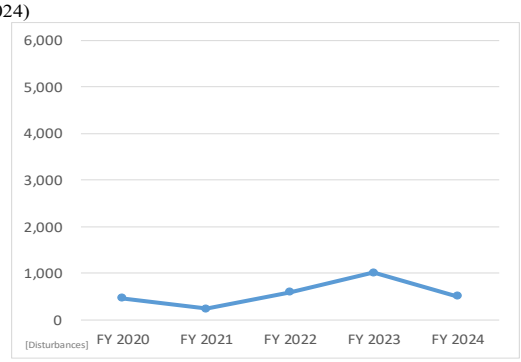

Figure 3-6 Transition of Supply Disturbances (Hokuriku, FY 2020–2024)

Table 3-7 Number of Supply Disturbances where Interruption Originated (Kansai, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		6	10	9	6	4	7.0
Transmission lines & Extra High Voltage Lines	Overhead	84	86	99	116	92	95.4
	Underground	4	8	2	3	4	4.2
	Total	88	94	101	119	96	99.6
High Voltage Lines	Overhead	1,254	1,384	1,480	1,723	1,318	1,431.8
	Underground	50	33	37	35	22	35.4
	Total	1,304	1,417	1,517	1,758	1,340	1,467.2
Low Voltage Lines							
Demand Facilities							
Involved Accidents		44	56	79	82	51	62.4
Total Disturbances		1,442	1,577	1,706	1,965	1,491	1,636.2

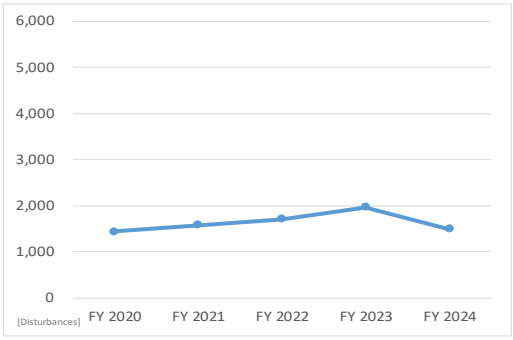

Figure 3-7 Transition of Supply Disturbances (Kansai, FY 2020–2024)

Table 3-8 Number of Supply Disturbances where Interruption Originated (Chugoku, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		3	6	11	8	4	6.4
Transmission lines & Extra High Voltage Lines	Overhead	11	25	11	14	26	17.4
	Underground		1	3	1		1.3
	Total	11	26	14	15	26	18.4
High Voltage Lines	Overhead	1,163	1,193	1,449	981	1,281	1,213.4
	Underground	12	15	20	16	24	17.4
	Total	1,175	1,208	1,469	997	1,305	1,230.8
Low Voltage Lines							
Demand Facilities							
Involved Accidents		32	37	32	34	31	33.2
Total Disturbances		1,221	1,277	1,526	1,054	1,366	1,288.8

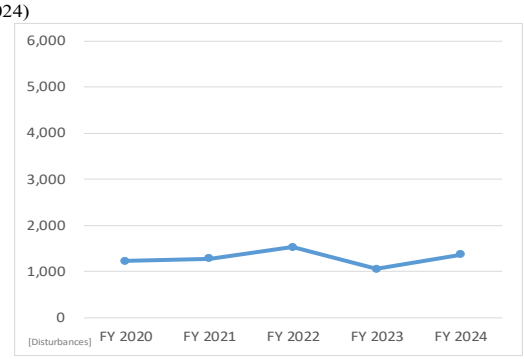

Figure 3-8 Transition of Supply Disturbances (Chugoku, FY 2020–2024)

Table 3-9 Number of Supply Disturbances where Interruption Originated (Shikoku, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		5	3		1	3	2.4
Transmission lines & Extra High Voltage Lines	Overhead	1	10	16	6	7	8.0
	Underground						
	Total	1	10	16	6	7	8.0
High Voltage Lines	Overhead	447	393	673	478	480	494.2
	Underground	6	10	3	6	8	6.6
	Total	453	403	676	484	488	500.8
Low Voltage Lines							
Demand Facilities							
Involved Accidents		6	10	10	21	12	11.8
Total Disturbances		465	426	702	512	510	523.0

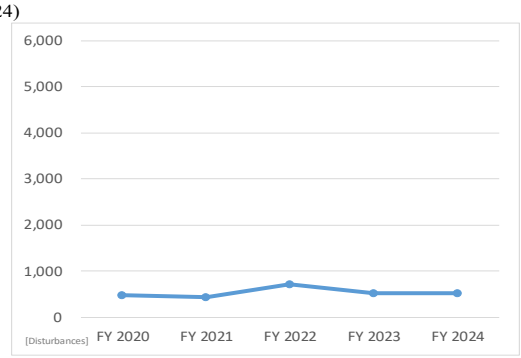

Figure 3-9 Transition of Supply Disturbances (Shikoku, FY 2020–2024)

Table 3-10 Number of Supply Disturbances where Interruption Originated (Kyushu, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		7	11	8	4	6	7.2
Transmission lines & Extra High Voltage Lines	Overhead	42	24	48	38	61	42.6
	Underground		1				0.3
	Total	42	25	48	38	61	42.8
High Voltage Lines	Overhead	2,614	1,088	2,605	1,677	2,271	2,051.0
	Underground	17	22	25	22	23	21.8
	Total	2,631	1,110	2,630	1,699	2,294	2,072.8
Low Voltage Lines							
Demand Facilities							
Involved Accidents		13	18	32	32	34	25.8
Total Disturbances		2,693	1,164	2,718	1,773	2,395	2,148.6

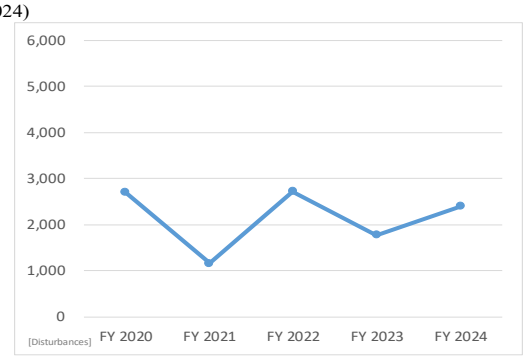

Figure 3-10 Transition of Supply Disturbances (Kyushu, FY 2020–2024)

