2018 Incident Classification Scale

Annual Report

30 September 2019

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1 INTRODUCTION

The 2018 annual report of the incident classification scale was prepared according to the incident classification scale methodology [1] developed by ENTSO-E pursuant to Article 8(3)(a) of Regulation (EC) 714/2009.

The incident classification scale methodology that has been approved by the ENTSO-E System Operations Committee on 10 April 2014 and the Assembly on 8 May 2014 was submitted to ACER on 25 June 2014 for opinion pursuant to Article 9(2) of Regulation (EC) 714/2009.

Recording of the incidents according to the common classification enables:

- monitoring the number of incidents and system performance during the year, comparable with previous years;
- identifying occurrences of high risk for system security breach;
- identification of incident investigations to be organized; and
- analysis of the incidents and the potential to improve system operation.

The annual report aggregates the data from the reports prepared by each transmission system operator (TSO) at the synchronous area level. The report provides a detailed review of the incidents on a scale of 2 and 3 at a synchronous area level and a high-level summary of scale 0 and 1 incidents.

The 2018 annual report of the incident classification scale covers the incident reports from 100 % of ENTSO-E's full members. The information regarding the incidents leading to frequency degradation in Continental Europe used in the report was provided by Amprion for odd months and Swissgrid for even months.

The ICS methodology was updated in 2018 to align it with the requirements of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (SO GL). This updated ICS methodology is being used for the first time in the 2018 report and results cannot be directly compared to previous years. An annual workshop took place to ensure continual high quality of reporting starting from 2018 for all TSOs.

2 Incident Classification Scale

2.1 The methodology

The criteria for incident classification have been defined by using definitions from the Commission Regulation (EU) establishing a guideline on electricity transmission system operation and IEC standards. Each criterion describes factually an incident or a situation which is observable.

Only significant incidents are recorded and classified according to a scale based on severity. Therefore, this report is not a compilation of all the incidents which occurred in 2018, but rather the incidents which meet the criteria of the incident classification scale methodology.

The incident classification scale has 4 levels of increasing severity, ranging from anomalies up to major or widespread incidents. It is compliant with the system state definitions listed in the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation [2]:

- scale 0 for anomalies, local incidents;
- scale 1 for noteworthy incidents;
- scale 2 for extensive incidents; and
- scale 3 for widespread or major incidents in the control area of one TSO.

Table 1. The Incident classification scale used to categorize incidents in the pan-European power system

Scale 0 Anomaly		Scale 1 Noteworthy incident		Scale 2 Extensive incidents		Scale 3 Wide area incident or major incident / 1 TSO	
Priority / Short definition (Criterion short code)		**Priority - Short definition (Criterion short code)**		**Priority - Short definition (Criterion short code)**		**Priority - Short definition (Criterion short code)**	
#20	Incidents leading to frequency degradation (F0)	**#11**	Incidents on load (L1)	**#2**	Incidents on load (L2)	**#1**	Blackout (OB3)
#21	Incidents on transmission network elements (T0)	**#12**	Incidents leading to frequency degradation (F1)	**#3**	Incidents leading to frequency degradation (F2)		
#22	Incidents on power generating facilities (G0)	**#13**	Incidents on transmission network elements (T1)	**#4**	Incidents on transmission network elements (T2)		
#23	Violation of standards on voltage (OV0)	**#14**	Incidents on power generating facilities (G1)	**#5**	Incidents on power generating facilities (G2)		
#24	Reduction of reserve capacity (RRC0)	**#15**	N-1 violation (ON1)	**#6**	N violation (ON2)		
#25	Loss of tools and facilities (LT0)	**#16**	Separation from the grid (RS1)	**#7**	Separation from the grid (RS2)		
		#17	Violation of standards on voltage (OV1)	**#8**	Violation of standards on voltage (OV2)		
		#18	Reduction of reserve capacity (RRC1)	**#9**	Reduction of reserve capacity (RRC2)		
		#19	Loss of tools and facilities (LT1)	**#10**	Loss of tools and facilities (LT2)		

3 Global Overview

3.1 Significant changes in the power system

During 2018, the trend of decreasing dispatchable generation capacity in Europe continued. In contrast, renewable installed capacities, mainly wind and photovoltaic, continued to grow strongly. While the net generating capacity of renewables increased by 3.5 % in 2018, the installed capacities of non-renewables decreased by 3.7 %.

The overall net generating capacity decreased from 2017 to 2018 by 0.7 % [3]. The circuit lengths increased slightly by 0.5 % from 2017 to 2018 [3].

The following chapters give the statistical overview of the incidents which occurred at the pan-European level in 2018.

3.2 Number of classified incidents

This section presents the number of incidents in total, which meet the ICS criteria, per synchronous area or per TSO distributed by scale or dominating criterion. The dominating scaling criteria used in this report are presented in Table 1.

As shown in Table 2, there were a total of 3030 incidents reported by TSOs in 2018, of which 2762 were reported to be of scale 0, 262 of scale 1, and 6 of scale 2. No incident of scale 3 was reported. The percentage distribution of scale 0, 1 and 2 incidents were 91.2 %, 8.6 % and 0.2 %, respectively.

Table 3 shows the number of incidents per TSO and scale. Incidents classified as scale 0 and scale 1 are widely distributed over most TSOs, while only two scale 2 incidents occurred in isolated networks, 3 in Continental Europe and 1 in Ireland.

Table 2. Number of incidents per scale in 2018 and the percentage distribution

Scale of incident	Number of incidents	Percentage (%)
Scale 0	2,762	91.2%
Scale 1	262	8.6%
Scale 2	6	0.2%
Scale 3	0	0.0%
Grand Total	3,030	100.0%

Table 3. Number of incidents per scale for each TSO in the pan-European transmission grid. The incidents in Continental Europe caused by *All* TSOs are incidents leading to frequency degradation (F0 and F1).

		Scale of incident				
Synchronous area	TSO	Scale 0	Scale 1	Scale 2	Scale 3	Grand Total
Baltic	AS Augstsprieguma tīkls	7	1			8
	Elering AS	7				7
	Litgrid AB	13				13
	Total	27	1			28
Continental Europe	50Hertz	30	5			35
	Amprion GmbH	60	14			74
	APG-Austrian Power Grid AG	10				10
	CEPS	35	14			49
	CGES	84				84
	ELES	4				4
	Elia	7	5			12
	EMS JSC	32				32
	Energinet (CE)	6				6
	ESO EAD	29				29
	HOPS	6				6
	IPTO	24	2			26
	ISO BiH					
	MAVIR ZRt	149	113			262
	MEPSO	4				4
	NOSBiH	80				80
	PSE	100				100
	REE	91	2			93
	REN	17				17
	RTE	187	59			246
	SEPS	6				6
	Swissgrid	18	2	3		23
	TenneT TSO B.V.	100	6			106
	TenneT TSO GmbH	34	5			39
	TERNA	63				63
	Transelectrica	225	1			226
	TransnetBW GmbH	14	4			18
	Frequency events for all TSOs	953	10			963
	Total	2,368	242	3		2,613
Great Britain	National Grid ESO	248	2			250
	Total	248	2			250
Ireland	EirGrid	22		1		23
	SONI	2				2
	Total	24		1		25
Isolated systems	Cyprus TSO					
	Landsnet	10	3	2		15
	Total	10	3	2		15
Nordic	Energinet (Nordic)	2	3			5
	Fingrid Oyj	10	3			13
	Statnett	23	7			30
	Svenska Kraftnät	50	1			51
	Total	85	14			99
Grand Total		2,762	262	6		3,030

Table 4 presents the total number of incidents per synchronous area and scale in 2018. Table 5 presents the percentage distribution of incidents in relation to the total number of incidents, which meet the ICS criteria, in the pan-European power grid. Figure 1 presents the distribution of faults per synchronous area.

As can be seen, 86 % of all incidents occurred in Continental Europe. This is because the synchronous area of Continental Europe is significantly larger than the other synchronous areas. The difference in the percentage distribution of incidents per scale in the other synchronous areas do not significantly differ from Continental Europe. However, it should be noted that single incidents affect notably the percentage distribution in those areas because the total number of incidents in them is small.

Table 4. Number of incidents per scale and synchronous area in 2018

	Synchronous area						
Scale of incident	Baltic	Continental Europe	Great Britain	Ireland	Isolated systems	Nordic	Grand Total
Scale 0	27	2,368	248	24	10	85	2,762
Scale 1	1	242	2		3	14	262
Scale 2		3		1	2		6
Scale 3							0
Grand Total	28	2,613	250	25	15	99	3,030

Table 5. Percentage distribution of all incidents per scale and synchronous area in 2018

	Synchronous area						
Scale of incident	Baltic	Continental Europe	Great Britain	Ireland	Isolated systems	Nordic	Grand Total
Scale 0	0.9%	78.2%	8.2%	0.8%	0.3%	2.8%	91.2%
Scale 1	0.0%	8.0%	0.1%		0.1%	0.5%	8.6%
Scale 2		0.1%		0.0%	0.1%		0.2%
Scale 3							
Grand Total	0.9%	86.2%	8.3%	0.8%	0.5%	3.3%	100.0%

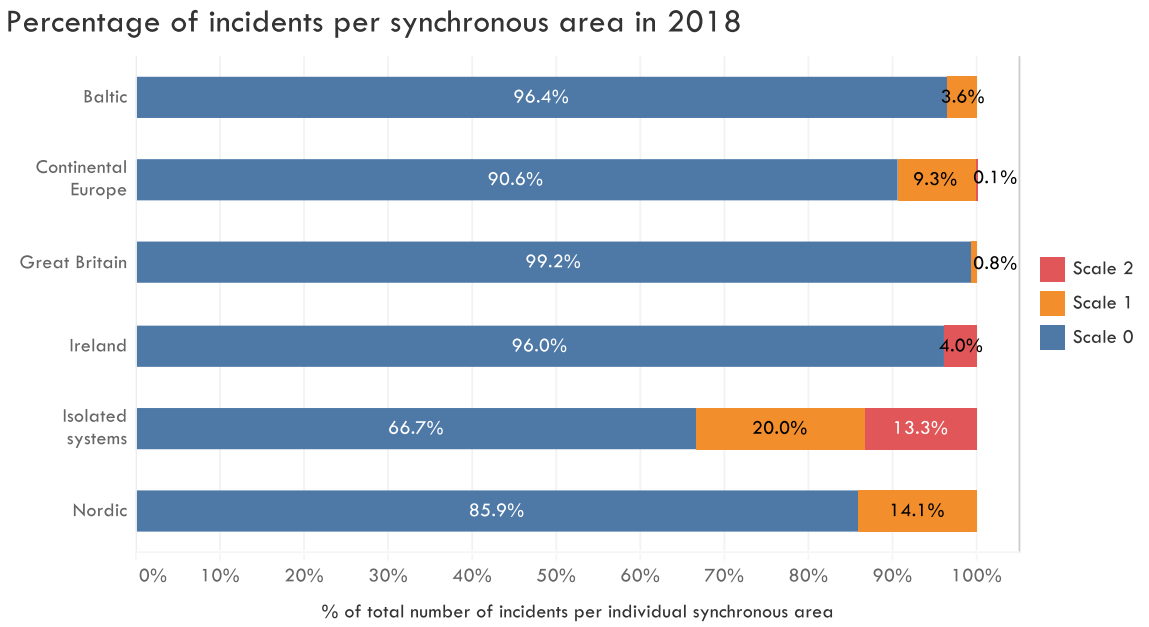

Figure 1. Proportions of scale 0, 1, and 2 incidents per synchronous area in 2018. There were no scale 3 incidents in 2018.

Table 6 displays the reported incidents per dominating criterion and synchronous area. All synchronous areas reported incidents involving Transmission Network Elements (T0), 1144 incidents in total.

Although the continental Europe reported 953 incidents leading to frequency degradation (F0), this type of incident was not reported by the smaller synchronous areas Baltic and Isolated systems. A similar observation can be seen on the violation of standards on voltage, which are mainly reported within Continental Europe. However, violations of standards on voltage have mostly local (TSO control area) consequences.

Table 6. Summary of incidents per dominating criteria in 2018

Scale of incident	Dominating Criterion	Synchronous area						
		Baltic	Continental Europe	Great Britain	Ireland	Isolated systems	Nordic	Grand Total
Scale 0	Incidents leading to frequency degradation (F0)		953	58	8		2	1,021
	Incidents on power generating facilities (G0)	2	113	3	7		1	126
	Incidents on transmission network elements (T0)	25	867	156	9	10	77	1,144
	Loss of tools and facilities (LT0)		99	31				130
	Violation of standards on voltage (OV0)		336				5	341
Scale 1	Incidents leading to frequency degradation (F1)		10					10
	Incidents on load (L1)		3				3	6
	Incidents on transmission network elements (T1)		5			3	7	15
	Loss of tools and facilities (LT1)	1	25				2	28
	N-1 violation (ON1)		31	2			2	35
	Reduction of reserve capacity (RRC1)		118					118
	Violation of standards on voltage (OV1)		50					50
Scale 2	Incidents leading to frequency degradation (F2)				1			1
	Incidents on load (L2)					1		1
	Loss of tools and facilities (LT2)					1		1
	N violation (ON2)		3					3
Grand Total		28	2,613	250	25	15	99	3,030

3.3 Incidents per length of circuit and energy consumption

The figures in this section present the number of incidents in proportion to consumption or length of circuit in the European synchronous areas in 2018.

The data in relation to the length of circuits and the energy consumption in 2018 is based on ENTSO-E statistical data [4].

Figure 2 shows the number of incidents per 1 TWh of energy consumption. For scale 0, the minimum value is 0.21 incidents per TWh for the Nordic synchronous area, and the maximum value is 0.96 incidents per TWh for the Baltic synchronous area. For scale 1, the minimum value is 0.007 incidents per TWh in GB, and the maximum value is 0.12 incidents per TWh in Isolated Systems. There were scale 2 events in isolated systems with 0.08 incidents per TWh. Continental Europe had also scale 2 incidents, however the number of scale 2 incidents per TWh was close to zero. The scale 2 event in Ireland is 0.03 incidents per TWh.

Figure 3 presents the number of incidents per 100 km of circuit at or above 220 kV. Continental Europe and Great Britain had over 2 incidents per 100 km of circuit while the Nordic and Baltic stayed below 1 incident per 100 km of circuit.

Figure 4 presents the number of incidents resulting in final tripping of transmission network equipment per 100 km of circuit at or above 220 kV. The greatest number of incidents per 100 km of circuit at or above 220 kV was observed in synchronous area of Great Britain.

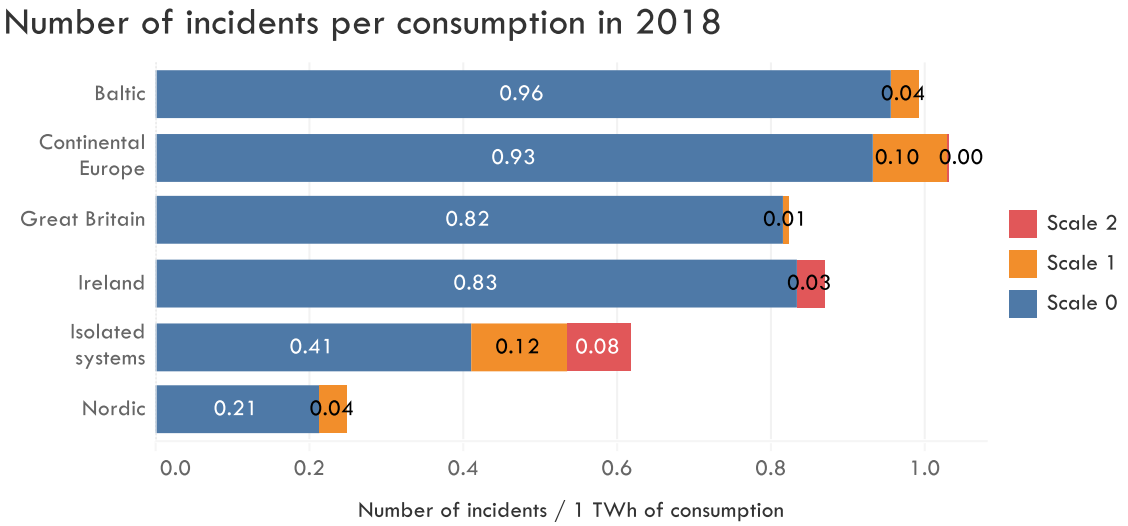

Figure 2. Number of incidents per 1 TWh of energy consumption

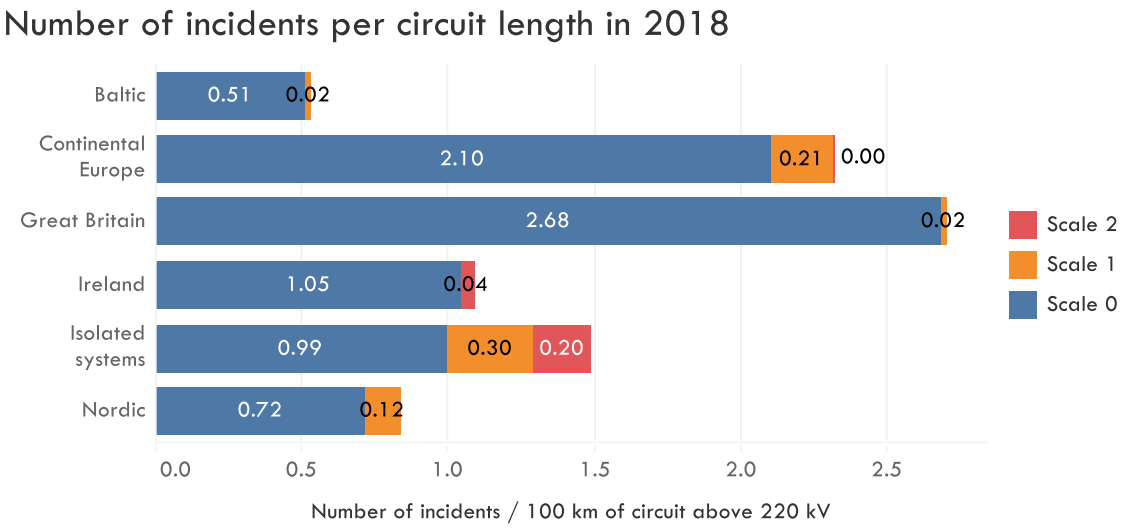

Figure 3. Number of incidents per 100 km of circuit at or above 220 kV

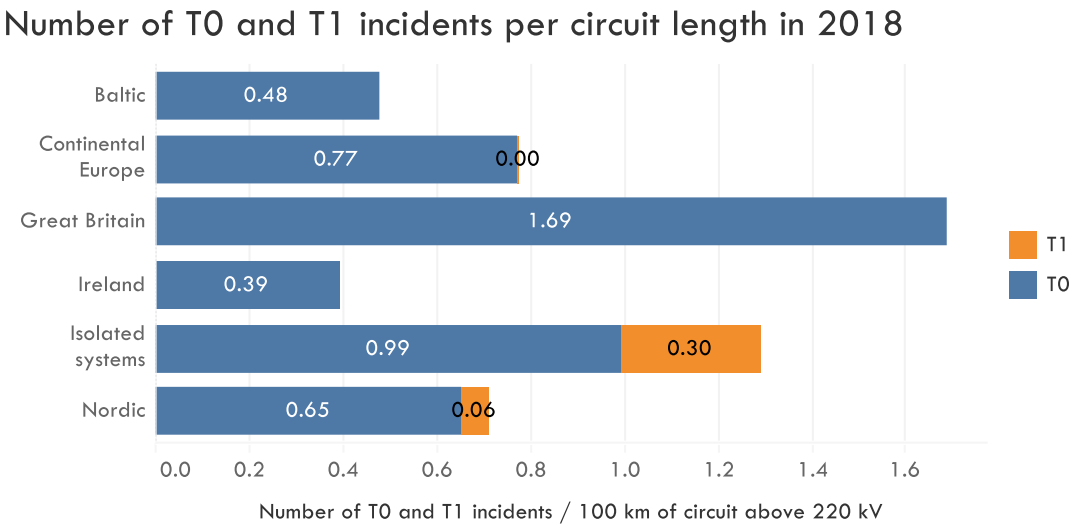

Figure 4. Number of incidents resulting in final tripping of transmission network equipment per 100 km of circuit at or above 220 kV

3.4 Evolution 2014–2018

The figures below show the changes in the number of incidents from 2014 to 2018. It should be noted that the 2014 to 2017 data was reported according to a previous version of the methodology, which was approved by ENTSO-E System Operations Committee in January 2013 [5]. Furthermore, an updated version of the methodology, which was approved on 11 April 2018, is used for the 2018 data. Therefore, the results for individual years cannot directly be compared against each other.

Figure 5 presents the annual number of incidents per scale during 2014–2018 and Figure 6 shows the annual percentage distribution of incidents by scale during 2014–2018. As can be seen, the number of scale 0 incidents has increased significantly in 2018. However, the number of scale 1 incidents has decreased for the first time since 2014. The substantial increase is a result of the updated Incident Classification Scale Methodology that was introduced for the annual report of 2018. The update has refined the definitions and thresholds in order to align with SOGL, to improve the overall data quality, make results comparable between synchronous areas and TSOs and to ease the analysis and identification of improvements to system operations.

The difference in the number of reported incidents per TSO in comparison to the previous year is also visible in Chapter 11.

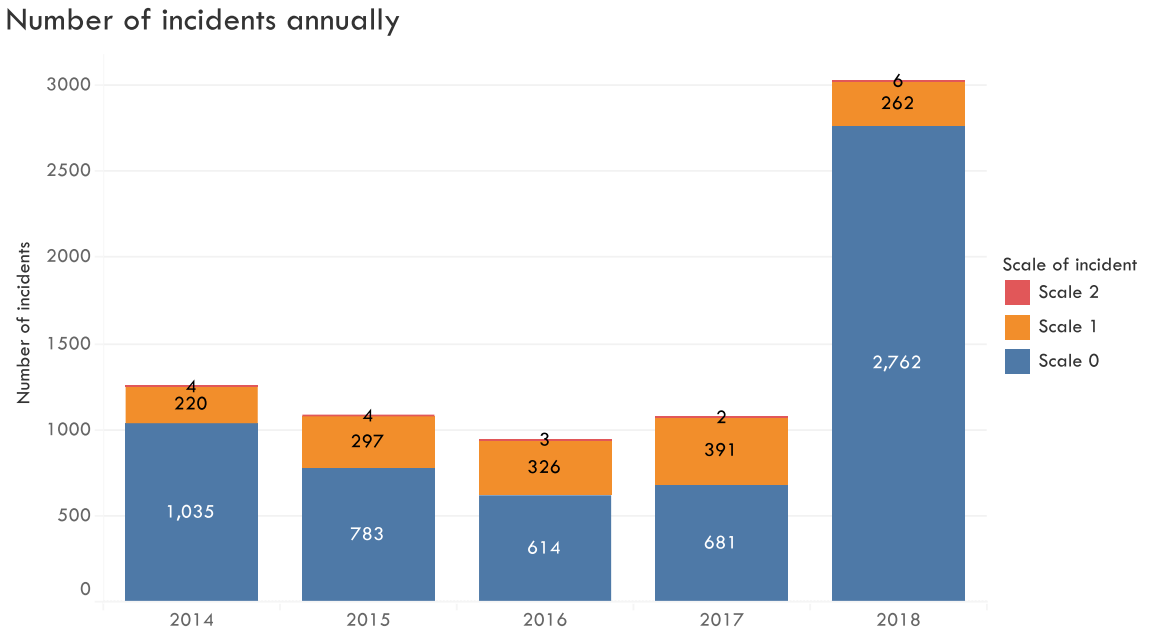

Figure 5. Annual number of incidents per scale during 2014–2018

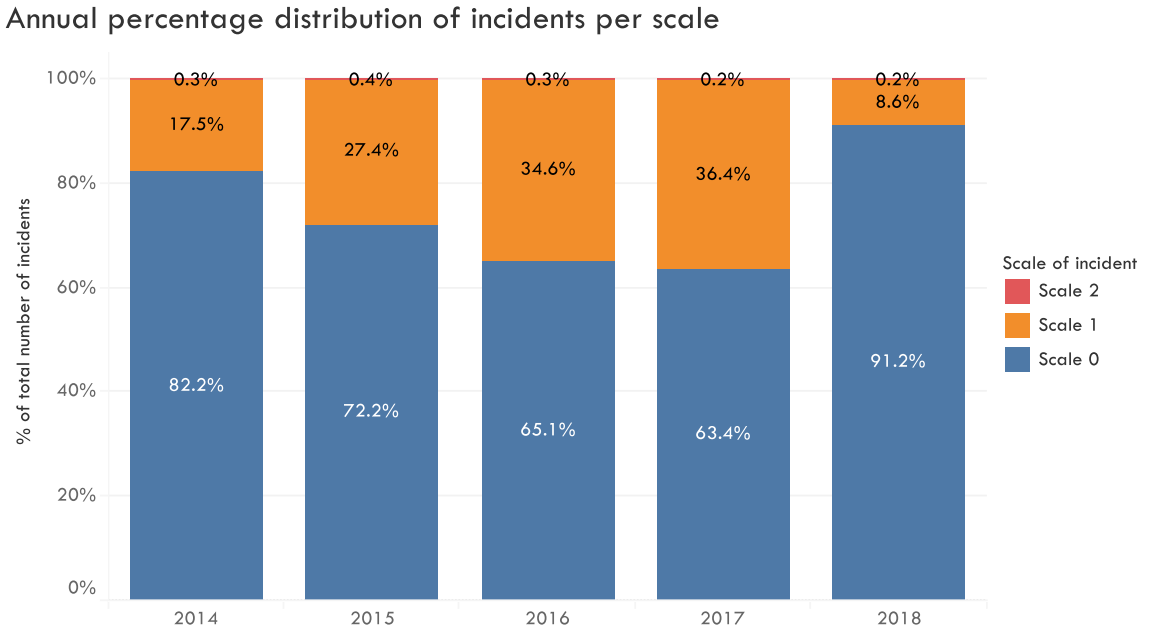

Figure 6. Annual percentage distribution of incidents per scale during 2014–2018

Figure 7, Figure 8 and Figure 9 present the annual scale 0 incidents to consumption ratio, scale 0 incidents to length of circuit ratio and T0 incidents to length of circuit ratio, respectively.

As illustrated by the figures, the incidents to consumption and incidents to length of circuit ratio in 2018 has increased in all synchronous areas, except for Ireland, compared to 2017. Figure 8 and Figure 9 are also similar because most of the incidents in the European power grids are incidents on transmission network installations.

It should be noted, that the trend and impact on the system must be interpreted according to specific considerations due to inherent differences in the way networks have been designed and are operated across different synchronous areas.

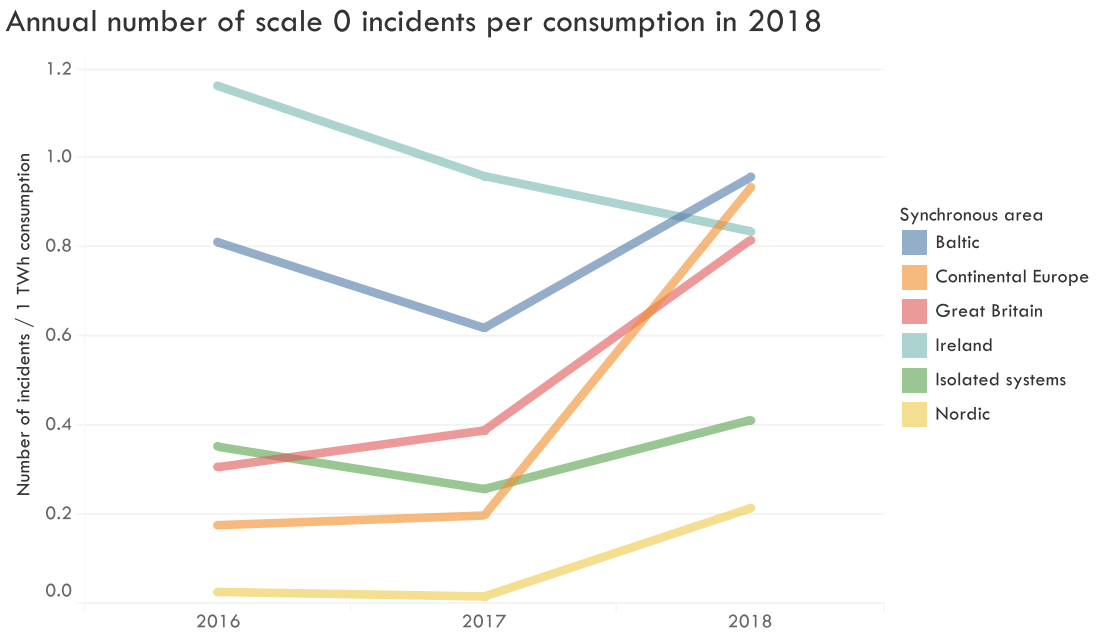

Figure 7. Annual number of scale 0 incidents per 1 TWh of energy consumption during 2016–2018. Years 2014 and 2015 are not included because the monthly domestic values of consumption are not available for those years in the ENTSO-E Statistical data [4].

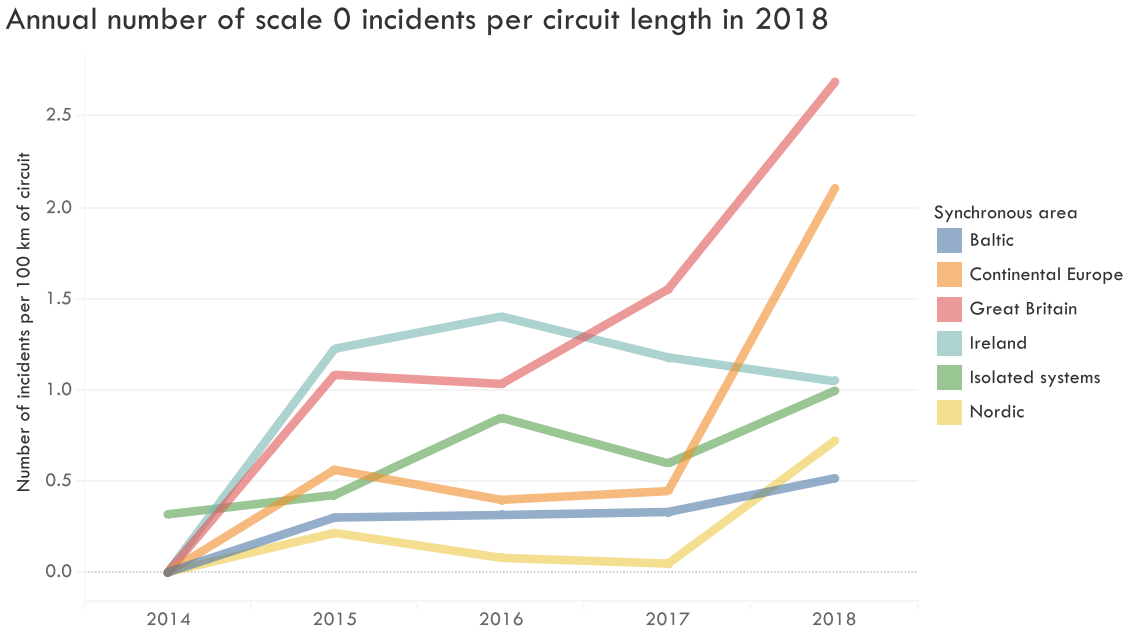

Figure 8. Annual number of scale 0 incidents per 100 km of circuit at or above 220 kV during 2014–2018

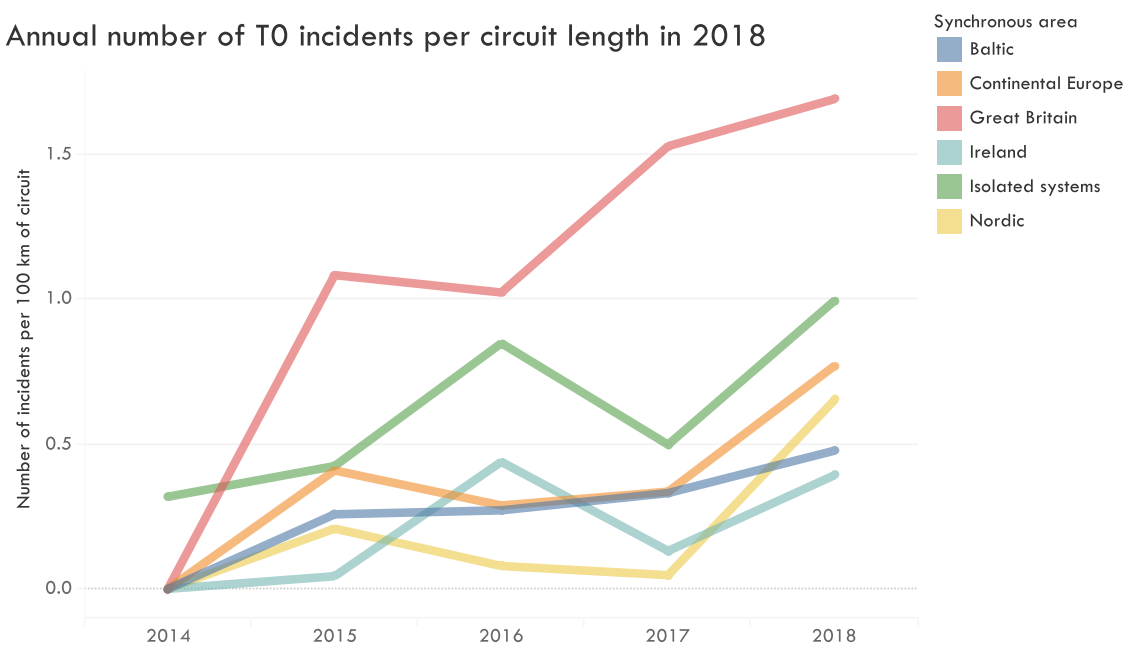

Figure 9. Annual number of scale 0 incidents with transmission network equipment per 100km of circuit at or above 220 kV during 2014–2018

Figure 10, Figure 11 and Figure 12 present the annual scale 1 incidents to consumption ratio, scale 1 incidents to length of circuit ratio and T1 incidents to length of circuit ratio, respectively. As indicated from the figures, the ratio of scale 1 incidents is decreasing in all synchronous areas except in Continental Europe where this indicator remains the same.

As can be seen, the number of scale 1 incidents compared to 2017 has decreased in all synchronous areas. However, the number of scale 0 incidents has increased as stated above.