Table 3-11 Number of Supply Disturbances where Interruption Originated (Okinawa, FY 2020–2024)

Occurrence at		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years average
Disturbance of General Transmission & Distribution Companies' Facilities							
Substations		4	2	1	1	3	2.2
Transmission lines & Extra High Voltage Lines	Overhead	56	45	56	57	76	58.0
	Underground		2				0.5
	Total	56	47	56	57	76	58.4
High Voltage Lines	Overhead	457	314	358	709	357	439.0
	Underground	5	4	7	5	1	4.4
	Total	462	318	365	714	358	443.4
Low Voltage Lines							
Demand Facilities							
Involved Accidents			14	13	12	6	9.0
Total Disturbances		522	381	435	784	443	513.0

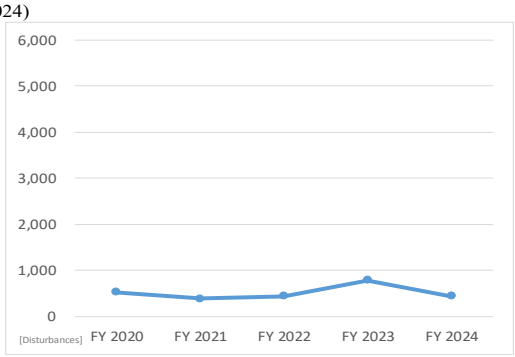

Figure 3-11 Transition of Supply Disturbances (Okinawa, FY 2020–2024)

2. Number of Supply Disturbances Where Interruptions Originated from Their Causes

(1) Data on Supply Disturbances above a Certain Scale

GT&D companies reported to the Director of Regional Industrial Safety and the Inspection Department in accordance with the provision of Item 8 of Paragraph 1 of Article 3 of the Reporting Rules of the Electricity Business and to the Minister of Economy, Trade, and Industry, in accordance with the provisions of Item 9 of the same paragraph regarding the causes of supply disturbances described in the previous paragraph of which the capacity lost by and the duration of disturbances were within the object scope shown in Figure 3-12.

The numbers of such supply disturbance at each point where an interruption originated and those by the scale of the interruption are shown in Table 3-12.[11]

An object scope in accordance with Item 8 of Paragraph 1 of Article 3 of the Reporting Rules of the Electricity Business

- Capacity lost by disturbance was 7,000–70,000 kW with durations longer than 1 h
- Capacity lost by disturbance was over 70,000 kW with durations longer than 10 min

An object scope in accordance with Item 9 of Paragraph 1 of Article 3 of the Reporting Rules of the Electricity Business

- Capacity lost by disturbance was over 100,000 kW with durations longer than 10 min

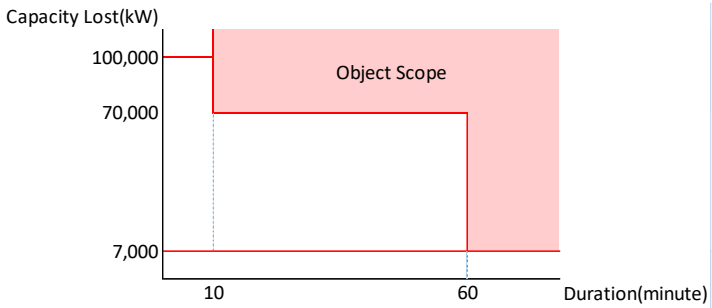

Figure 3-12 Number of Supply Disturbances over a Certain Scale

Table 19 Number of Supply Disturbances where Interruption Originated by Scale of Interruption (Nationwide, FY 2023) [Disturbances]

Scale of Disturbance [Duration & Capacity lost] / Occurrence at		10 min. till 30 min.		30 min. till 1 hour		1hour till 3 hours			Longer than 3 hours			Total Disturbances
		70,000kW to 100,000kW under	100,000kW over[8]	70,000kW to 100,000kW under	100,000kW over[8]	7,000kW to 70,000kW under	70,000kW to 100,000kW under	100,000kW over[8]	7,000kW to 70,000kW under	70,000kW to 100,000kW under	100,000kW over[8]	
Accidents of Facilities of General Transmission & Distribution Companies												
Substations		1				4			6			11
Transmission lines & Extra High Voltage Lines	Overhead	1				1			3			5
	Under-ground								1			1
	Total	1				1			4			6
High Voltage Distribution Lines	Overhead											
	Under-ground											
	Total											
Demand Facilities												
Involved Accidents												
Total Disturbances		2				5			10			17

[11] The table columns are left blank if the corresponding data are not available.

(2) Number and causes of supply disturbances above a certain scale (FY 2020–2024)

Regarding the supply disturbances above a certain scale as described in the previous paragraph, Table 3-13 and Figure 3-13 show nationwide data on the number of supply disturbances by cause, and Tables 3-14 to 3-23 show the same data from each regional service area for FY 2020–2024.[12]

The total number of nationwide supply disturbances above a certain scale in FY 2024 was 15 cases, which was 2 cases fewer than the previous fiscal year and was lower than the average of the past five years (FY 2020–2024) of 18 cases. As for the number of supply disturbances by cause, disturbances due to the Fault of Facility or Maintenance increased to 10 cases, which was 1 case higher than the previous fiscal year, and those due to the Natural Disaster was 4 cases, which was 1 case fewer than the previous fiscal year.

The supply disturbance occurred in Shikoku on November 9, 2024 (one case recorded in the "Miscellaneous" column in the Table of Cause of Disturbances of nationwide data) occurred because when a recovery operation was conducted for the Honshi interconnection line 2L as a response to a failure of the Honshi interconnection line 1L that occurred on the same day, the power flow of the interconnection facilities between Kihoku and Anan AC/DC Converter Station towards Honshu increased rapidly, and the supply capacity in the Shikoku area became insufficient, the under frequency relay (UFR) to keep the supply-demand balance was operated, and this caused the supply interruption.