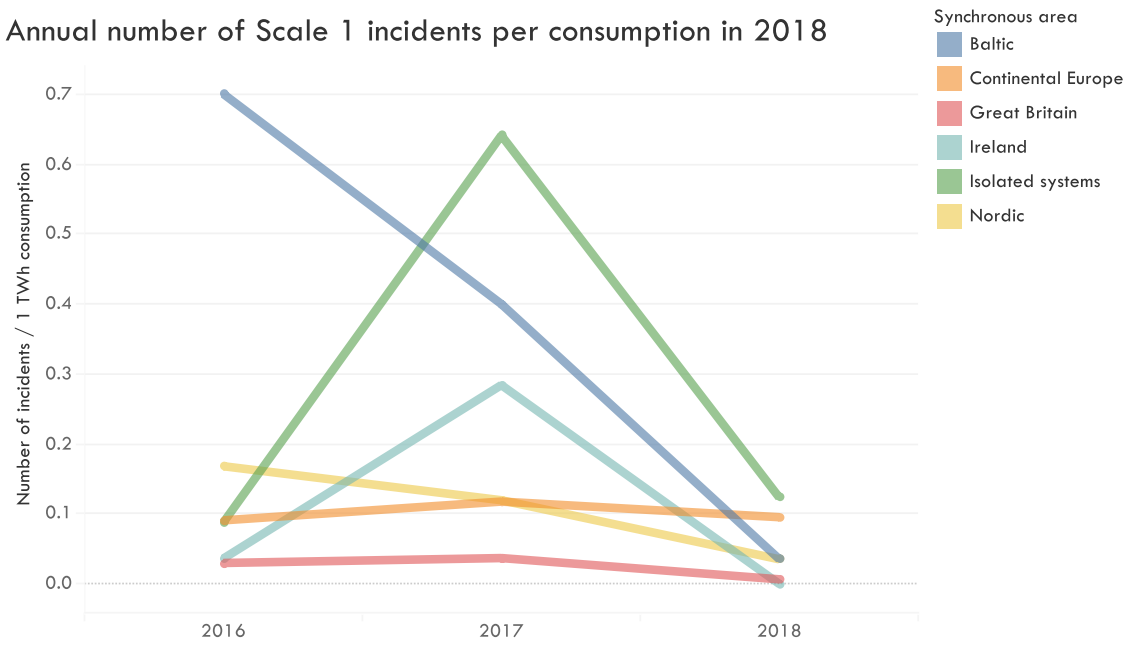

Figure 10. Annual number of scale 1 incidents per 1 TWh of energy consumption during 2016–2018. Years 2014 and 2015 are not included because the monthly domestic values of consumption are not available for those years in the ENTSO-E Statistical data [4].

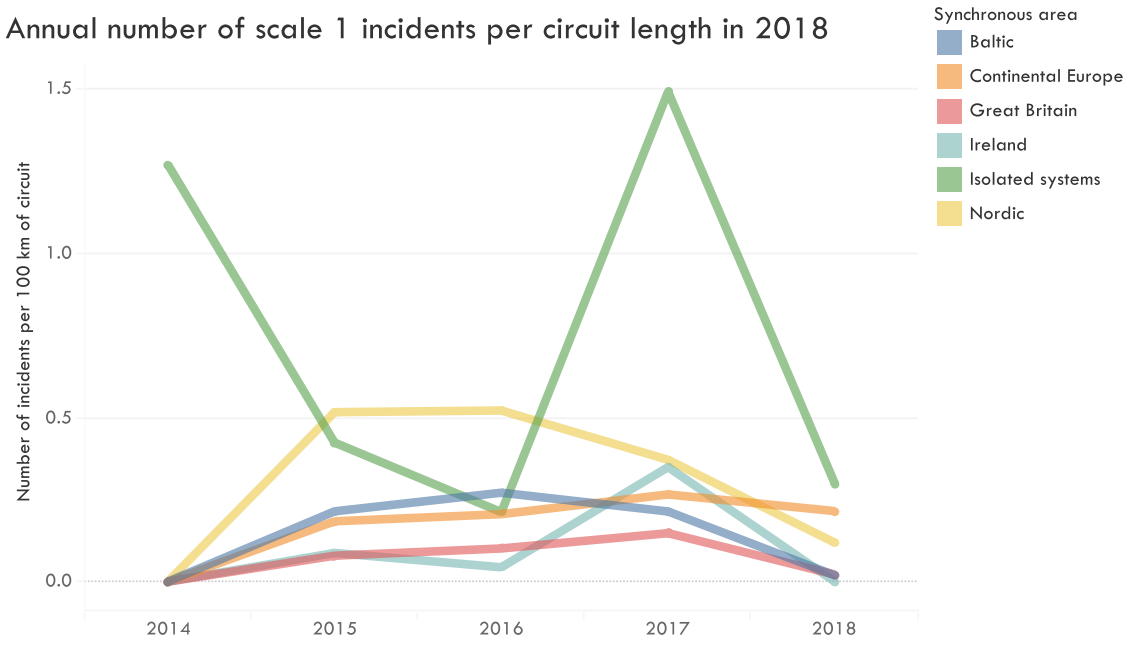

Figure 11. Annual number of scale 1 incidents per 100 km of circuit at or above 220 kV

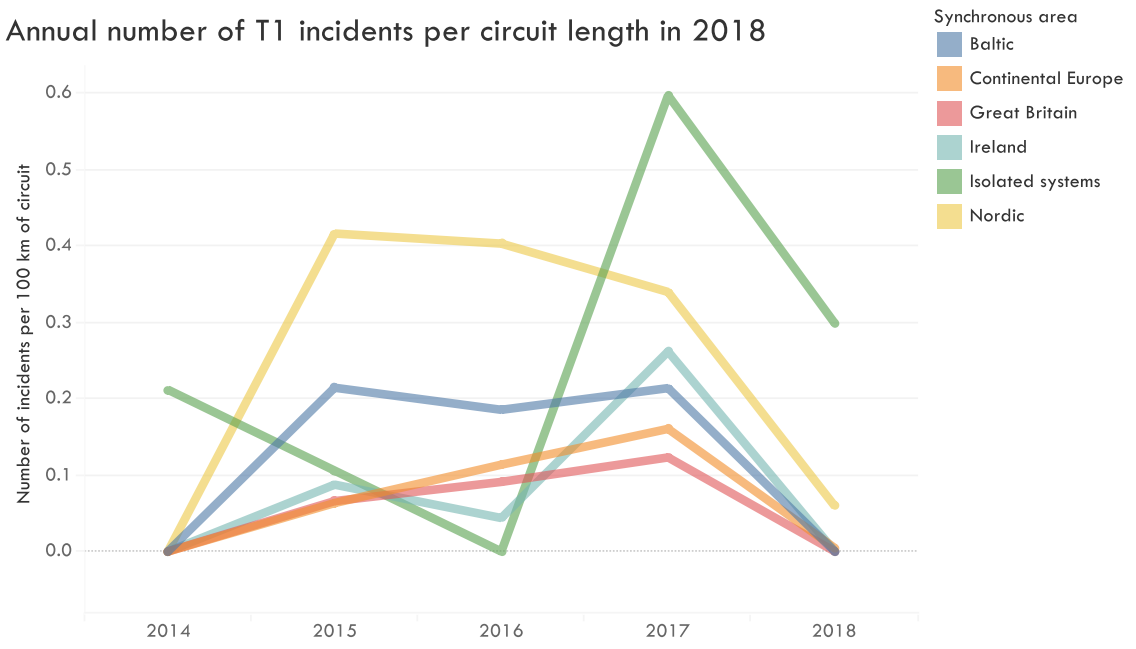

Figure 12. Annual number of scale 1 incidents with transmission network equipment per 100 km of circuit at or above 220 kV

4 Operational Security Indicators

This chapter presents the operational security indicators relevant for operational security and operational planning and scheduling.

4.1 Operational security indicators relevant for operational security

This section presents the operational security indicators relevant for operational security. For convenience, each security indicator along with abbreviation, description and calculation method is presented in Table 7.

Table 8 shows the calculated values for each security indicator for the year 2018.

Table 7 The operational security indicators relevant for operational security

Abbr.	Description of the operational security indicator	Calculation method
OS-A	Number of tripped transmission system elements per year per TSO.	Sum the number of tripped transmission system elements reported for scale 0–3 incidents.
OS-B	Number of tripped power generation facilities per year per TSO.	Sum the number of tripped power generation facilities reported for scale 0–3 incidents.
OS-C	Energy not supplied due to unscheduled disconnection of demand facilities per year per TSO.	Sum the reported energy not supplied due to unscheduled disconnection of demand facilities for scale 0–3 incidents.
OS-D1	Time duration of being in alert and emergency states per year per TSO.	Sum the time duration (in minutes) of being in alert and emergency states of all reported incidents for scale 0–3 incidents.
OS-D2	Number of reported alert and emergency state incidents per year per TSO.	Count the number of scale 0–3 incidents in which an alert or emergency state was reported.
OS-E1	Time duration within which there was a lack of reserve identified per year per TSO	Sum the duration of incidents reported under the criteria RRC0, RRC1 and RRC2; and the duration of all other incidents on scale 0–3 in case the reduction of reserve capacity is reported.
OS-E2	Number of events within which there was a lack of reserve identified per year per TSO.	Add up the number of incidents reported under the criteria RRC0, RRC1 and RRC2; and the number of all other incidents on scale 0–3 in case the reduction of reserve capacity is reported.
OS-F1	Time duration of voltage deviations exceeding the ranges from tables 1 and 2 of SO GL Annex II per year per TSO.	Add up the duration of incidents reported under the criteria OV0, OV1 and OV2; and the duration of all other incidents on scale 0–3 in case voltage deviations exceeding the ranges from SO GL Annex II are reported.

OS-F2	Number of voltage deviations exceeding the ranges from tables 1 and 2 of SO GL Annex II per year per TSO.	Count the number of violation of standards of voltage incidents (OV0, OV1 and OV2) and the number of all other scale 0–3 incidents in which the voltage standards are violated.
OS-G1	Number of minutes outside the standard frequency range per year per synchronous area.	Sum the number of minutes outside the standard frequency range for all scale 0–3 incidents.
OS-G2	Number of minutes outside the 50% of maximum steady state frequency range per year per synchronous area.	Sum the number of minutes outside the 50% of maximum steady state frequency deviation for all scale 0–3 incidents.
OS-H	Number of system-split separations or local blackout states per year.	Count the number of separation of grid incidents (RS1 and RS2).
OS-I	Number of blackouts involving two or more TSOs per year.	Count the number of blackout incidents (OB3) in which two or more TSOs were involved.

Table 8. Operational security indicators relevant to operational security, per synchronous area, (PGF stands for Power Generating Facility).

	Synchronous area						
	Baltic	Continental Europe	Great Britain	Ireland	Isolated systems	Nordic	Grand Total
OS-A [tripped elements]	25	1,557	210	10	25	128	1,955
OS-B [tripped PGF]	0	123	0	15	8	17	163
OS-C [MWh]	0	715	0	0	455	1,398	2,568
OS-D1 [minutes]	0	15,807	815	0	25	32	16,679
OS-D2 [incidents]	0	65	3	0	1	3	72
OS-E1 [minutes]	0	152,651	0	0	0	0	152,651
OS-E2 [incidents]	0	120	0	0	0	0	120
OS-F1 [minutes]	0	58,398	0	0	0	240	58,638
OS-F2 [incidents]	0	386	0	0	0	5	391
OS-G1 [minutes]	0	5,285	102	4	0	1	5,393
OS-G2 [minutes]	0	260	45	0	0	0	305
OS-H [incidents]	0	0	0	0	0	0	0
OS-I [blackouts]	0	0	0	0	0	0	0

4.1.1 Evolution 2014–2018

Figure 13, Figure 14, Figure 15 and Figure 16 show the annual calculated values during 2014–2018 for operational security indicators OS-A, OS-C and OS-D, respectively. The values for 2014 can be considered as the starting point for analysing trends in the following years.

The substantial increases in the operational security indicators are a result of the updated Incident Classification Scale Methodology that was introduced for the annual report of 2018. The update has refined the definitions and thresholds in order to align with SOGL, to improve the overall data quality, make results comparable between synchronous areas and TSOs and to ease the analysis and identification of improvements to system operations.

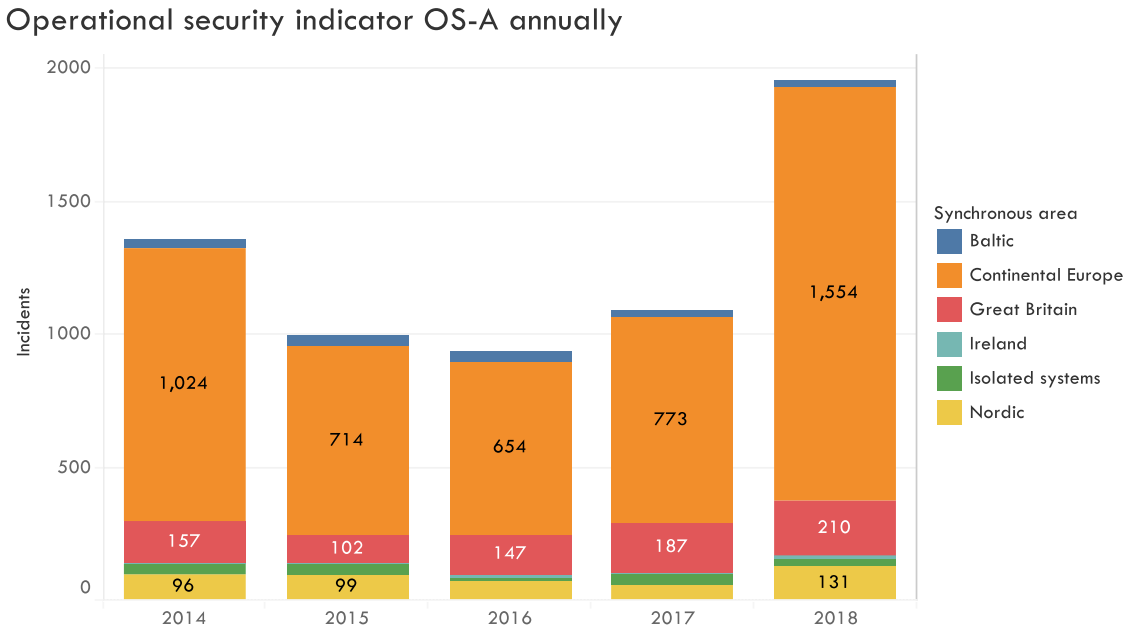

Figure 13. Operational security indicator OS-A annually during 2014–2018. It is calculated by summing the number of tripped transmission system elements reported for all scale 0–3 incidents.

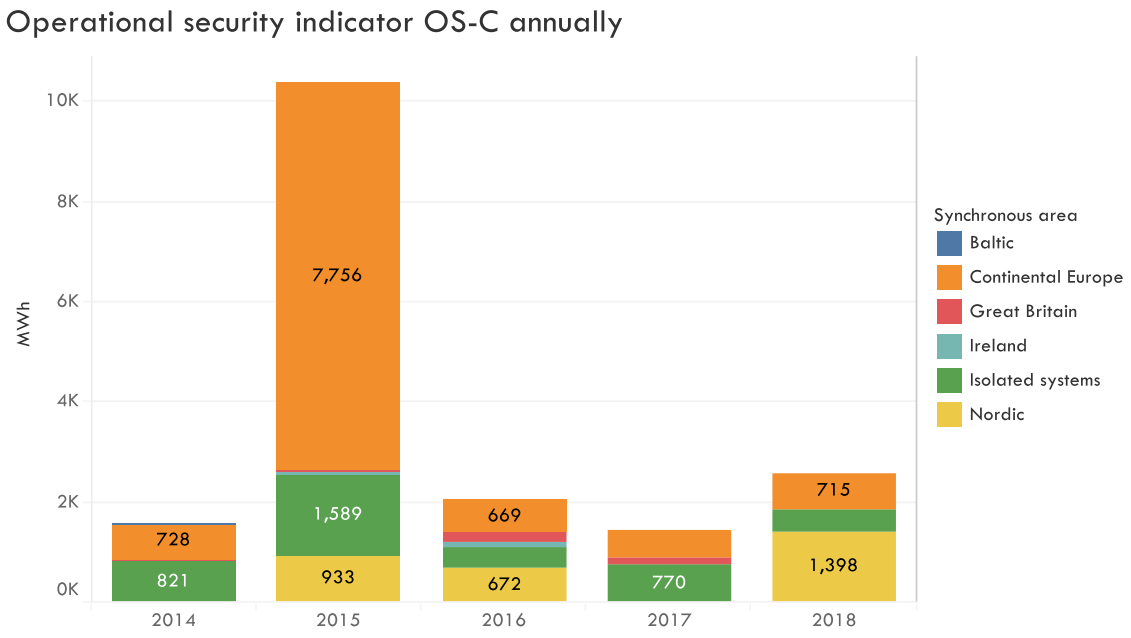

Figure 14. Operational security indicator OS-C annually during 2014–2018. It is calculated summing the reported energy not supplied due to unscheduled disconnection of demand facilities for all scale 0–3 incidents

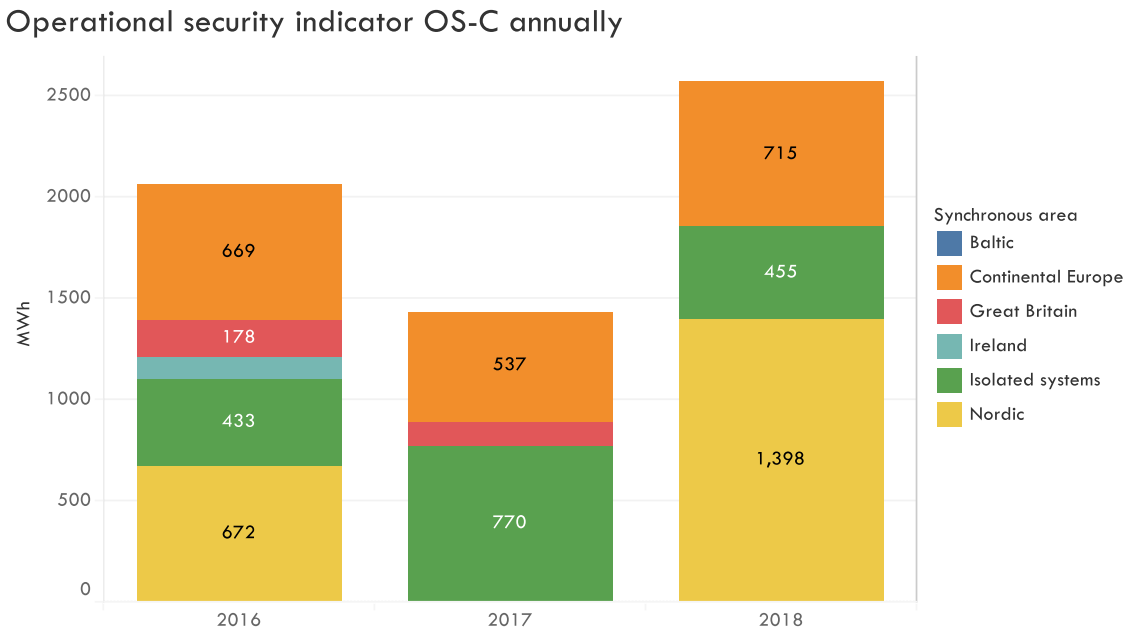

Figure 15. Operational security indicator OS-C annually during 2016-2018. Because there were incidents in 2015 with a high number of energy not supplied, this figure shows the years 2016-2018 for a better comparison between the last 3 years.

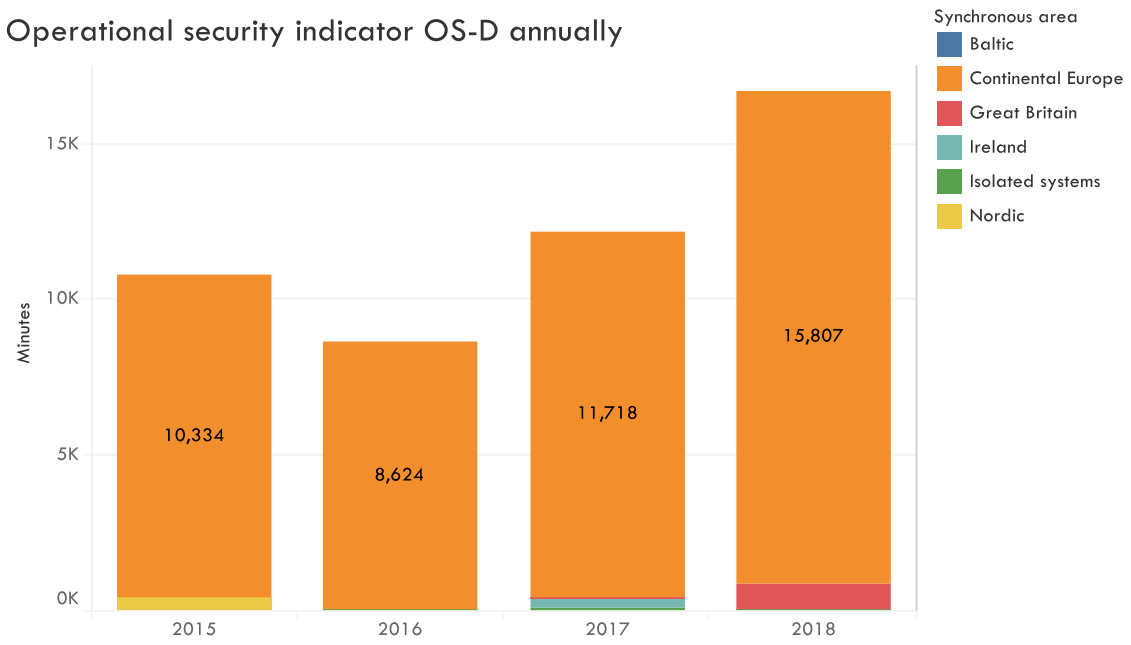

Figure 16. Operational security indicator OS-D annually during 2015–2018. The year 2014 is not shown because the data is inaccurate. It is calculated by summing the time duration (in minutes) of being in alert and emergency states of all reported incidents for scale 0–3 incidents.

4.2 Operational security indicators relevant for operational planning and scheduling

The operational security indicators relevant for operational planning and scheduling are presented in Table 9. Table 10 presents the calculated value of each operational security indicators relevant to operational planning and scheduling for the year 2018.

Table 9 The operational security indicators relevant for operational planning and scheduling

Abbr.	Description of the operational security indicator	Calculation method
OPS-A	Number of events in which an incident contained in the contingency list led to a degradation of the system operation state.	Count the number of scale 0–3 incidents in which the system operation state degraded and in case the cause of the incident was a contingency from contingency list.
OPS-B	Number of the OPS-A indicator events, in which a degradation of system operation conditions occurred as a result of unexpected discrepancies from load or generation forecasts.	Count the number of OPS-A indicators in which the cause was unexpected discrepancies from load and generation forecasts.
OPS-C	Number of events in which there was a degradation in system operation conditions due to an exceptional contingency.	Count the number of scale 0–3 incidents in case degradation of system operation state is reported and in case the cause of the incident is an exceptional contingency.

OPS-D	Number of OPS-C indicator events, in which a degradation of system operation conditions occurred as a result of unexpected discrepancies from load or generation forecasts.	Count the number indicator OPS-C incidents in case unexpected discrepancies from load and generation forecasts were reported as the cause of the incident.
OPS-E	Number of events leading to a degradation in system operation conditions due to lack of active power reserves.	Count the number of scale 0–3 incidents in case lack of active power reserves was reported as the cause of the incident.

Table 10. Operational security indicators relevant for operational planning and scheduling for each synchronous area

	Synchronous area						
	Baltic	Continental Europe	Great Britain	Ireland	Isolated systems	Nordic	Grand Total
OPS-A [incidents]	0	40	0	0	4	10	54
OPS-B [incidents]	0	2	0	0	0	0	2
OPS-C [incidents]	0	5	2	0	1	0	8
OPS-D [incidents]	0	0	0	0	0	0	0
OPS-E [incidents]	0	117	0	0	0	0	117

4.2.1 Evolution 2014–2018

Figure 17 to Figure 19 show the annual calculated values during 2014–2018 for operational security indicators OPS-A, OPS-C and OPS-E, respectively. The values for 2014 can be considered as the starting point for analysing trends in the following years.

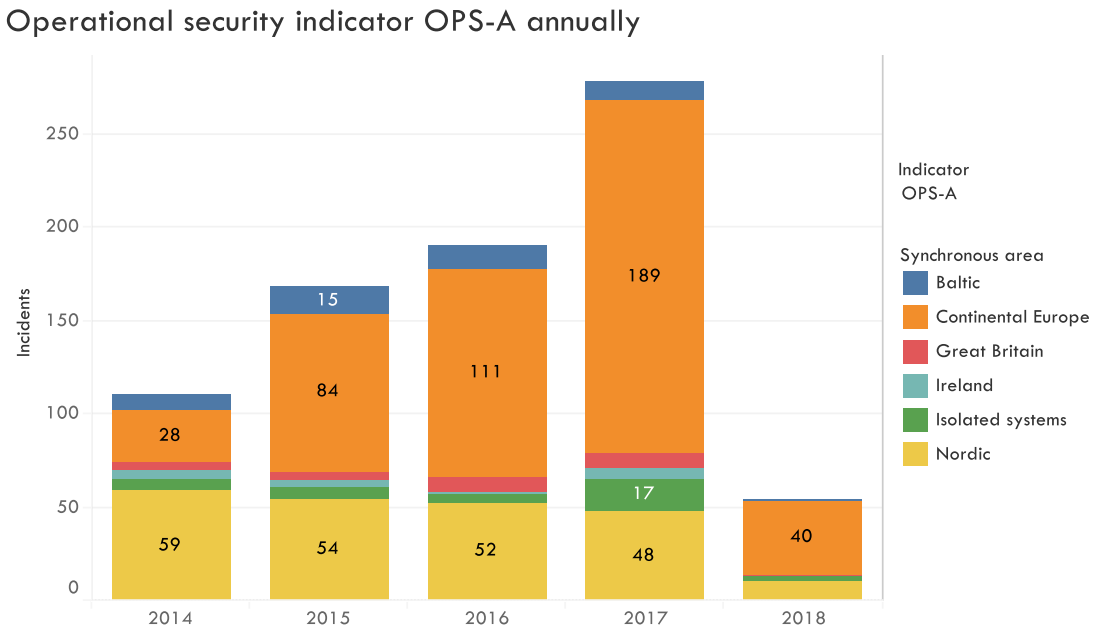

Figure 17. Operational security indicator OPS-A annually during 2014–2018. It is calculated by counting the number of scale 0–3 incidents in which the system operation state degraded, and the cause of the incident was a contingency from contingency list.

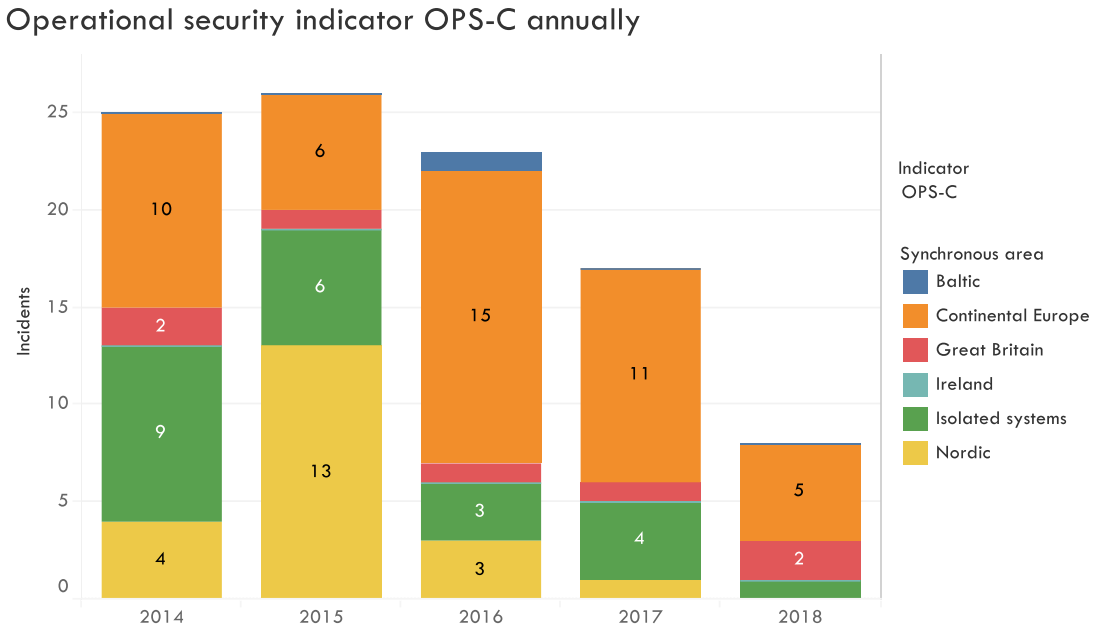

Figure 18. Operational security indicator OPS-C annually during 2014–2018. It is calculated by counting the number of scale 0–3 incidents in case degradation of system operation state is reported and the cause of the incident is an exceptional contingency

The substantial increase in operational security indicator OPS-E, as seen in Figure 19, is a result of the updated Incident Classification Scale Methodology that was introduced for the annual report of 2018. The update has refined the definitions and thresholds in order to align with SO GL, to improve the overall data quality, make results comparable between synchronous areas and TSOs and to ease the analysis and identification of improvements to system operations.

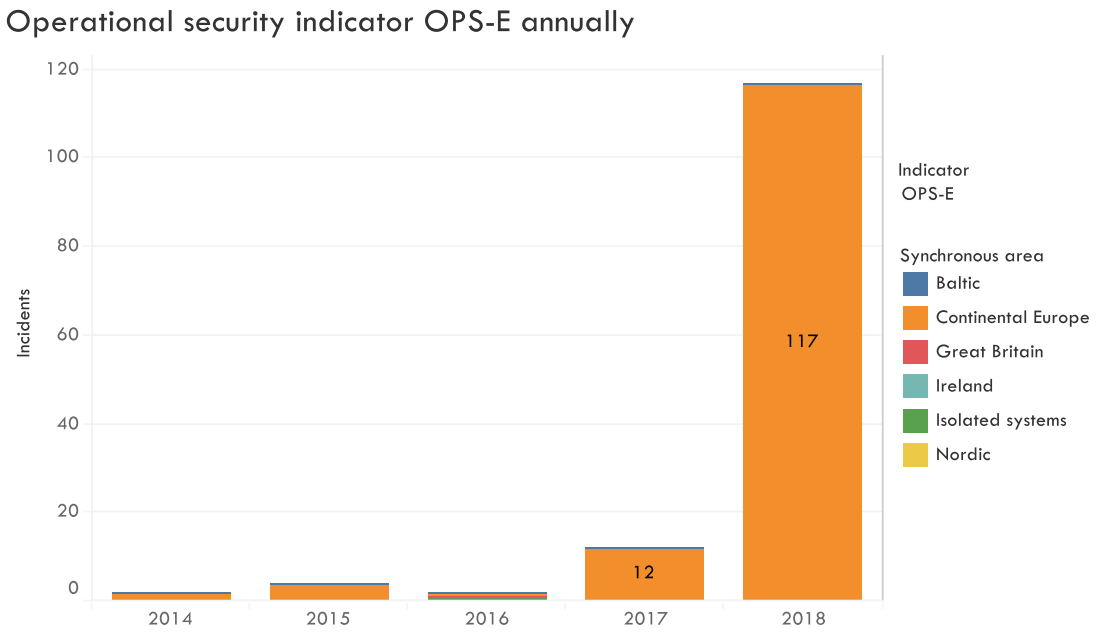

Figure 19. Operational security indicator OPS-E annually during 2014–2018. It is calculated by counting the number of scale 0–3 incidents in case lack of active power reserves was reported as the cause of the incident.

5 Incidents in Continental Europe

5.1 Overview of 2018

This section presents an overview of incidents in Continental Europe in 2018. This includes incidents per dominating criterion. The incidents are further distributed per month and duration of the incident and presented respectively.

In 2018, 2624 incidents in total were reported in Continental Europe, which meet the ICS criteria. The reported incidents covered the total quantity of criteria for scale 0, scale 1 and scale 2 (no incident of Scale 3).

The next largest groups of incidents were incidents on transmission network elements (T0) and Violations of standards on voltage (OV0).

Table 11 also portrays that the number of incidents recorded in 2018 has a uniform distribution during the year, with three exceptions – incidents involving transmission network elements, and incidents leading to frequency degradation and violation of standards on voltage. The number of T0 incidents was high during the summer and the number of F0 incidents was high during the winter and autumn. The number of OV0 and OV1 was higher in spring.

Incidents on transmission network elements (T0) were mainly due to tripped transmission network element.

There were 869 incidents reported for transmission network elements (T0) in 2018, of which 4 cases also involved load disconnections.

There were 336 violations of standards of voltage (OV0) were reported in 2018.

Furthermore, 113 Incidents at power generating facilities (G0) were reported by 10 TSOs in 2018.

Table 11. Number of incidents by dominant criteria distributed per month in 2018 in Continental Europe

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents leading to frequency degradation (F0)	89	143	145	79	38	43	42	52	69	105	78	70	953
	Incidents on load (L0)													
	Incidents on power generating facilities (G0)	13	11	14	8	5	8	10	10	14	7	4	9	113
	Incidents on transmission network elements (T0)	64	61	79	70	67	84	92	112	58	99	47	34	867
	Loss of tools and facilities (LT0)	6	15	12	12	9	14	8	3	8	4	5	3	99
	Reduction of reserve capacity (RRC0)													
	Violation of standards on voltage (OV0)	8	2	19	12	95	21	27	40	27	24	38	23	336
	Total	180	232	269	181	214	170	179	217	176	239	172	139	2,368
Scale 1	Incidents leading to frequency degradation (F1)	2			8									10
	Incidents on load (L1)						1	1	1					3
	Incidents on power generating facilities (G1)													
	Incidents on transmission network elements (T1)			1		2		1					1	5
	Loss of tools and facilities (LT1)		1	2	1	1	3		4	1	7	4	1	25
	N-1 violation (ON1)		1	2	6	2	4	1	5	1	6	2	1	31
	Reduction of reserve capacity (RRC1)	5	7	15	9	16	14	3	9	7	7	12	14	118
	Separation from the grid (RS1)													
	Violation of standards on voltage (OV1)			5	15	12	3	3	5	1	2	1	3	50
	Total	7	9	25	39	33	25	9	24	10	22	19	20	242
Scale 2	Incidents leading to frequency degradation (F2)													
	Incidents on load (L2)													
	Incidents on power generating facilities (G2)													
	Incidents on transmission network elements (T2)													
	Loss of tools and facilities (LT2)													
	N violation (ON2)								1	2				3
	Reduction of reserve capacity (RRC2)													
	Separation from the grid (RS2)													
	Total								1	2				3
Scale 3	Blackout (OB3)													
	Total													
Grand Total		187	241	294	220	247	195	188	242	188	261	191	159	2,613

The analysis of the distribution of incidents per duration shows the significant share of incidents with durations <1h. Other categories with duration >1h are comparable. The shares are in the range between 5 % and 12 %.

Most of the reported incidents lasting less than 1 hour were incidents leading to frequency degradation (F0), as shown in Table 12. Furthermore, it was not possible to determine the TSOs responsible for the incidents. Therefore, a responsible TSO has not been assigned to these events. The events can be seen as “frequency events for all TSOs” in Table 3.

Across Continental Europe, more than 90 % of incidents, regardless of criterion, were resolved in less than 24 hours. Majority of incidents lasting longer than 24 hours were due to non-return of production units and network elements after tripping.