Table 3-13 Causes of Disturbances above a Certain Scale (Nationwide, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault	1	2	1	2	1	1.4
Maintenance fault	1	1		1	3	1.2
Accident/vandalism	4	1	3	3	3	2.8
Physical contact	6	4	1	3	3	3.4
Involved accident						
Electric shock(worker)						
Electric shock(public)		1				0.2
Subtotal	12	9	5	9	10	9.0
Natural Disaster						
Thunderbolt	2	4	3	2		2.2
Rainstorm		2	1	1		0.8
Snowstorm		2	1	1	3	1.4
Earthquake	3	9		1		2.6
Landslide, avalanche			1		1	0.4
Dust/Gas						
Subtotal	5	17	6	5	4	7.4
Unknown	1	1		2		0.8
Miscellaneous	1		1	1	1	0.8
Total disturbances	19	27	12	17	15	18.0

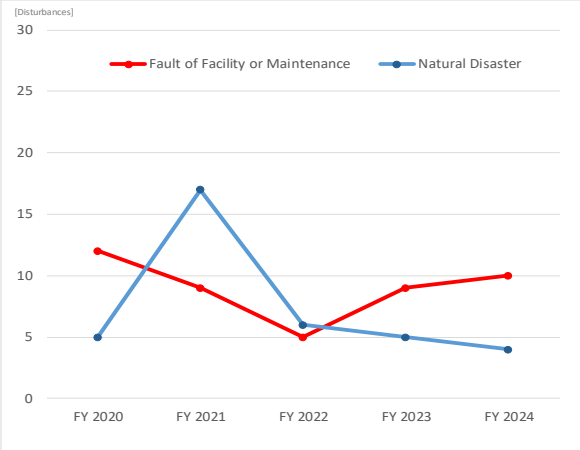

Figure 3-13 Transition of Disturbances by Cause (Nationwide, FY 2020–2024)

Table 3-14 Causes of Disturbances above a Certain Scale (Hokkaido, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault	1					0.2
Maintenance fault						
Accident/vandalism						
Physical contact			1	1		0.4
Involved accident						
Electric shock(worker)						
Electric shock(public)						
Subtotal	1		1	1		0.6
Natural Disaster						
Thunderbolt						
Rainstorm		1				0.2
Snowstorm			1			0.2
Earthquake						
Landslide, avalanche						
Dust/Gas						
Subtotal		1	1			0.4
Unknown		1				0.2
Miscellaneous						
Total disturbances	1	2	2	1		1.2

Table 3-15 Causes of Disturbances above a Certain Scale (Tohoku, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault			1			0.2
Maintenance fault						
Accident/vandalism		1	1	1		0.6
Physical contact		1				0.2
Involved accident						
Electric shock(worker)						
Electric shock(public)						
Subtotal		2	2	1		1.0
Natural Disaster						
Thunderbolt						
Rainstorm				1		0.2
Snowstorm						
Earthquake	3	8				2.2
Landslide, avalanche						
Dust/Gas						
Subtotal	3	8		1		2.4
Unknown						
Miscellaneous						
Total disturbances	3	10	2	2		3.4

[12] With respect to the "Classification of Causes" in the table, causes whose corresponding data for the past 10 years are not available are omitted. The table columns are left blank if the corresponding data are not available.

Table 3-16 Causes of Disturbances above a Certain Scale (Tokyo, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault						
Maintenance fault		1			1	0.4
Accident/vandalism	2		1	1	2	1.2
Physical contact	1	1		2	1	1.0
Involved accident						
Electric shock(worker)						
Electric shock(public)		1				0.2
Subtotal	3	3	1	3	4	2.8
Natural Disaster						
Thunderbolt		2	2	1		1.0
Rainstorm			1			0.2
Snowstorm						
Earthquake						
Landslide, avalanche						
Dust/Gas						
Subtotal		2	3	1		1.2
Unknown	1			1		0.4
Miscellaneous	1					0.2
Total disturbances	5	5	4	5	4	4.6

Table 3-17 Causes of Disturbances above a Certain Scale (Chubu, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault						
Maintenance fault						
Accident/vandalism	1					0.2
Physical contact		2			1	0.6
Involved accident						
Electric shock(worker)						
Electric shock(public)						
Subtotal	1	2			1	0.8
Natural Disaster						
Thunderbolt	1					0.2
Rainstorm						
Snowstorm				1	2	0.6
Earthquake						
Landslide, avalanche			1		1	0.4
Dust/Gas						
Subtotal	1		1	1	3	1.2
Unknown						
Miscellaneous						
Total disturbances	2	2	1	1	4	2.0

Table 3-18 Causes of Disturbances above a Certain Scale (Hokuriku, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault						
Maintenance fault						
Accident/vandalism						
Physical contact						
Involved accident						
Electric shock(worker)						
Electric shock(public)						
Subtotal						
Natural Disaster						
Thunderbolt						
Rainstorm						
Snowstorm						
Earthquake				1		0.2
Landslide, avalanche						
Dust/Gas						
Subtotal				1		0.2
Unknown						
Miscellaneous						
Total disturbances				1		0.2

Table 3-19 Causes of Disturbances above a Certain Scale (Kansai, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault		2		2	1	1.0
Maintenance fault	1				1	0.4
Accident/vandalism	1				1	0.4
Physical contact	4					0.8
Involved accident						
Electric shock(worker)						
Electric shock(public)						
Subtotal	6	2		2	3	2.6
Natural Disaster						
Thunderbolt	1	1				0.4
Rainstorm		1				0.2
Snowstorm		1			1	0.4
Earthquake						
Landslide, avalanche						
Dust/Gas						
Subtotal	1	3			1	1.0
Unknown						
Miscellaneous			1			0.2
Total disturbances	7	5	1	2	4	3.8