Scale 1 incidents with short time durations predominated in 2018. More than half of all scale 1 incidents had a duration of less than 1 hour.

Table 12. Number of incidents by dominating criteria and duration in 2018 in Continental Europe

Scale	Dominating criterion	2018 < 1h	1–2h	2–5h	5–10h	10–24h	>24h	Grand Total
Scale 0	Incidents leading to frequency degradation (F0)	953						953
	Incidents on load (L0)							
	Incidents on power generating facilities (G0)	16	10	15	12	15	45	113
	Incidents on transmission network elements (T0)	301	75	155	99	92	145	867
	Loss of tools and facilities (LT0)	61	13	12	8	3	2	99
	Reduction of reserve capacity (RRC0)							
	Violation of standards on voltage (OV0)	159	70	66	36	5		336
	Total	1,490	168	248	155	115	192	2,368
Scale 1	Incidents leading to frequency degradation (F1)	10						10
	Incidents on load (L1)	1	2					3
	Incidents on power generating facilities (G1)							
	Incidents on transmission network elements (T1)	1		1			3	5
	Loss of tools and facilities (LT1)	4	5	7	5	2	2	25
	N-1 violation (ON1)	7	14	4		4	2	31
	Reduction of reserve capacity (RRC1)	103	11	4				118
	Separation from the grid (RS1)							
	Violation of standards on voltage (OV1)	14	9	15	6	2	4	50
	Total	140	41	31	11	8	11	242
Scale 2	Incidents leading to frequency degradation (F2)							
	Incidents on load (L2)							
	Incidents on power generating facilities (G2)							
	Incidents on transmission network elements (T2)							
	Loss of tools and facilities (LT2)							
	N violation (ON2)	1		2				3
	Reduction of reserve capacity (RRC2)							
	Separation from the grid (RS2)							
	Total	1		2				3
Scale 3	Blackout (OB3)							
	Total							
Grand Total		1,631	209	281	166	123	203	2,613

5.2 Evolution 2014–2018

This section presents the annual number of incidents in Continental Europe during 2014–2018. This includes the annual number of incident distributed by scale, presented in Figure 20, and the annual number of reported incidents per dominating criterion, presented in Table 13.

Scale 0 incidents reported in 2018 increased by 1827 in comparison to 2017, as seen in Figure 20. The substantial change in the number of incidents are a result of the updated Incident Classification Scale Methodology that was introduced for the annual report of 2018. The update has refined the definitions and thresholds in order to align with SOGL, to improve the overall data quality, make results comparable between synchronous areas and TSOs and to ease the analysis and identification of improvements to system operations.

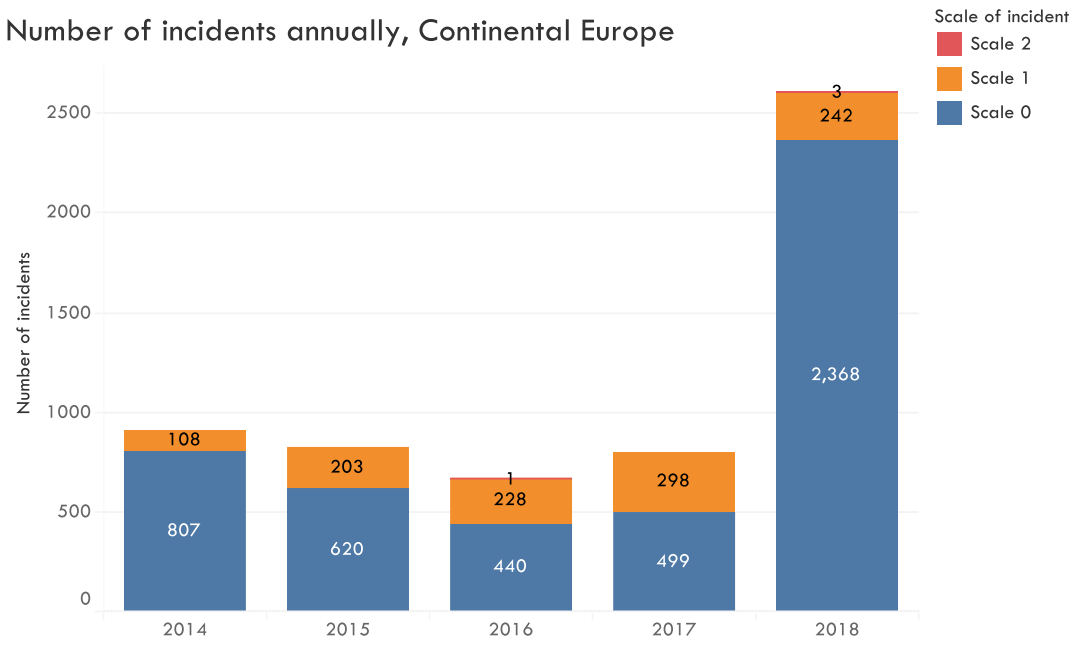

Figure 20. Annual number of reported incidents divided by scale during 2014–2018 in Continental Europe

The increase of scale 0 incidents was mostly caused by incidents leading to frequency degradation (F0, +942 incidents) and incidents on transmission system elements (T0, +493 incidents) and also increase in violation of standard on voltage (OV0, +309) as seen in Table 13. The increases in reporting of more incidents is mainly due the new methodology. This evolution of this trend needs to be followed up in the next years when the methodology is stable.

Scale 1 incidents reported in 2018 decreased by 47 incidents. Incidents on transmission system elements (T1) decreased by 174. However, scale 1 incidents due to reduction of reserve capacity (RRC1) increased by 106.

There were 3 Scale 2 incidents (N-violation) in Continental Europe in 2018, which were caused in Switzerland due to unexpected high flows on the Switzerland and Italian border due to unexpected high production in Italy). No Scale 3 incidents were reported in 2018.

Table 13. Annual number of incidents per dominating criterion during 2014–2018

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)	4	25	15	11	953
	Incidents on load (L0)	17				
	Incidents on power generating facilities (G0)	103	131	85	84	113
	Incidents on transmission network elements (T0)	667	451	319	376	867
	Loss of tools and facilities (LT0)					99
	Reduction of reserve capacity (RRC0)			2	1	
	Violation of standards on voltage (OV0)	16	13	19	27	336
	Total	807	620	440	499	2,368
Scale 1	Incidents leading to frequency degradation (F1)					10
	Incidents on load (L1)	1	5	2	1	3
	Incidents on power generating facilities (G1)	3		1		
	Incidents on transmission network elements (T1)	36	70	126	180	5
	Loss of tools and facilities (LT1)	21	11	15	18	25
	N-1 violation (ON1)	45	93	68	66	31
	Reduction of reserve capacity (RRC1)	2	3	1	12	118
	Separation from the grid (RS1)					
	Violation of standards on voltage (OV1)		21	15	21	50
	Total	108	203	228	298	242
Scale 2	Incidents leading to frequency degradation (F2)					
	Incidents on load (L2)					
	Incidents on power generating facilities (G2)					
	Incidents on transmission network elements (T2)					
	Loss of tools and facilities (LT2)					
	N violation (ON2)					3
	Reduction of reserve capacity (RRC2)					
	Separation from the grid (RS2)			1		
	Total			1		3
Scale 3	Blackout (OB3)					
	Total					
Grand Total		915	823	669	797	2,613

5.3 N-1 violations (ON1)

This section presents N-1 violations in Continental Europe in 2018 and during 2014–2018.

Table 14 presents an overview of N-1 violations for the year 2018. This includes the number of N-1 violations as well as the number of times other TSOs were affected and the number of times the incident aggravated the system to an alert state. Table 15 presents the annual monthly distribution of N-1 violations and Figure 21 the annual number of incidents grouped by the duration of the incident during 2014–2018.

There were 37 N-1 violations reported by 10 TSOs in 2018 in Continental Europe, mainly by Central European TSOs, as seen in Table 3. Most of the N-1 violations (76 %) were caused by unexpected flows, as is presented in Table 14.

There are different interpretations of the gravity of the N-1 violations by reporting TSOs. Therefore, the normal state was not changed during some instances of N-1 violations. There are also some doubts about there being so many TSOs without any N-1 violations. Further work is ongoing to improve the interpretation of the methodology.

Table 14. Overview of N-1 violations in 2018 in Continental Europe

	Main causes			
	Unexpected flows	Unknown	Other	Grand Total
Number of N-1 violations	23	0	8	31
Number of times other TSOs affected	15	0	3	18
Number of times in alert state	13	0	1	14

Unexpected flows can occur as a result of a combination of increased shares of variable renewable energy sources, interdependencies between the different transmission systems, planned/unplanned outages of equipment and shorter market time intervals. Consequently, it is more important to increase cooperation between TSOs in order to coordinate remedial actions or capacity calculation methods necessary to avoid or solve N-1 violations.

Reducing the occurrence of unexpected flows requires coordination between TSOs in all operational planning phases, including intraday, re-dispatching of power sources and measures to change network configurations.

The number of N-1 violations has continued to decrease since 2015, as is illustrated in Table 15. Furthermore, N-1 violations are not showing a definitive trend of seasonal occurring during the period 2014–2018.

Most N-1 violations were resolved in less than 5 hours (81 % of cases).

Table 15. Monthly distribution of N-1 violations per year in Continental Europe during 2014–2018

Year ..	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2018		1	2	6	2	4	1	5	1	6	2	1	31
2017	14	8	3	4	3	4	2	4	1	6	8	9	66
2016	14	7	5	1	9		7		13	3		9	68
2015	4	5	7	1		1	28	13	13	7	10	4	93
2014	2	4	5		1	11	8	2	3	4	3	2	45

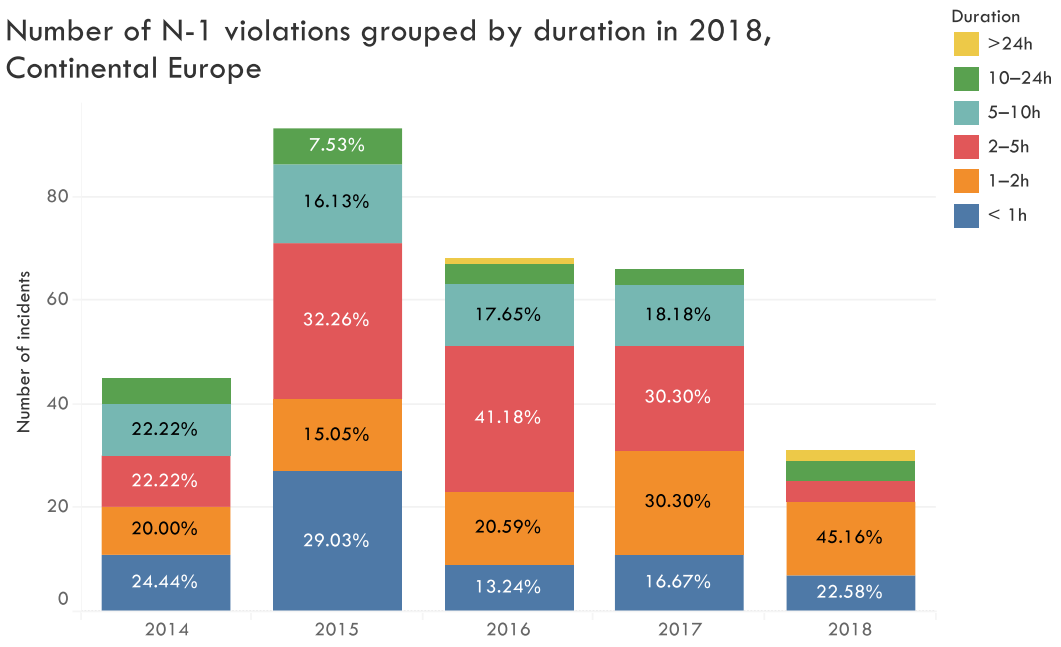

Figure 21. Annual number of N–1 violations grouped by duration in Continental Europe for the period 2014 – 2018

5.4 Loss of tools or facilities (LT)

This section presents loss of tools or facilities (LT) incidents in 2018 and during 2014–2018. A loss of tools or facilities incident occurs when a TSO loses, in real-time, control over necessary tools or facilities that are needed to operate the power grid.

Table 16 presents an overview of loss of tools or facilities incidents. This includes the total number of LT incidents, the number of times other TSOs were affected by one TSO's LT incident and how many times an LT incident aggravated the system to an alert state. Furthermore, these values are given in a per scale basis. Table 17 presents the annual number of LT incidents grouped by their duration.

The number of LT incidents is approximately 5 % of all incidents in 2018 but it is the highest value in last 5 years. The increases in reporting of more incidents is mainly due the new methodology. This evolution of this trend needs to be followed up in the next years when the methodology is stable.

Table 16. Overview of loss of tools incidents in 2018 in Continental Europe

	Scale 0	Scale 1	Scale 2	Scale 3	Total
Number of LT incidents	99	25	0		124
Number of times other TSOs affected	0	15	0		15
Number of times in alert state	13	17	0		30

Table 17 Annual number of LT incidents grouped by duration during 2014–2018 in Continental Europe

Duration	2014	2015	2016	2017	2018
1–2h	4	3	6	4	18
2–5h	2	3	3	8	19
5–10h	1	2	3		13
10–24h	1		1	1	5
< 1h	9	2	2	3	65
>24h	4	1		2	4
Grand Total	21	11	15	18	124

5.5 Analysis of significant changes in trends

In 2018, a total of 2613 incidents were reported in Continental Europe, which is an increase in comparison to 2017, when 797 incidents were reported. Dominant incidents were incidents leading to frequency degradation (F0), incidents involving transmission network elements (T0), and violation of standards on voltage (OV0). The number of scale 0 incidents increased significantly, and the number of scale 1 incidents decreased compared to the year 2017. The number of instances of reduction of reserve capacity (RRC1) and incidents involving transmission elements (T0), incidents leading to frequency degradation (F0) and violation of standards on voltage (OV0) increased significantly. More serious incidents on transmission system elements (T1) decreased substantially as many T1 incidents shifted now to scale 0.

There were no significant changes in the number of the other incident types in comparison to the previous years.

The substantial change in the number of incidents are a result of the updated Incident Classification Scale Methodology that was introduced for the annual report of 2018. The update has refined the definitions and thresholds in order to align with SOGL, to improve the overall data quality, make results comparable between synchronous areas and TSOs and to ease the analysis and identification of improvements to system operations.

6 Incidents in the Nordic Area

6.1 Overview of 2018

This section presents an overview of incidents in the Nordic synchronous area in 2018. This includes incidents per dominating criterion. The incidents are further distributed per month and duration of the incident and presented in Table 18 and Table 19, respectively.

In 2018, totally 94 incidents were reported in the Nordic synchronous area. The reported incidents covered the total quantity of criteria for scale 0, scale 1 and scale 2 (no incident of Scale 3). However, no scale 2 or 3 incidents were recorder in 2018.

Incidents on transmission network elements (T0) was the most common type of incident with 75 incidents, as shown in Table 18. The next largest groups of incidents were incidents on transmission network elements (T1).

Table 18 also portrays that nearly half of the incidents recorded in 2018 occurred during the summer season and were caused by incidents on transmission network elements (T0).

Incidents on transmission network elements (T0 & T1) were mainly due to tripped transmission network elements. Some of them were caused by weather conditions (strong wind, snowstorms and heat waves).

Only one of the incidents on transmission elements (T0) caused a nuclear plant tripping. This incident caused a loss of 888 MW generation capability.

Table 18. Number of incidents by dominant criteria distributed per month in 2018 in the Nordic countries

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents leading to frequency degradation (F0)						1						1	2
	Incidents on load (L0)													
	Incidents on power generating facilities (G0)					1								1
	Incidents on transmission network elements (T0)	6	4	7	3	4	8	16	10	5	5	5	4	77
	Loss of tools and facilities (LT0)													
	Reduction of reserve capacity (RRC0)													
	Violation of standards on voltage (OV0)			1	4									5
	Total	6	4	8	7	5	9	16	10	5	5	5	5	85
Scale 1	Incidents leading to frequency degradation (F1)													
	Incidents on load (L1)	1	1						1					3
	Incidents on power generating facilities (G1)													
	Incidents on transmission network elements (T1)				1			1	1		1	1	2	7
	Loss of tools and facilities (LT1)			1					1					2
	N-1 violation (ON1)							2						2
	Reduction of reserve capacity (RRC1)													
	Separation from the grid (RS1)													
	Violation of standards on voltage (OV1)													
	Total	1	1	1	1			3	3		1	1	2	14
Scale 2	Incidents leading to frequency degradation (F2)													
	Incidents on load (L2)													
	Incidents on power generating facilities (G2)													
	Incidents on transmission network elements (T2)													
	Loss of tools and facilities (LT2)													
	N violation (ON2)													
	Reduction of reserve capacity (RRC2)													
	Separation from the grid (RS2)													
	Total													
Scale 3	Blackout (OB3)													
	Total													
Grand Total		7	5	9	8	5	9	19	13	5	6	6	7	99

The analysis of the distribution of incidents per duration shows that approximately a third of the incidents are resolved in less than 1 hour. Nearly 80 % of the incidents were resolved in less than 24 hours.

The majority of the reported incidents lasting less than 1 hour were incidents on transmission network elements (T0), as shown in Table 19.

Scale 1 incidents with short time durations predominated in 2018. More than half of all scale 1 incidents had a duration of less than 1 hour.

Table 19. Number of incidents by dominating criteria and duration in 2018 in the Nordic synchronous area

Scale	Dominating criterion	2018 < 1h	1–2h	2–5h	5–10h	10–24h	>24h	Grand Total
Scale 0	Incidents leading to frequency degradation (F0)	1			1			2
	Incidents on load (L0)							
	Incidents on power generating facilities (G0)					1		1
	Incidents on transmission network elements (T0)	24	11	14	1	8	19	77
	Loss of tools and facilities (LT0)							
	Reduction of reserve capacity (RRC0)							
	Violation of standards on voltage (OV0)	4		1				5
	Total	29	11	15	2	9	19	85
Scale 1	Incidents leading to frequency degradation (F1)							
	Incidents on load (L1)	2		1				3
	Incidents on power generating facilities (G1)							
	Incidents on transmission network elements (T1)	2	1	1			3	7
	Loss of tools and facilities (LT1)				1	1		2
	N-1 violation (ON1)	2						2
	Reduction of reserve capacity (RRC1)							
	Separation from the grid (RS1)							
	Violation of standards on voltage (OV1)							
	Total	6	1	2	1	1	3	14
Scale 2	Incidents leading to frequency degradation (F2)							
	Incidents on load (L2)							
	Incidents on power generating facilities (G2)							
	Incidents on transmission network elements (T2)							
	Loss of tools and facilities (LT2)							
	N violation (ON2)							
	Reduction of reserve capacity (RRC2)							
	Separation from the grid (RS2)							
	Total							
Scale 3	Blackout (OB3)							
	Total							
Grand Total		35	12	17	3	10	22	99

6.2 Evolution 2014–2018

This section presents the annual number of incidents in the Nordic synchronous area during 2014–2018. This includes the annual number of incident distributed by scale, presented in Figure 22, and the annual number of reported incidents per dominating criterion, presented in Table 20.

Scale 0 incidents reported in 2018 increased by 77 in comparison to 2017, as seen in Figure 22. The substantial increase is a result of the updated Incident Classification Scale Methodology that was introduced for the annual report of 2018. The update has refined the definitions and thresholds in order to align with SO GL, to improve the overall data quality, make results comparable between synchronous areas and TSOs and to ease the analysis and identification of improvements to system operations.

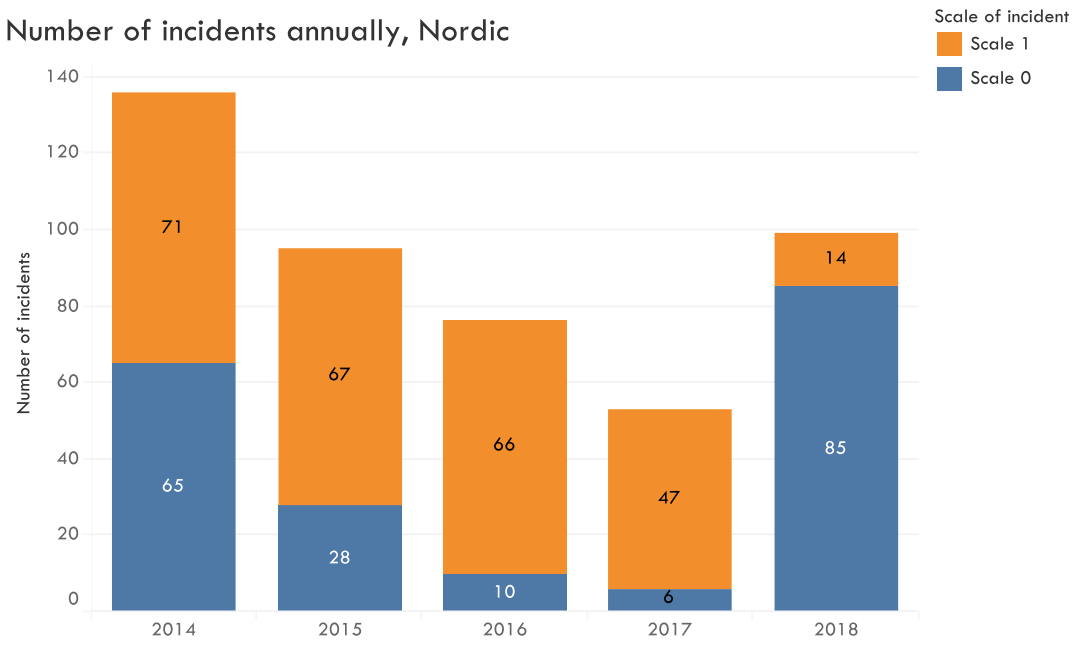

Figure 22. Annual number of reported incidents divided by scale during 2014–2018 in the Nordic synchronous area

The increase of scale 0 incidents was mostly caused by incidents on transmission network elements (T0, +69 incidents), as seen in Table 20.

Scale 1 incidents reported in 2018 decreased by 33 incidents. Incidents on transmission system elements (T1) decreased by 37 and incidents on load (L1) increased by 1.

There were no Scale 2 or Scale 3 incidents in the Nordic synchronous area in 2018.

Table 20. Annual number of incidents per dominating criterion during 2014–2018

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)	1	1			2
	Incidents on load (L0)	3				
	Incidents on power generating facilities (G0)					1
	Incidents on transmission network elements (T0)	17	27	10	6	77
	Loss of tools and facilities (LT0)					
	Reduction of reserve capacity (RRC0)					
	Violation of standards on voltage (OV0)	44				5
	Total	65	28	10	6	85
Scale 1	Incidents leading to frequency degradation (F1)					
	Incidents on load (L1)		3	2	2	3
	Incidents on power generating facilities (G1)			1		
	Incidents on transmission network elements (T1)	63	54	51	43	7
	Loss of tools and facilities (LT1)	4		3	2	2
	N-1 violation (ON1)		10	9		2
	Reduction of reserve capacity (RRC1)					
	Separation from the grid (RS1)					
	Violation of standards on voltage (OV1)	4				
	Total	71	67	66	47	14
Scale 2	Incidents leading to frequency degradation (F2)					
	Incidents on load (L2)					
	Incidents on power generating facilities (G2)					
	Incidents on transmission network elements (T2)					
	Loss of tools and facilities (LT2)					
	N violation (ON2)					
	Reduction of reserve capacity (RRC2)					
	Separation from the grid (RS2)					
	Total					
Scale 3	Blackout (OB3)					
	Total					
Grand Total		136	95	76	53	99

6.3 N-1 violations (ON1)

This section presents N-1 violations in the Nordic synchronous area in 2018 and during 2014–2018.

Table 21 presents an overview of N-1 violations for the year 2018. This includes the number of N-1 violations as well as the number of times other TSOs were affected and the number of times the incident aggravated the system to an alert state. Furthermore, these are distributed according to the main cause of the incident. Table 22 presents the annual monthly distribution of N-1 violations and Figure 23 the annual number of incidents grouped by the duration of the incident during 2014–2018.

There were 2 N-1 violations in 2018 in the Nordic synchronous area. Both N-1 violations were caused by other causes (due to tripping of a network elements), as shown in Table 21.

There are different interpretations of the gravity of the N-1 violations by reporting TSOs. Therefore, the normal state was not changed during some instances of N-1 violations.

Table 21. Overview of N-1 violations in 2018 in the Nordic synchronous area

	Main causes			
	Unexpected flows	Unknown	Other	Grand Total
Number of N-1 violations		0	2	2
Number of times other TSOs affected		0	2	2
Number of times in alert state		0	0	0

The number of N-1 violations is showing a decreasing trend since 2015, as is illustrated in Table 22 and Figure 23. Furthermore, N-1 violations are not showing a definitive trend of seasonal occurrence during the period 2014–2018.

All N-1 violations were resolved within 1 hour in 2018.

Table 22. Monthly distribution of N-1 violations per year in the Nordic synchronous area during 2014–2018

Year ..	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2018							2						2
2017													
2016		1	1					5	2				9
2015		3	1	1	2	1	1	1					10
2014													

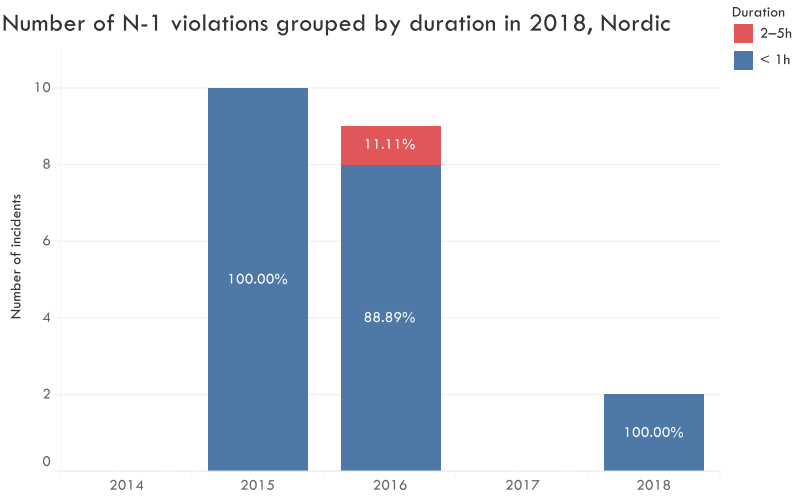

Figure 23. Annual number of N–1 violations grouped by duration in the Nordic synchronous area for the period 2014 – 2018

6.4 Loss of tools or facilities (LT)

This section presents loss of tools or facilities (LT) incidents during 2014–2018. A loss of tools or facilities incident occurs when a TSO loses, in real-time, control over necessary tools or facilities that are needed to operate the power grid.

Table 23 presents the annual number of LT incidents grouped by their duration. The number of LT incidents is minor compared to the total number of incidents and is showing an irregular pattern.

Table 23 Annual number of LT incidents grouped by duration during 2014–2018 in the Nordic synchronous area

Duration	2014	2015	2016	2017	2018
1–2h	2		1		
2–5h	1			2	
5–10h					1
10–24h					1
< 1h	1		2		
>24h					
Grand Total	4		3	2	2

6.5 Analysis of significant changes in trends

In 2018, a total of 94 incidents were reported in the Nordic synchronous area, which is an increase of 41 incidents compared to 2017 when 53 incidents were reported. 80 % of all incidents were caused by incidents involving transmission network elements (T0) compared to 2017. The number of scale 0 incidents increased significantly, and the number of scale 1 incidents decreased.

The substantial change in the number of incidents are a result of the updated Incident Classification Scale Methodology that was introduced for the annual report of 2018. The update has refined the definitions and thresholds in order to align with SOGL, to improve the overall data quality, make results comparable between synchronous areas and TSOs and to ease the analysis and identification of improvements to system operations.

7 Incidents in Great Britain

7.1 Overview of 2018

This section presents an overview of incidents in Great Britain in 2018. This includes incidents per dominating criterion. The incidents are further distributed per month and duration of the incident and are presented in Table 24 and Table 25, respectively.

National Grid Electricity System Operator (National Grid ESO) of Great Britain has reported 250 incidents in total in 2018, out of which 248 incidents are in Scale 0 and 2 incidents are in Scale 1.

Out of the 248 Scale 0 incidents in 2018 156 incidents resulted in a final tripping of Transmission System Elements (T0), 58 incidents resulted in Frequency degradation (F0), 31 incidents resulted in Loss of tools and facilities (LT0) and only 3 incidents were associated with unexpected disconnections from the grid of power generating facilities (G0). All the transmission incidents were secured following the application of curative remedial actions within appropriate timescales.

Disturbances on Transmission Network elements (T0), Frequency degradation (F0) and Loss of tools and facilities (LT0) made up the largest part of the reported incidents as is shown in Table 25. Furthermore, there were only three incidents reported under the Loss of power generating Facilities (G0) and two incidents under the N-1 violation (ON1).

Table 24 indicate that most of the reported incidents occurred during winter. The maximum number of 30 incidents occurred in February due to cold weather conditions.

On five occasions a generating unit tripped and disconnected just over 600 MW from the grid. Of those, two had reached a Scale 0 Frequency degradation (F0) level and therefore only three events are reported under the Loss of Power Generating Facilities (G0).

More than half (88) of the Incidents on Transmission System Elements (T0) in 2018 were caused by primary system faults that resulted in the automatic operation of circuit breakers following the detection of primary system fault current. The system remained secure following all the incidents.

Table 24. Number of incidents by dominant criteria distributed per month in 2018 in the Great Britain

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents leading to frequency degradation (F0)	5	8	7	3	1	4	8	5	3	6	5	3	58
	Incidents on load (L0)													
	Incidents on power generating facilities (G0)						1	1		1				3
	Incidents on transmission network elements (T0)	14	14	20	15	13	11	11	8	7	19	16	8	156
	Loss of tools and facilities (LT0)	4	6	2	4		1	1	3	1	2	3	4	31
	Reduction of reserve capacity (RRC0)													
	Violation of standards on voltage (OV0)													
	Total	23	28	29	22	14	17	21	16	12	27	24	15	248
Scale 1	Incidents leading to frequency degradation (F1)													
	Incidents on load (L1)													
	Incidents on power generating facilities (G1)													
	Incidents on transmission network elements (T1)													
	Loss of tools and facilities (LT1)													
	N-1 violation (ON1)		2											2
	Reduction of reserve capacity (RRC1)													
	Separation from the grid (RS1)													
	Violation of standards on voltage (OV1)													
	Total		2											2
Scale 2	Incidents leading to frequency degradation (F2)													
	Incidents on load (L2)													
	Incidents on power generating facilities (G2)													
	Incidents on transmission network elements (T2)													
	Loss of tools and facilities (LT2)													
	N violation (ON2)													
	Reduction of reserve capacity (RRC2)													
	Separation from the grid (RS2)													
	Total													
Scale 3	Blackout (OB3)													
	Total													
Grand Total		23	30	29	22	14	17	21	16	12	27	24	15	250

31% of the reported incidents had a very short duration, i.e. <1h, as presented in Table 25. In addition, 25% of the reported incidents lasted longer than 24 hours. Thorough site investigations were initiated and mitigating actions were deployed in most incidents to ensure that the network elements were re-conditioned and maintained before re-energisation, hence the longer restoration times.

All 58 Frequency Degradation (F0) incident had relatively short durations each lasting less than 5 minutes. Nearly 40% of the Disturbances on Transmission Network elements (T0) lasted more than 24 hours (61 incidents).

Table 25. Number of incidents by dominating criteria and duration in 2018 in Great Britain

Scale	Dominating criterion	2018 < 1h	1–2h	2–5h	5–10h	10–24h	>24h	Grand Total
Scale 0	Incidents leading to frequency degradation (F0)	58						58
	Incidents on load (L0)							
	Incidents on power generating facilities (G0)					2	1	3
	Incidents on transmission network elements (T0)	16	15	32	15	17	61	156
	Loss of tools and facilities (LT0)	4	4	11	7	4	1	31
	Reduction of reserve capacity (RRC0)							
	Violation of standards on voltage (OV0)							
	Total	78	19	43	22	23	63	248
Scale 1	Incidents leading to frequency degradation (F1)							
	Incidents on load (L1)							
	Incidents on power generating facilities (G1)							
	Incidents on transmission network elements (T1)							
	Loss of tools and facilities (LT1)							
	N-1 violation (ON1)		1	1				2
	Reduction of reserve capacity (RRC1)							
	Separation from the grid (RS1)							
	Violation of standards on voltage (OV1)							
	Total		1	1				2
Scale 2	Incidents leading to frequency degradation (F2)							
	Incidents on load (L2)							
	Incidents on power generating facilities (G2)							
	Incidents on transmission network elements (T2)							
	Loss of tools and facilities (LT2)							
	N violation (ON2)							
	Reduction of reserve capacity (RRC2)							
	Separation from the grid (RS2)							
	Total							
Scale 3	Blackout (OB3)							
	Total							
Grand Total		78	20	44	22	23	63	250

7.2 Evolution 2014–2018

This section presents the annual number of incidents in Great Britain during 2014–2018. This includes the annual number of incident distributed by scale, presented in Figure 24, and the annual number of reported incidents per dominating criterion, presented in Table 26.

National Grid Electricity System Operator (NGESO) of Great Britain (GB) recorded 250 incidents in 2018 in comparison with 138 in 2017, 112 incidents in 2016, 88 incidents in 2015 and 125 incidents in 2014.

The high number of incidents in 2018 was due to a combination of 248 Scale 0 and 2 Scale 1 incidents in comparison with 2017 when there were 126 Scale 0 and 12 Scale 1 incidents. Furthermore Figure 24 suggests that there has been an upward trend between 2014 and 2017. The large

amount of Scale 0 incidents in 2018 was due to a recent change in the reporting criteria.

In 2018, Great Britain has recorded 2 Scale 1 incidents in comparison with 12 in 2017, 10 in 2016, 6 in 2015 and 16 in 2014.

The number of Scale 1 incidents reported in 2018 had decreased in comparison with previous years. There were only 2 Scale 1 events both reported as N-1 violation (ON1).

There were no Scale 2 and Scale 3 incidents reported from 2014 until 2018.