Table 3-20 Causes of Disturbances above a Certain Scale (Chugoku, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault						
Maintenance fault						
Accident/vandalism			1	1		0.4
Physical contact					1	0.2
Involved accident						
Electric shock(worker)						
Electric shock(public)						
Subtotal			1	1	1	0.6
Natural Disaster						
Thunderbolt		1	1	1		0.6
Rainstorm						
Snowstorm		1				0.2
Earthquake						
Landslide, avalanche						
Dust/Gas						
Subtotal		2	1	1		0.8
Unknown						
Miscellaneous						
Total disturbances		2	2	2	1	1.4

Table 3-21 Causes of Disturbances above a Certain Scale (Shikoku, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault						
Maintenance fault						
Accident/vandalism						
Physical contact						
Involved accident						
Electric shock(worker)						
Electric shock(public)						
Subtotal						
Natural Disaster						
Thunderbolt						
Rainstorm						
Snowstorm						
Earthquake						
Landslide, avalanche						
Dust/Gas						
Subtotal						
Unknown						
Miscellaneous					1	0.2
Total disturbances					1	0.2

Table 3-22 Causes of Disturbances above a Certain Scale (Kyushu, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault						
Maintenance fault						
Accident/vandalism						
Physical contact						
Involved accident						
Electric shock(worker)						
Electric shock(public)						
Subtotal						
Natural Disaster						
Thunderbolt						
Rainstorm						
Snowstorm						
Earthquake		1				0.2
Landslide, avalanche						
Dust/Gas						
Subtotal		1				0.2
Unknown						
Miscellaneous						
Total disturbances		1				0.2

Table 3-23 Causes of Disturbances above a Certain Scale (Okinawa, FY 2020–2024) [Disturbances]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
Fault of Facility or Maintenance						
Facility fault						
Maintenance fault				1	1	0.4
Accident/vandalism						
Physical contact	1					0.2
Involved accident						
Electric shock(worker)						
Electric shock(public)						
Subtotal	1			1	1	0.6
Natural Disaster						
Thunderbolt						
Rainstorm						
Snowstorm						
Earthquake						
Landslide, avalanche						
Dust/Gas						
Subtotal						
Unknown						
Miscellaneous						
Total disturbances	1			1	1	0.6

<Reference> Classification and Description of the Causes of Supply Disturbances above a Certain Scale

Classification of Causes		Description
Facility fault		Flawed production (improper design, fabrication, or material of electric facilities) or installation (improper operation of construction or maintenance work).
Maintenance fault		Flawed maintenance (improper operation of patrols, inspections or cleaning), natural deterioration (deterioration of material or mechanism of electric facilities not due to production, installations or maintenance), or overloading (current above the rated capacity).
Accident/vandalism		Worker accident, intentional act, or accident by public (stone throwing, wire theft, etc.), illegal logging, or fires. In the case of an accompanying electric shock, instances are classified under "Electric shock (worker)" or "Electric shock (public)."
Physical contact		Physical contact by trees, wildlife, or others (kite, model airplane).
Corrosion		Corrosion caused by current leakage from the DC electric railroad or by chemical action.
Vibrations		Vibrations from heavy vehicle traffic or construction work.
Involved accident		Accident involving other electric facilities of one's own company or the electric facilities of another company.
Improper fuel		Accident with improper fuel of notably different ingredients from that designated.
Electric fire		Electric fire accident caused by facility fault, maintenance fault, natural disaster, accident, intentional act, or work without permission.
Electric shock (worker)		Workers' accident from electric shock caused by misuse of equipment, malfunction of electric facilities, accident by injured or third person, etc.
Electric shock (public)		Electric shock accident to the public due to misuse of equipment, malfunction of electric facilities, accident by injured or third person, etc.
Natural disaster	Thunderbolt	Direct or indirect lightning strike
	Rainstorm	Rain, wind, or rainstorm (including contact with fallen branches, etc.)
	Snowstorm	Snow, frazil, hail, sleet, or snowstorm.
	Earthquake	Earthquake.
	Flood	Flood, storm surge, or tsunami
	Landslide	Rockslide, avalanche, landslide, or ground subsidence.
	Dust/gas	Briny air, volcanic dust and ash, fog, offensive gas, or smoke and soot.
Unknown		Unknown causes, despite an investigation.
Miscellaneous		Causes not categorized above.

* According to the list of interruption causes published by METI
https://www.meti.go.jp/policy/safety_security/industrial_safety/sangyo/electric/files/geninbunruihyo.pdf

3. Data of Interruptions for Low-Voltage (LV) Customers

(1) Indices of System Average Interruption for LV Customers

As indices of system average interruptions for LV Customers, the frequency and duration of an outage that occurred to one customer over one year are used. The following formulae calculate the indices.

System average interruption frequency index (SAIFI/interruptions)

$$= \frac{\text{LV customers affected by interruption}}{\text{LV customers served at the beginning of the fiscal year}}$$

System average interruption duration index (SAIDI/minutes)

$$= \frac{\text{Interruption duration (min)} \times \text{LV customers affected by interruption}}{\text{LV customers served at the beginning of the fiscal year}}$$

(2) Data on System Average Interruption Nationwide and by Regional Service Area (FY 2020–2024)[13]

With respect to the data on system average interruptions for LV customers for FY 2020–2024, Table 3-25 and Figure 3-14 show the nationwide data by cause, and Tables 3-26–3-35 and Figures 3-15–3-24 show the data by service area in accordance with Item 3 of Paragraph 1 of Article 268 of the Network Codes by using information received from GT&D companies regarding statistics of system average interruption. In addition, Table 3-36 shows the FY 2024 data of each service area classified by point where interruptions originated.

With respect to the nationwide data in FY 2024, the SAIFI value was 0.13 cases, which was 0.02 fewer than the previous fiscal year, and the SAIDI value was 24 minutes, which was 13-minutes shorter than the previous fiscal year. With respect to the SAIFI and SAIDI values of each service area compared with the previous fiscal year, the SAIFI value decreased by 1.61 cases and the SAIDI value decreased 1,231 minutes in Okinawa, and the SAIFI value decreased by 0.26 cases and the SAIDI value decreased by 290 minutes in Hokuriku. Meanwhile, the SAIFI value increased by 0.07 cases and the SAIDI value increased by 79 minutes from the previous fiscal year in Kyushu because of the damage from Typhoon No. 10 in August 2024, and the SAIFI value increased by 0.15 cases and the SAIDI value increased by 5 minutes in Shikoku because of the supply disturbances in November 2024.