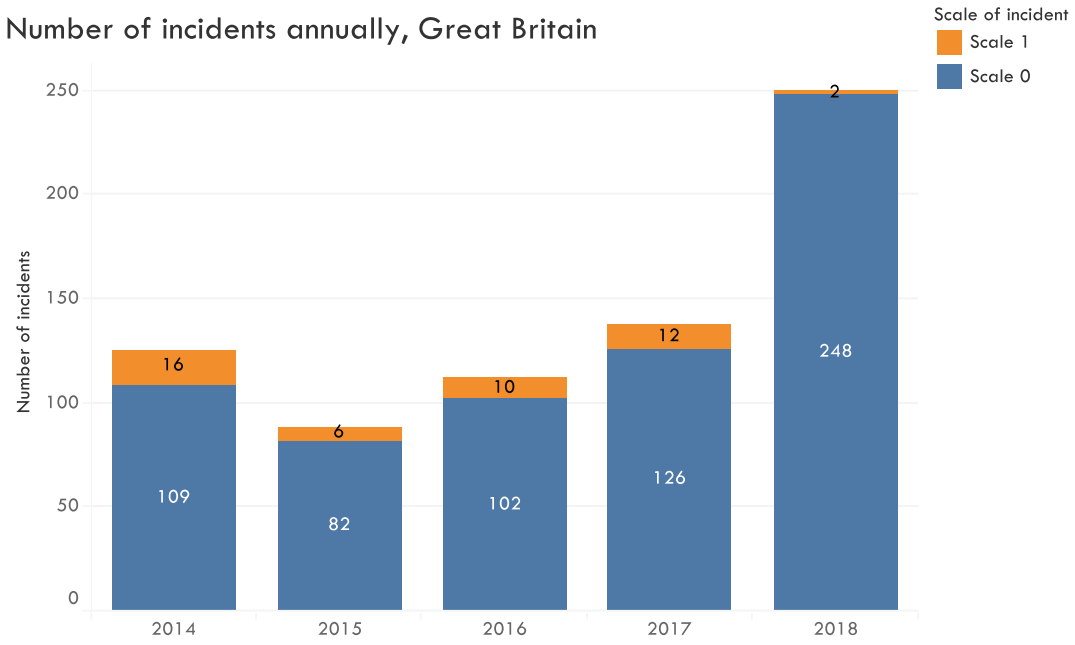

Figure 24. Annual number of reported incidents divided by scale during 2014–2018 in Great Britain

The number of Scale 0 incidents reported in 2018 were nearly twice as many as that reported in 2017, as seen in Table 26. This was due to the reporting scale change on the Frequency Degradation (F0) and Loss of tools and facilities (LT0). If we exclude the F0 and LT0 events, the number of incidents is similar to those reported between 2014 and 2017.

Table 26. Annual number of incidents per dominating criterion during 2014–2018 in Great Britain

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)					58
	Incidents on load (L0)					
	Incidents on power generating facilities (G0)	1		1	2	3
	Incidents on transmission network elements (T0)	108	82	101	124	156
	Loss of tools and facilities (LT0)					31
	Reduction of reserve capacity (RRC0)					
	Violation of standards on voltage (OV0)					
	Total	109	82	102	126	248
Scale 1	Incidents leading to frequency degradation (F1)					
	Incidents on load (L1)					
	Incidents on power generating facilities (G1)					
	Incidents on transmission network elements (T1)	6	5	9	10	
	Loss of tools and facilities (LT1)	3	1	1	2	
	N-1 violation (ON1)					2
	Reduction of reserve capacity (RRC1)					
	Separation from the grid (RS1)					
	Violation of standards on voltage (OV1)	7				
	Total	16	6	10	12	2
Scale 2	Incidents leading to frequency degradation (F2)					
	Incidents on load (L2)					
	Incidents on power generating facilities (G2)					
	Incidents on transmission network elements (T2)					
	Loss of tools and facilities (LT2)					
	N violation (ON2)					
	Reduction of reserve capacity (RRC2)					
	Separation from the grid (RS2)					
	Total					
Scale 3	Blackout (OB3)					
	Total					
Grand Total		125	88	112	138	250

7.3 N-1 violations (ON1)

This section presents N-1 violations in Great Britain in 2018 and during 2014–2018.

Table 27 presents an overview of N-1 violations for the year 2018. This includes the number of N-1 violations as well as the number of times other TSOs were affected and also the number of times the incident aggravated the system to an alert state. Furthermore, these are distributed according to the main cause of the incident.

National Grid Electricity System Operator of Great Britain experienced 2 Scale 1 incidents associated with N-1 violation (ON1).

On the 27th February 2018, the South-East network included a number of planned outages, which could not be returned. Additionally, one of the interconnectors was scheduled to export heavily from 06:00 to 19:00 and trading action took place to proactively

reduce the export between 06:00 to 13:00. However, prior to 06:00 2 units desynchronised, or failed to synchronise and remained unavailable, increasing the risk of exceeding a South East import constraint. Short term operating reserve was fully deployed in the South East. The situation was further compounded by the withdrawal of an available remedial action from a neighbouring TSO which led to the ON1 incident. Generation availability improved in the South East and trading was enacted on one of the interconnector reducing the export from 13:00 onwards. The incident duration was 3 hours and 30 minutes.

On the 28th of February 2018, there were a number of planned outages in the South East and particularly cold temperature was affecting the country. Two generators unexpectedly desynchronised (1145 MW) during the morning. Due to large exports on the interconnectors, short term operating reserves were dispatched until fully deployed. The situation was further compounded by the withdrawal of an available remedial action from a neighbouring TSO between 14:09 and 15:10 which led to the ON1 incident. The remedial action was made available again at 15:10 and the two generators resynchronised at 1530 and 1630 respectively. The incident duration was 1 hour and 1 minute.

Table 27. Overview of N-1 violations in 2018 in Great Britain

	Main causes			
	Unexpected flows	Unknown	Other	Grand Total
Number of N-1 violations		0	2	2
Number of times other TSOs affected		0	2	2
Number of times in alert state		0	2	2

7.4 Loss of tools or facilities (LT)

This section presents loss of tools or facilities (LT) incidents during 2014–2018. A loss of tools or facilities incident occurs when a TSO loses, in real-time, control over necessary tools or facilities that are needed to operate the power grid.

Table 28 presents an overview of loss of tools or facilities incidents. This includes the total number of LT incidents, the number of times other TSOs were affected by one TSO's LT incident and also the number of times a LT incident aggravated the system to an alert state. Furthermore, these values are presented on a per scale basis.

Table 29 presents the annual number of LT incidents grouped by their duration. The number of LT incidents was approximately 12 % of all incidents in 2018.

Table 28. Overview of loss of tools incidents in 2018 in Great Britain

	Scale 0	Scale 1	Scale 2	Scale 3	Total
Number of LT incidents	31	0			31
Number of times other TSOs affected	0	0			0
Number of times in alert state	0	0			0

Table 29 Annual number of LT incidents grouped by duration during 2014–2018 in Great Britain

Duration	2014	2015	2016	2017	2018
1–2h				1	4
2–5h	1	1	1		11
5–10h	1				7
10–24h	1				4
< 1h				1	4
>24h					1
Grand Total	3	1	1	2	31

7.5 Analysis of significant changes in trends

In 2018, a total of 250 incidents have been reported in Great Britain synchronous area, which has increased in comparison to 138 reported incidents in 2017. Dominant incidents were incidents on Transmission System Elements (T0). The number of Scale 0 in 2018 increased in comparison to the numbers in 2017 but Scale 1 decreased. There was no Scale 2 or Scale 3 incidents, which remained unchanged in 2018. For the other type of incidents, there were no significant changes in trends in comparison to previous years.

The increases in reporting of more incidents is mainly due the new methodology. This evolution of this trend needs to be followed up in the next years when the methodology is stable.

8 Incidents in the Baltic area

8.1 Overview of 2018

This section presents an overview of incidents in the Baltic area in 2018. This includes incidents per dominating criterion. The incidents are further distributed per month and duration of the incident and presented in Table 30 and Table 31, respectively.

In 2018, totally 28 incidents were reported in the Baltic area. The reported incidents covered the total quantity of criteria for scale 0, scale 1 (no incidents of Scale 2 and 3).

Incidents on transmission network elements (T0) was the most common type of incident as shown in Table 30. The causes were mainly weather conditions and maintenance and operation issues.

There were 2 Incidents at power generating facilities (G0) and 1 Loss of tool (LT1).

Table 30 also portrays that the number of incidents recorded in 2018 has a uniform distribution during the year.

Table 30. Number of incidents by dominant criteria distributed per month in 2018 in the Nordic countries

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents leading to frequency degradation (F0)													
	Incidents on load (L0)													
	Incidents on power generating facilities (G0)								1			1		2
	Incidents on transmission network elements (T0)		3	2	2	3	3	3	4	1	3	1		25
	Loss of tools and facilities (LT0)													
	Reduction of reserve capacity (RRC0)													
	Violation of standards on voltage (OV0)													
	Total		3	2	2	3	3	3	5	1	3	2		27
Scale 1	Incidents leading to frequency degradation (F1)													
	Incidents on load (L1)													
	Incidents on power generating facilities (G1)													
	Incidents on transmission network elements (T1)													
	Loss of tools and facilities (LT1)												1	1
	N-1 violation (ON1)													
	Reduction of reserve capacity (RRC1)													
	Separation from the grid (RS1)													
	Violation of standards on voltage (OV1)													
	Total												1	1
Scale 2	Incidents leading to frequency degradation (F2)													
	Incidents on load (L2)													
	Incidents on power generating facilities (G2)													
	Incidents on transmission network elements (T2)													
	Loss of tools and facilities (LT2)													
	N violation (ON2)													
	Reduction of reserve capacity (RRC2)													
	Separation from the grid (RS2)													
	Total													
Scale 3	Blackout (OB3)													
	Total													
Grand Total			3	2	2	3	3	3	5	1	3	2	1	28

The analysis of the distribution of incidents per duration shown in Table 31 portrays that the significant share of incidents are with durations <1h.

Table 31. Number of incidents by dominating criteria and duration in 2018 in the Baltic area

Scale	Dominating criterion	2018 < 1h	1–2h	2–5h	5–10h	>24h	Grand Total
Scale 0	Incidents leading to frequency degradation (F0)						
	Incidents on load (L0)						
	Incidents on power generating facilities (G0)					2	2
	Incidents on transmission network elements (T0)	15	4	3	1	2	25
	Loss of tools and facilities (LT0)						
	Reduction of reserve capacity (RRC0)						
	Violation of standards on voltage (OV0)						
	Total	15	4	3	1	4	27
Scale 1	Incidents leading to frequency degradation (F1)						
	Incidents on load (L1)						
	Incidents on power generating facilities (G1)						
	Incidents on transmission network elements (T1)						
	Loss of tools and facilities (LT1)			1			1
	N-1 violation (ON1)						
	Reduction of reserve capacity (RRC1)						
	Separation from the grid (RS1)						
	Violation of standards on voltage (OV1)						
	Total			1			1
Scale 2	Incidents leading to frequency degradation (F2)						
	Incidents on load (L2)						
	Incidents on power generating facilities (G2)						
	Incidents on transmission network elements (T2)						
	Loss of tools and facilities (LT2)						
	N violation (ON2)						
	Reduction of reserve capacity (RRC2)						
	Separation from the grid (RS2)						
	Total						
Scale 3	Blackout (OB3)						
	Total						
Grand Total		15	4	4	1	4	28

8.2 Evolution 2014–2018

This section presents the annual number of incidents in the Baltic area power system during 2014–2018. This includes the annual number of incident distributed by scale, presented in Figure 25, and the annual number of reported incidents per dominating criterion, presented in Table 32.

Increase of Scale 0 incidents and decrease of Scale 1 incidents reported in 2018 is a result of the updated Incident Classification

Scale Methodology that was introduced for the annual report of 2018. The update has refined the definitions and thresholds in order to align with SOGL, improve the overall data quality, make results comparable between synchronous areas and TSOs and to ease the analysis and identification of improvements to system operations.

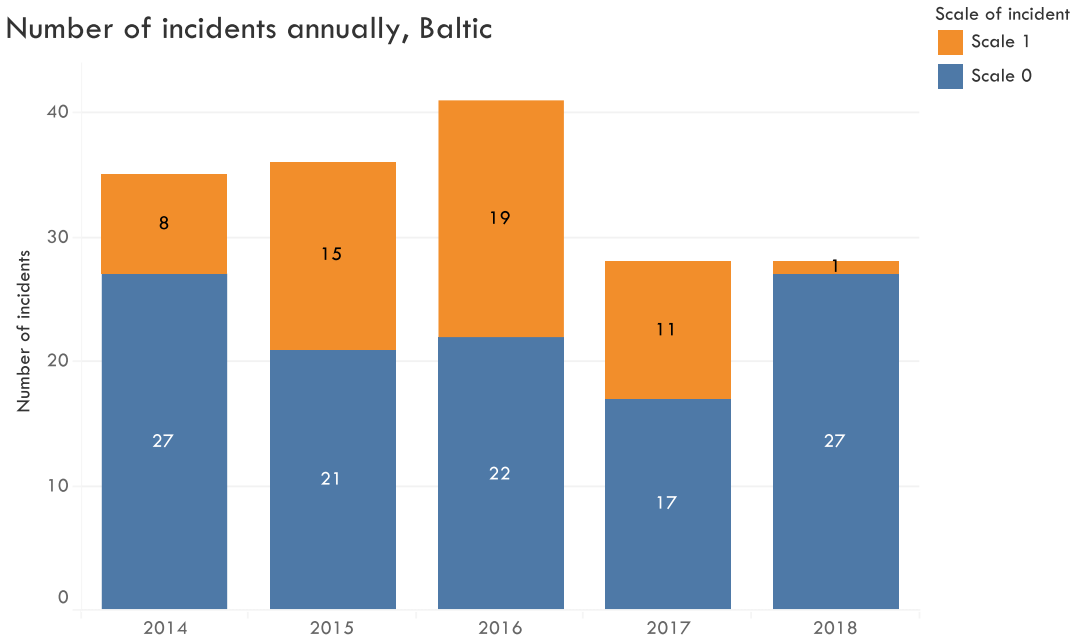

Figure 25. Annual number of reported incidents divided by scale during 2014–2018 in the Baltic area

The increase of scale 0 incidents was mostly caused by incidents on transmission system elements (T0, +8 incidents), as seen in Table 32.

Scale 1 incidents reported in 2018 decreased by 10 incidents mostly due to differences from previous methodology.

Table 32. Annual number of incidents per dominating criterion during 2014–2018

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)					
	Incidents on load (L0)	1				
	Incidents on power generating facilities (G0)	2	3	3		2
	Incidents on transmission network elements (T0)	24	18	19	17	25
	Loss of tools and facilities (LT0)					
	Reduction of reserve capacity (RRC0)					
	Violation of standards on voltage (OV0)					
	Total	27	21	22	17	27
Scale 1	Incidents leading to frequency degradation (F1)			1		
	Incidents on load (L1)					
	Incidents on power generating facilities (G1)			1		
	Incidents on transmission network elements (T1)	8	15	13	11	
	Loss of tools and facilities (LT1)			4		1
	N-1 violation (ON1)					
	Reduction of reserve capacity (RRC1)					
	Separation from the grid (RS1)					
	Violation of standards on voltage (OV1)					
	Total	8	15	19	11	1
Scale 2	Incidents leading to frequency degradation (F2)					
	Incidents on load (L2)					
	Incidents on power generating facilities (G2)					
	Incidents on transmission network elements (T2)					
	Loss of tools and facilities (LT2)					
	N violation (ON2)					
	Reduction of reserve capacity (RRC2)					
	Separation from the grid (RS2)					
	Total					
Scale 3	Blackout (OB3)					
	Total					
Grand Total		35	36	41	28	28

8.3 N-1 violations (ON1)

The Baltic area has not had any N-1 violations during 2014–2018.

8.4 Loss of tools or facilities (LT)

This section presents loss of tools or facilities (LT) incidents in 2018 and during 2014–2018. A loss of tools or facilities incident occurs when a TSO loses, in real-time, control

over necessary tools or facilities that are needed to operate the power grid.

Table 33 presents an overview of loss of tools or facilities incidents. This includes the total number of LT incidents, the number of times other TSOs were affected by one TSO's LT incident and how many times an LT incident aggravated the system to an alert state. Furthermore, these values are given on a per scale basis. Table 34 presents the annual number of LT incidents grouped by their duration.

Table 33. Overview of loss of tools incidents in 2018 in the Baltic area

	Scale 0	Scale 1	Scale 2	Scale 3	Total
Number of LT incidents	0	1			1
Number of times other TSOs affected	0	1			1
Number of times in alert state	0	0			0

Table 34 Annual number of LT incidents grouped by duration during 2014–2018 in the Baltic area

Duration	2014	2015	2016	2017	2018
1–2h			3		
2–5h			1		1
5–10h					
10–24h					
< 1h					
>24h					
Grand Total			4		1

8.5 Analysis of significant changes in trends

In 2018, a total of 28 incidents were reported in the Baltic area, Dominant incidents were Incidents involving transmission network elements (T0). The number of scale 0 incidents increased significantly, and the number of scale 1 incidents decreased due to differences from previous methodology where incidents on HVDC links were reported as Scale 1.

In general, the largest part of all incidents are incidents on transmission system elements. Small differences on other incident categories are more connected to the size of the Baltic area and probability of uncommon incidents.

9 Incidents in Ireland

9.1 Overview of 2018

This section presents an overview of incidents in Ireland in 2018. This includes incidents per dominating criterion. The incidents are further distributed per month and duration of the incident and presented in Table 35 and Table 36, respectively.

In 2018, totally 25 incidents were reported in Ireland. The reported incidents covered the total quantity of criteria for scale 0 and scale 2 (no incident of Scale 1or 3).

Incidents on power generating facilities (G0) transmission network elements (T0) and frequency deviation events (F0) are equally distributed as shown in Table 35. There is only one scale 2 event due to a frequency deviation (F2)

Table 35 also portrays that the number of incidents recorded in 2018 has a uniform distribution during the year.

9 incidents on transmission network elements (T0) were reported. Outages were considered as ordinary outages due to different reasons such as vegetation, failure equipment.

8 incidents on frequency deviations (F0) were reported, 7 due to a power generation loss and one due to a loss of transmission system element (HVDC tie line).

There was one F2 incident due to a loss of generation of 391 MW. The maximum value of the frequency deviation was 599 mHz. The frequency was outside the normal range for 8 seconds.

Furthermore, 7 Incidents at power generating facilities (G0) were reported with an average generation disconnection of 258 MW.