Table 3-25 Indices of System Average Interruption (Nationwide, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	0.13	0.10	0.14	0.13	0.11	0.12
	Planned	0.04	0.03	0.03	0.02	0.02	0.03
	Total ●	0.17	0.13	0.16	0.15	0.13	0.15
SAIDI [Minutes]	Forced	24	7	22	34	21	22
	Planned	3	3	3	3	3	3
	Total ●	27	10	25	37	24	25

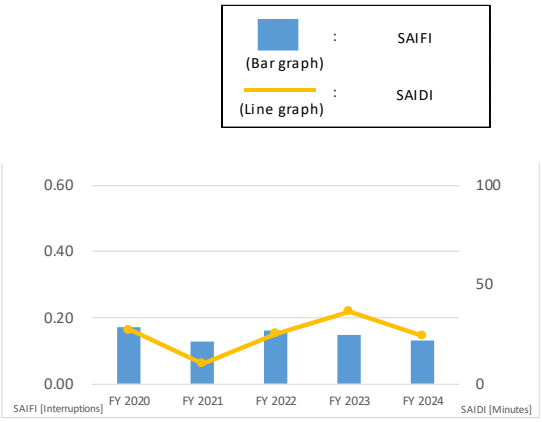

Figure 3-14 System Average Interruption Indices of LV customers (Nationwide, FY 2020–2024)

[13] Alpha (α) is shown if the data are a fraction less than a unit. For SAIFI, α falls to $0 < \alpha < 0.005$, whereas for SAIDI, α falls to $0 < \alpha < 0.5$. Numbers may not align because of rounding differences.

Table 3-26 Indices of System Average Interruption (Hokkaido, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	0.09	0.14	0.12	0.09	0.07	0.10
	Planned	α	α	α	0.01	α	0.01
	Total 🔵	0.09	0.14	0.12	0.09	0.07	0.10
SAIDI [Minutes]	Forced	5	12	20	5	4	9
	Planned	α	α	1	1	1	1
	Total 🟡	5	12	21	6	4	10

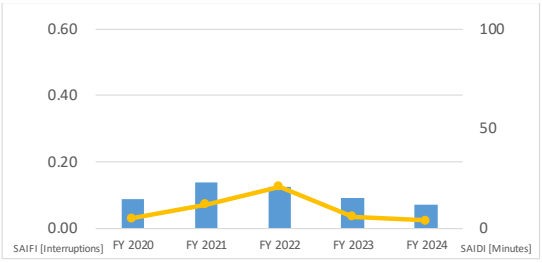

Figure 3-15 System Average Interruption Indices of LV customers (Hokkaido, FY 2020–2024)

Table 3-27 Indices of System Average Interruption (Tohoku, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	0.11	0.16	0.11	0.12	0.10	0.12
	Planned	0.02	0.02	0.02	0.01	0.01	0.02
	Total 🔵	0.12	0.18	0.13	0.13	0.11	0.13
SAIDI [Minutes]	Forced	15	25	15	12	14	16
	Planned	2	4	2	2	2	2
	Total 🟡	17	29	18	14	16	19

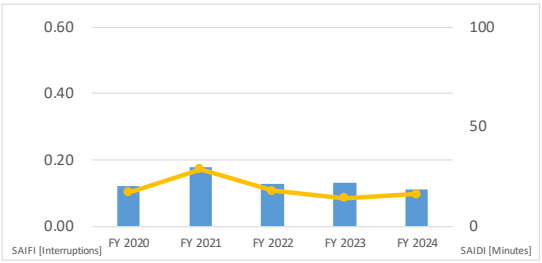

Figure 3-16 System Average Interruption Indices of LV customers (Tohoku, FY 2020–2024)

Table 3-28 Indices of System Average Interruption (Tokyo, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	0.11	0.10	0.13	0.07	0.08	0.10
	Planned	0.06	0.01	0.01	α	α	0.02
	Total 🔵	0.17	0.11	0.13	0.08	0.08	0.11
SAIDI [Minutes]	Forced	7	6	5	5	6	6
	Planned	1	1	1	α	α	1
	Total 🟡	8	7	6	5	6	6

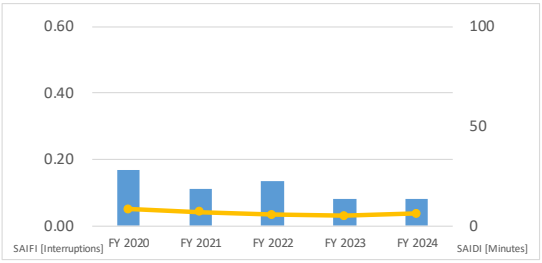

Figure 3-17 System Average Interruption Indices of LV customers (Tokyo, FY 2020–2024)

Table 3-29 Indices of System Average Interruption (Chubu, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	0.07	0.09	0.14	0.10	0.11	0.10
	Planned	0.05	0.05	0.05	0.05	0.05	0.05
	Total 🔵	0.13	0.14	0.19	0.15	0.16	0.15
SAIDI [Minutes]	Forced	6	5	16	14	9	10
	Planned	7	7	6	7	6	6
	Total 🟡	12	12	22	19	16	16

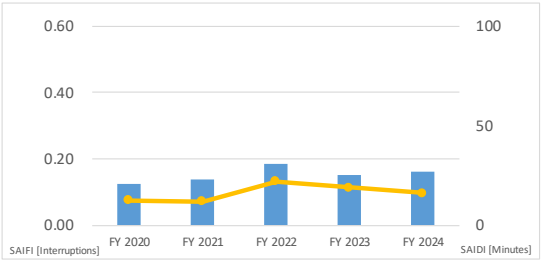

Figure 3-18 System Average Interruption Indices of LV customers (Chubu, FY 2020–2024)

Table 3-30 Indices of System Average Interruption (Hokuriku, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	0.06	0.04	0.08	0.48	0.22	0.17
	Planned	0.08	0.08	0.08	0.08	0.07	0.08
	Total 🔵	0.14	0.12	0.16	0.55	0.29	0.25
SAIDI [Minutes]	Forced	7	3	12	495	204	144
	Planned	15	14	14	15	16	15
	Total 🟡	22	17	26	510	220	159

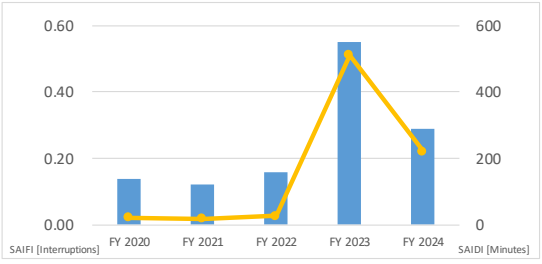

Figure 3-19 System Average Interruption Indices of LV customers (Hokuriku, FY 2020–2024)

Table 3-31 Indices of System Average Interruption (Kansai, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	0.09	0.08	0.11	0.12	0.08	0.10
	Planned	0.01	0.01	0.01	0.02	0.01	0.01
	Total	0.10	0.10	0.12	0.13	0.09	0.11
SAIDI [Minutes]	Forced	7	6	6	8	7	7
	Planned	1	2	1	1	1	1
	Total	8	7	7	9	8	8

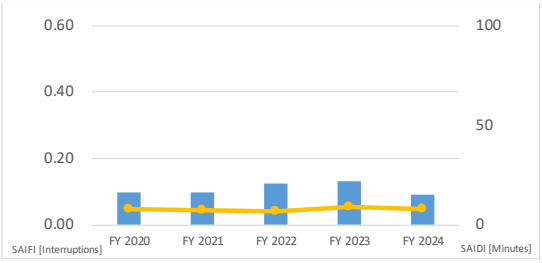

Figure 3-20 System Average Interruption Indices of LV customers (Kansai, FY 2020–2024)

Table 3-32 Indices of System Average Interruption (Chugoku, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	0.15	0.15	0.14	0.09	0.10	0.13
	Planned	0.10	0.08	0.08	0.08	0.08	0.09
	Total	0.25	0.23	0.22	0.17	0.18	0.21
SAIDI [Minutes]	Forced	20	10	12	7	9	12
	Planned	11	9	9	9	9	9
	Total	31	19	21	15	18	21

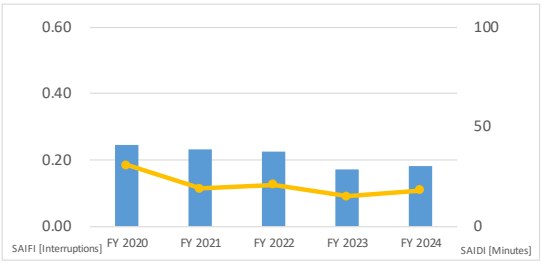

Figure 3-21 System Average Interruption Indices of LV customers (Chugoku, FY 2020–2024)

Table 3-33 Indices of System Average Interruption (Shikoku, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	0.14	0.12	0.23	0.14	0.28	0.18
	Planned	0.14	0.14	0.15	0.14	0.15	0.14
	Total	0.28	0.26	0.38	0.28	0.43	0.33
SAIDI [Minutes]	Forced	10	7	35	8	14	15
	Planned	15	15	16	16	15	15
	Total	24	23	51	24	29	30

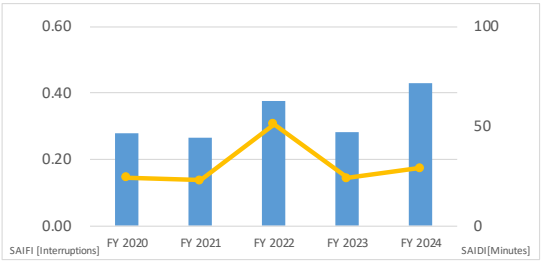

Figure 3-22 System Average Interruption Indices of LV customers (Shikoku, FY 2020–2024)

Table 3-34 Indices of System Average Interruption (Kyushu, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	0.21	0.07	0.15	0.08	0.15	0.13
	Planned	0	0	0	0	0	0
	Total	0.21	0.07	0.15	0.08	0.15	0.13
SAIDI [Minutes]	Forced	139	3	115	11	90	72
	Planned	0	0	0	0	0	0
	Total	139	3	115	11	90	72

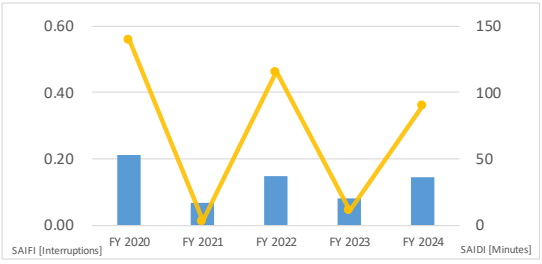

Figure 3-23 System Average Interruption Indices of LV customers (Kyushu, FY 2020–2024)

Table 3-35 Indices of System Average Interruption (Okinawa, FY 2020–2024)

		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	5-years Average
SAIFI [Interruptions]	Forced	1.12	0.57	0.98	2.30	0.69	1.13
	Planned	0.06	0.05	0.05	0.04	0.04	0.05
	Total	1.18	0.61	1.03	2.34	0.73	1.18
SAIDI [Minutes]	Forced	90	40	56	1,274	42	300
	Planned	11	5	5	4	5	6
	Total	101	45	61	1,278	47	306

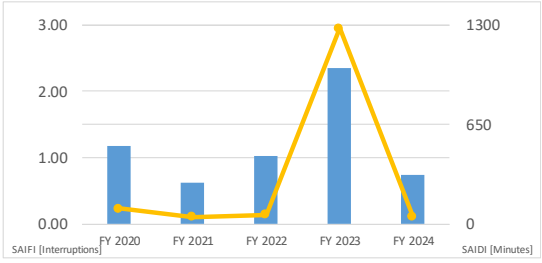

Figure 3-24 System Average Interruption Indices of LV customers (Okinawa, FY 2020–2024)

Table 3-36 System average disturbances where interruptions were caused by outages (Nationwide, FY 2024)[14,]

		Hokkaido	Tohoku	Tokyo	Chubu	Hokuriku	Kansai	Chugoku	Shikoku	Kyushu	Okinawa	Nationwide
SAIFI [Interruptions]	Forced outage											
	Generators	0.02	α	0.02	0.04	0.01	0.04	0.01	0.18	0.03	0.43	
	HV lines	0.05	0.09	0.05	0.06	0.20	0.04	0.09	0.10	0.11	0.25	
	LV lines	α	α	α	α	α	α	α	α	α	0.01	
	Subtotal	0.07	0.10	0.08	0.11	0.22	0.08	0.10	0.28	0.15	0.69	0.11
	Planned outage											
	Generators	α	α	α	0.00	α	α	0.00	0.00	0.00	0.00	
	HV lines	α	0.01	α	0.04	0.06	α	0.06	0.09	0.00	0.01	
	LV lines	α	α	α	0.01	0.01	0.01	0.02	0.06	0.00	0.03	
	Subtotal	α	0.01	α	0.05	0.07	0.01	0.08	0.15	0.00	0.04	0.02
	Total outage											
	Generators	0.02	α	0.02	0.04	0.01	0.04	0.01	0.18	0.03	0.43	
	HV lines	0.05	0.11	0.06	0.10	0.26	0.04	0.16	0.18	0.11	0.26	
	LV lines	α	α	α	0.01	0.01	0.01	0.02	0.06	α	0.04	
	Total	0.07	0.11	0.08	0.16	0.29	0.09	0.18	0.43	0.15	0.73	0.13
SAIDI [Minutes]	Forced outage											
	Generators	1	α	α	1	α	3	α	6	1	29	
	HV lines	3	13	5	6	202	3	8	6	89	10	
	LV lines	α	1	α	2	1	1	1	1	1	3	
	Subtotal	4	14	6	9	204	7	9	14	90	42	21
	Planned outage											
	Generators	α	α	α	0	α	α	0	0	0	0	
	HV lines	1	2	α	5	14	α	8	12	0	2	
	LV lines	α	α	α	1	1	1	1	4	0	3	
	Subtotal	1	2	α	6	16	1	9	15	0	5	3
	Total outage											
	Generators	1	α	α	1	α	3	α	6	1	29	
	HV lines	3	14	5	12	217	3	16	18	89	12	
	LV lines	α	2	α	3	2	2	2	5	1	6	
	Total	4	16	6	16	220	8	18	29	90	47	24

* Nationwide values are calculated by multiplying the frequency and the duration of outages that occurred to one customer in each service area by the number of LV customers at the beginning of the fiscal year of each service area and dividing such multiplied value of each service area by the number of LV customers across the nation at the beginning of fiscal year. In this calculation, nationwide SAIFI and SAIDI values are calculated.

<Reference> Classification of causes and description of outages that occurred to LV customers

Table 3-37 Classification of Causes and Description of Outages

Classification of Causes	Description
Forced outage	Supply interruptions occurred to end-use customers caused by damage and accidents involving electric facilities (except for the case where electricity supply is resumed by automatic-reclosing of electrical circuit.[15]
Planned outage	The electric power company interrupts its electricity supply in a planned manner for construction, improvements, and maintenance.

***** According to the explanation part of the statistics of average system interruptions from the electrical safety statistics in FY 2000 on the website of METI.

https://www.meti.go.jp/policy/safety_security/industrial_safety/sangyo/electric/files/12hoan-tokei/501.PDF

[14] Electric facilities such as generating plants, substations, transmission lines, and extra high voltage lines. Alpha (α) is shown if the data are a fraction less than a unit.

[15] See footnote 7 for definitions.

<Reference> Data on Average System Interruptions in Major U.S. States (FY 2020–2024)[16]

Table 4-1 and Figure 4-1 show the SAIFI values for Japan and the major U.S. states for FY 2020–2024, and Table 4-2 and Figure 4-2 show the SAIDI values for the same regions and periods.[17] Because the monitoring conditions[18] vary for each set of data, the data may not be directly comparable between countries. However, both the SAIDI and SAIFI values for Japan for FY 2020–2024 remain at lower levels than those for major U.S. states. Additionally, only LV customer data are monitored for Japan. However, it is estimated that this will have only a marginal effect on the actual interruption data because the number of customers who are supplied electricity by other than LV network is very few.

[16] With respect to data for European countries, we used to obtain data from the website of the Council of European Energy Regulators (CEER); however, data have not been published by CEER since FY 2018; therefore, we do not publish the data continuously from the previous year.

[17] Data for major U.S. states are according to the materials published by the public utilities commission of each state.
・State of California: California Public Utilities Commission (*2024 Annual Electric System Reliability Reports*) (Published on July 2025)
https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/electric-reliability/electric-system-reliability-annual-reports/2024-annual-electric-reliability-reports
・State of Texas: Public Utility Commission of Texas (*Service Quality Report To The Public Utility Commission of Texas*) (data were obtained from a report search site of the same state)
http://interchange.puc.texas.gov/WebApp/Interchange/application/dbapps/login/pgLogin.asp
・State of New York: NEW YORK STATE, Department of Public Service (*Electric Service Reliability Reports*) (Published on June 2025)
https://dps.ny.gov/electric-service-reliability-reports
Values for the states of California and Texas were calculated by weighing the numbers of customers of major electric power companies according to their reliability reports. (For California, SDG&E, PG&E, SCE, and PacifiCorp are used; for Texas, all electric power companies are used in the calculation.)

[18] Aggregation period of yearly data (Japan: from April 1 to March 31, Major U.S. states: from January 1 to December 31), and other conditions

Table 4-1 SAIFI of Japan and major U.S. states for 2020–2024 by Forced and Planned Outages

(Interruptions/year· customer)

Country/State			Year					Events	Voltage	Natural disaster
			2020	2021	2022	2023	2024			
JAPAN			0.21	0.13	0.16	0.15	0.13	All*	Low Voltage	Include
		Forced	0.17	0.10	0.14	0.13	0.11			
		Planned	0.03	0.03	0.03	0.02	0.02			
U.S.A.	California		1.26	1.35	1.63	1.68	1.64	> 5 min.	All	Include
		Forced	1.19	1.20	1.31	1.43	1.37			
		Planned	0.07	0.14	0.31	0.25	0.27			
	Texas		1.69	3.01	1.80	1.88	2.49			
		Forced	1.57	2.88	1.58	1.73	2.34			
		Planned	0.12	0.13	0.22	0.15	0.15			
	New York		1.06	0.85	0.87	0.72	0.91			
		Forced	-	-	-	-	-			
		Planned	-	-	-	-	-			

* Excludes the case of which is restored by the auto-reclosing of transmission line.

* SAIFI of forced outage in Texas was supposed to increase due to fierce wind and heavy rain of tropical cyclone struck on July 8, 2024.

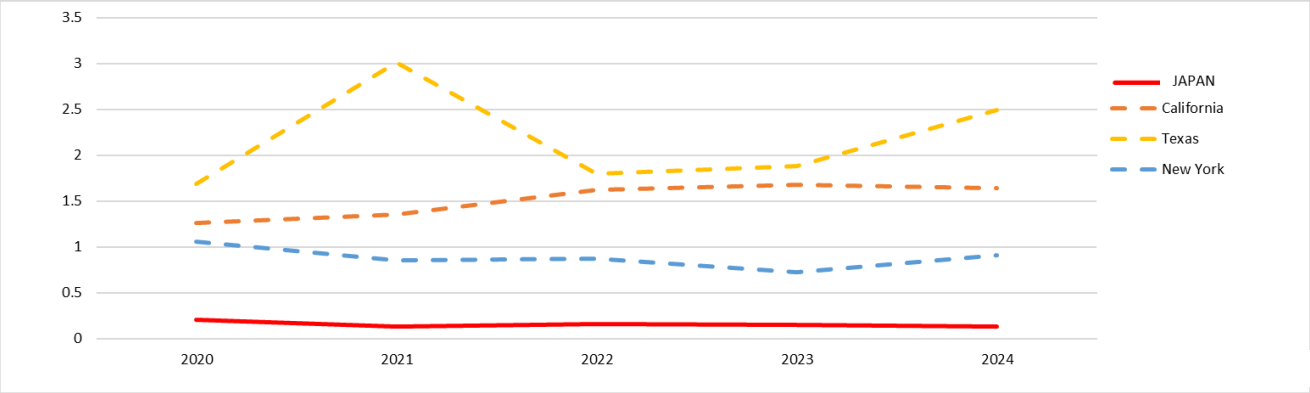

Figure 4-1 SAIFI of Japan, European countries, and major U.S. states for 2020–2024 (Interruptions /Year· Customer)

Table 4-2 SAIDI of Japan and major U.S. states for 2020–2024 by Forced and Planned Outages

(Minutes/year· customer)

Country/State			Year					Events	Voltage	Natural disaster
			2020	2021	2022	2023	2024			
JAPAN			76	10	25	36	24	All*	Low Voltage	Include
		Forced	72	7	22	34	21			
		Planned	3	3	3	3	3			
U.S.A.	California		327	355	337	435	358	> 5 min.	All	Include
		Forced	310	330	200	352	289			
		Planned	18	25	138	84	69			
	Texas		356	1136	230	451	1619			
		Forced	343	1121	207	438	1606			
		Planned	13	15	23	13	13			
	New York		538	167	234	166	242			
		Forced	-	-	-	-	-			
		Planned	-	-	-	-	-			

* Excludes the case of which is restored by the auto-reclosing of transmission line.
* SAIDI of forced outage in Texas was supposed to increase due to fierce wind and heavy rain of tropical cyclone struck on July 8, 2024.

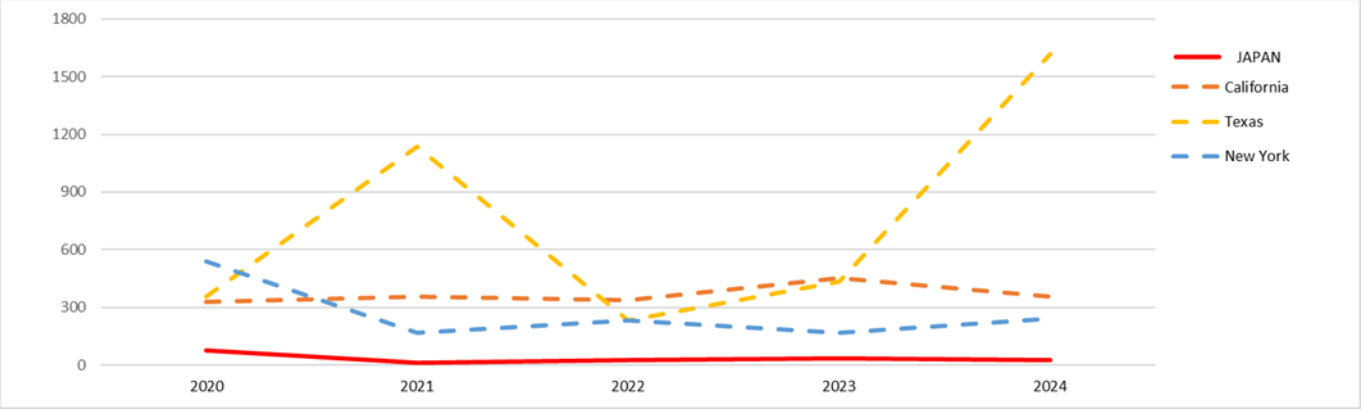

Figure 4-2 SAIDI of Japan and major U.S. states for 2020–2024 (Minutes /year· customer)

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