Table 35. Number of incidents by dominant criteria distributed per month in 2018 in Ireland

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents leading to frequency degradation (F0)		1				1	1		1		3	1	8
	Incidents on load (L0)													
	Incidents on power generating facilities (G0)		2	2		1			1			1		7
	Incidents on transmission network elements (T0)	1		3			1	1			1	2		9
	Loss of tools and facilities (LT0)													
	Reduction of reserve capacity (RRC0)													
	Violation of standards on voltage (OV0)													
	Total	1	3	5		1	2	2	1	1	1	6	1	24
Scale 1	Incidents leading to frequency degradation (F1)													
	Incidents on load (L1)													
	Incidents on power generating facilities (G1)													
	Incidents on transmission network elements (T1)													
	Loss of tools and facilities (LT1)													
	N-1 violation (ON1)													
	Reduction of reserve capacity (RRC1)													
	Separation from the grid (RS1)													
	Violation of standards on voltage (OV1)													
	Total													
Scale 2	Incidents leading to frequency degradation (F2)	1												1
	Incidents on load (L2)													
	Incidents on power generating facilities (G2)													
	Incidents on transmission network elements (T2)													
	Loss of tools and facilities (LT2)													
	N violation (ON2)													
	Reduction of reserve capacity (RRC2)													
	Separation from the grid (RS2)													
	Total	1												1
Scale 3	Blackout (OB3)													
	Total													
Grand Total		2	3	5		1	2	2	1	1	1	6	1	25

The analysis of the distribution of incidents per duration shown in Table 36 shows the significant share of incidents (12) with durations >24 h which is comparable with last year (12 events in 2017). Other categories are comparable (same trend than 2017).

Most of the reported incidents lasting more than 24hour were incidents on transmission network elements (T0), as shown in Table 36.

The loss of generation which created the event lasted 1 hour and 38 minutes while the scale 2 incident lasted only 8 seconds.

Table 36. Number of incidents by dominating criteria and duration in 2018 in Ireland

Scale	Dominating criterion	2018 1–2h	2–5h	5–10h	10–24h	>24h	Grand Total
Scale 0	Incidents leading to frequency degradation (F0)		3		1	4	8
	Incidents on load (L0)						
	Incidents on power generating facilities (G0)	1	2	2	1	1	7
	Incidents on transmission network elements (T0)		1		1	7	9
	Loss of tools and facilities (LT0)						
	Reduction of reserve capacity (RRC0)						
	Violation of standards on voltage (OV0)						
	Total	1	6	2	3	12	24
Scale 1	Incidents leading to frequency degradation (F1)						
	Incidents on load (L1)						
	Incidents on power generating facilities (G1)						
	Incidents on transmission network elements (T1)						
	Loss of tools and facilities (LT1)						
	N-1 violation (ON1)						
	Reduction of reserve capacity (RRC1)						
	Separation from the grid (RS1)						
	Violation of standards on voltage (OV1)						
	Total						
Scale 2	Incidents leading to frequency degradation (F2)	1					1
	Incidents on load (L2)						
	Incidents on power generating facilities (G2)						
	Incidents on transmission network elements (T2)						
	Loss of tools and facilities (LT2)						
	N violation (ON2)						
	Reduction of reserve capacity (RRC2)						
	Separation from the grid (RS2)						
	Total	1					1
Scale 3	Blackout (OB3)						
	Total						
Grand Total		2	6	2	3	12	25

9.2 Evolution 2014–2018

This section presents the annual number of incidents in Ireland during 2014–2018. This includes the annual number of incident distributed by scale, presented in Figure 26, and the annual number of reported incidents per dominating criterion, presented in Table 37.

Scale 0 incidents reported in 2018 is comparable to last year, as seen in Figure 26.

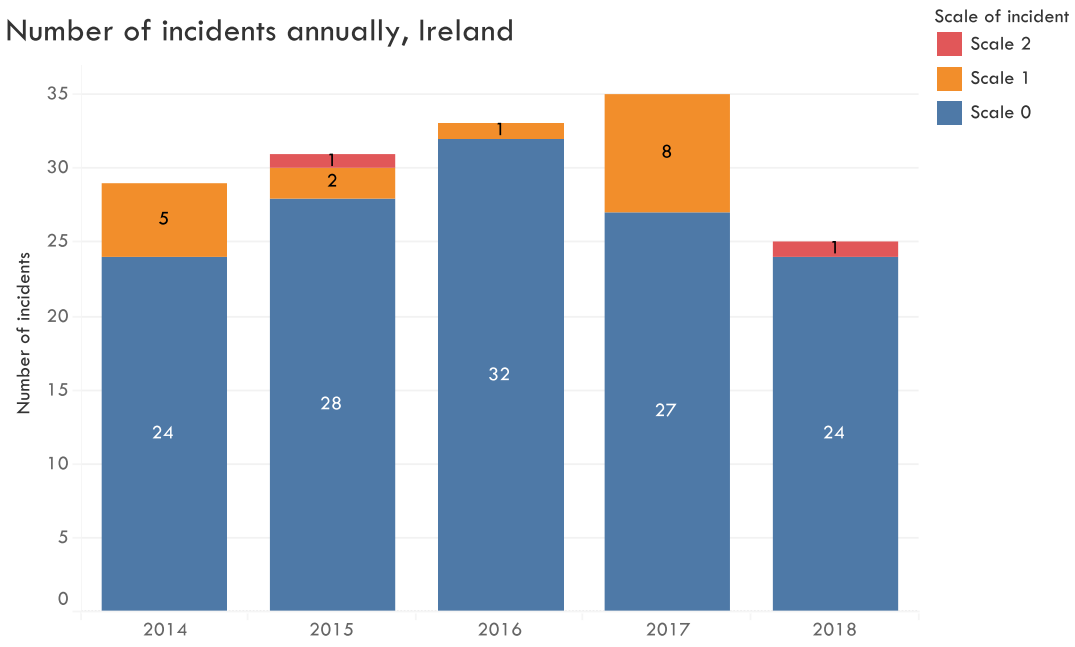

Figure 26. Annual number of reported incidents divided by scale during 2014–2018 in Ireland

There were no Scale 1 incidents reported in 2018.

There was one Scale 2 incident in Ireland in 2018, which was caused by a frequency deviation created mainly by a loss of generation. No Scale 3 incidents were reported in 2018. The numbers of scale 1 and 2 events are not significant to make a relevant comparison with previous year.

Table 37. Annual number of incidents per dominating criterion during 2014–2018

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)					8
	Incidents on load (L0)					
	Incidents on power generating facilities (G0)	23	27	21	24	7
	Incidents on transmission network elements (T0)	1	1	10	3	9
	Loss of tools and facilities (LT0)					
	Reduction of reserve capacity (RRC0)					
	Violation of standards on voltage (OV0)			1		
	Total	24	28	32	27	24
Scale 1	Incidents leading to frequency degradation (F1)					
	Incidents on load (L1)					
	Incidents on power generating facilities (G1)					
	Incidents on transmission network elements (T1)	5	2	1	6	
	Loss of tools and facilities (LT1)				2	
	N-1 violation (ON1)					
	Reduction of reserve capacity (RRC1)					
	Separation from the grid (RS1)					
	Violation of standards on voltage (OV1)					
	Total	5	2	1	8	
Scale 2	Incidents leading to frequency degradation (F2)					1
	Incidents on load (L2)		1			
	Incidents on power generating facilities (G2)					
	Incidents on transmission network elements (T2)					
	Loss of tools and facilities (LT2)					
	N violation (ON2)					
	Reduction of reserve capacity (RRC2)					
	Separation from the grid (RS2)					
	Total		1			1
Scale 3	Blackout (OB3)					
	Total					
Grand Total		29	31	33	35	25

9.3 N-1 violations (ON1)

No N-1violations have occurred in Ireland during 2014–2018.

9.4 Loss of tools or facilities (LT)

No loss of tools or facilities incidents have occurred in Ireland during 2014–2018.

9.5 Analysis of significant changes in trends

In 2018, a total of 25 incidents were reported on Ireland, which is comparable to 2017, when 35 incidents were reported. Dominant incidents were: Incidents involving transmission network elements (T0), incidents leading to frequency degradation (F0) and incidents on power generating facilities (G0). Two events are related to the loss of HVDC interconnector: one is T0 (loss of 250 MW) and the other F0 (loss of 500 MW)

The trend that only G0, T0 and F0 events are reported can still be seen.

10 Incidents in Isolated Systems

10.1 Overview of 2018

This section presents an overview of incidents in Isolated systems in 2018. This includes incidents per dominating criterion. The incidents are further distributed per month and duration of the incident and presented in Table 38 and Table 39, respectively.

In 2018, a total of 15 incidents were reported in Isolated systems. The reported incidents covered the total quantity of criteria for scale 0, scale 1 and scale 2 (no incident of Scale 3).

Incidents on transmission network elements (T0) were the most common type of incident, as shown in Table 38, followed by Incidents on Load (L2) and Loss of tools and facilities (LT2).

Table 38 shows that besides the T0 and T1 incidents, only L2 and LT2 incidents have been reported.

Incidents on transmission network elements (T0 & T1) were mainly due to tripped transmission network element.

The one L2 incident was caused by a trip of an aluminium smelter pot line accompanied by a wrong protection scheme that tripped another pot line (320 MW). As a result, the transmission system splits into 4 islands with widespread disturbance. The total loss of load was 603 MW.

Furthermore, the LT2 incident was caused by a power failure in the control centre which caused all systems to stop for several hours.

Table 38. Number of incidents by dominant criteria distributed per month in 2018 in Isolated systems

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents leading to frequency degradation (F0)													
	Incidents on load (L0)													
	Incidents on power generating facilities (G0)													
	Incidents on transmission network elements (T0)	1	1			2	2	1		1	1	1		10
	Loss of tools and facilities (LT0)													
	Reduction of reserve capacity (RRC0)													
	Violation of standards on voltage (OV0)													
	Total	1	1			2	2	1		1	1	1		10
Scale 1	Incidents leading to frequency degradation (F1)													
	Incidents on load (L1)													
	Incidents on power generating facilities (G1)													
	Incidents on transmission network elements (T1)		1			1		1						3
	Loss of tools and facilities (LT1)													
	N-1 violation (ON1)													
	Reduction of reserve capacity (RRC1)													
	Separation from the grid (RS1)													
	Violation of standards on voltage (OV1)													
	Total		1			1		1						3
Scale 2	Incidents leading to frequency degradation (F2)													
	Incidents on load (L2)		1											1
	Incidents on power generating facilities (G2)													
	Incidents on transmission network elements (T2)													
	Loss of tools and facilities (LT2)			1										1
	N violation (ON2)													
	Reduction of reserve capacity (RRC2)													
	Separation from the grid (RS2)													
	Total		1	1										2
Scale 3	Blackout (OB3)													
	Total													
Grand Total		1	3	1		3	2	2		1	1	1		15

The analysis of the distribution of incidents per duration shows uniform distribution over the categories for scale 0 incidents. Due to the low number of incidents in scale 1 and scale 2, no conclusions can be drawn.

Almost half of the reported incidents lasted less than 1 hour. The scale 2 incidents were solved within 5 hours.

Table 39. Number of incidents by dominating criteria and duration in 2018 in Isolated systems

Scale	Dominating criterion	2018 < 1h	2–5h	5–10h	10–24h	>24h	Grand Total
Scale 0	Incidents leading to frequency degradation (F0)						
	Incidents on load (L0)						
	Incidents on power generating facilities (G0)						
	Incidents on transmission network elements (T0)	3	1	2	1	3	10
	Loss of tools and facilities (LT0)						
	Reduction of reserve capacity (RRC0)						
	Violation of standards on voltage (OV0)						
	Total	3	1	2	1	3	10
Scale 1	Incidents leading to frequency degradation (F1)						
	Incidents on load (L1)						
	Incidents on power generating facilities (G1)						
	Incidents on transmission network elements (T1)	2		1			3
	Loss of tools and facilities (LT1)						
	N-1 violation (ON1)						
	Reduction of reserve capacity (RRC1)						
	Separation from the grid (RS1)						
	Violation of standards on voltage (OV1)						
	Total	2		1			3
Scale 2	Incidents leading to frequency degradation (F2)						
	Incidents on load (L2)	1					1
	Incidents on power generating facilities (G2)						
	Incidents on transmission network elements (T2)						
	Loss of tools and facilities (LT2)		1				1
	N violation (ON2)						
	Reduction of reserve capacity (RRC2)						
	Separation from the grid (RS2)						
	Total	1	1				2
Scale 3	Blackout (OB3)						
	Total						
Grand Total		6	2	3	1	3	15

10.2 Evolution 2014–2018

This section presents the annual number of incidents in the isolated systems 2014–2018. This includes the annual number of incident distributed by scale, presented in Figure 27, and the annual number of reported incidents per dominating criterion, presented in Table 40.

Scale 0 incidents reported in 2018 increased by four in comparison to 2017, as seen in Figure 27. This increase of around 66 % may seem substantial, however, it might be also a result of the updated Incident Classification Scale Methodology that was introduced for the annual report of 2018.

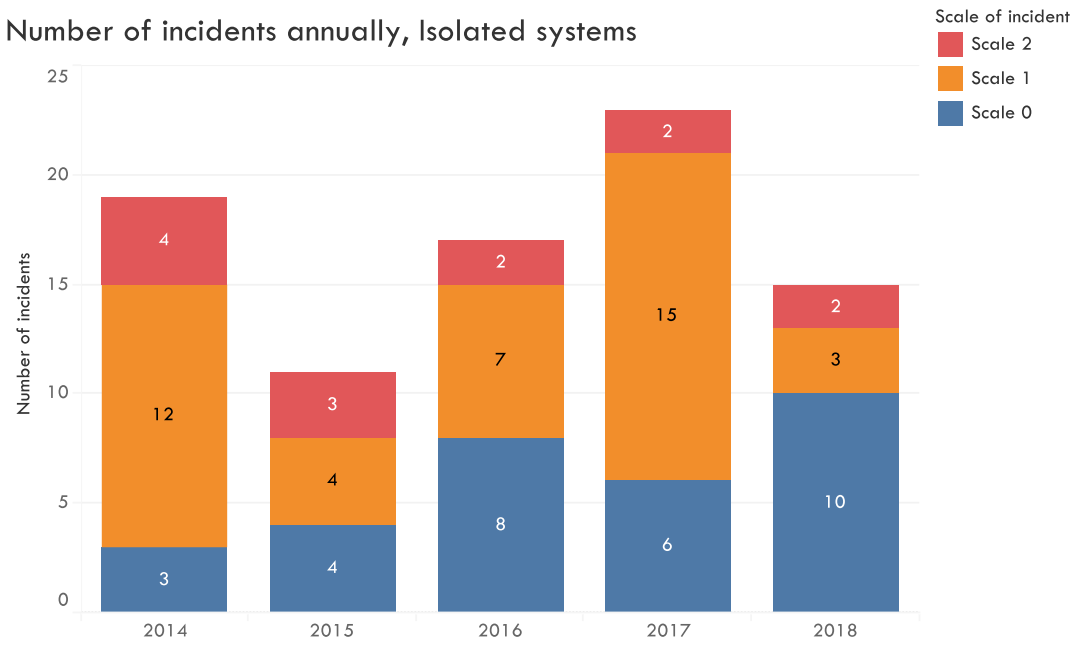

Figure 27. Annual number of reported incidents divided by scale during 2014–2018 in isolated systems

The increase of scale 0 incidents was only caused by incidents on transmission network elements (T0, +5) as seen in Table 40.

Scale 1 incidents, which contains incidents on transmission network elements (T1) reported in 2018 decreased by 3 incidents.

There were two Scale 2 incidents in Isolated systems in 2018, which were incidents on load (L2) and loss of tools and facilities (LT2). No Scale 3 incidents were reported in 2018.

Table 40. Annual number of incidents per dominating criterion in isolated systems during 2014–2018

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)					
	Incidents on load (L0)					
	Incidents on power generating facilities (G0)				1	
	Incidents on transmission network elements (T0)	3	4	8	5	10
	Loss of tools and facilities (LT0)					
	Reduction of reserve capacity (RRC0)					
	Violation of standards on voltage (OV0)					
	Total	3	4	8	6	10
Scale 1	Incidents leading to frequency degradation (F1)					
	Incidents on load (L1)	10	3	2	7	
	Incidents on power generating facilities (G1)				2	
	Incidents on transmission network elements (T1)	2	1		6	3
	Loss of tools and facilities (LT1)					
	N-1 violation (ON1)					
	Reduction of reserve capacity (RRC1)					
	Separation from the grid (RS1)					
	Violation of standards on voltage (OV1)					
	Total	12	4	2	15	3
Scale 2	Incidents leading to frequency degradation (F2)					
	Incidents on load (L2)	4	3	1	2	1
	Incidents on power generating facilities (G2)			1		
	Incidents on transmission network elements (T2)					
	Loss of tools and facilities (LT2)					1
	N violation (ON2)					
	Reduction of reserve capacity (RRC2)					
	Separation from the grid (RS2)					
	Total	4	3	2	2	2
Scale 3	Blackout (OB3)					
	Total					
Grand Total		19	11	12	23	15

10.3 Analysis of significant changes in trends

In 2018, a total of 15 incidents were reported on Isolated systems. There is no clear trend visible over the last years; nevertheless, in 2018. Due to the low overall number of incidents and only two TSOs in the synchronous area of Isolated Networks, the interpretation of data must be treated carefully.

11 Overview of incidents per TSO

This chapter presents detailed information about each TSO that has reported data according to the Incident Classification Scale Methodology. In total, 38 TSOs have delivered data to the 2018 ICS report.

Table 41. The TSOs included in the ICS report 2018 and the number of incidents they have reported

Synchronous area	TSO	Number of incidents
Baltic	AS Augstsprieguma tīkls	8
	Elering AS	7
	Litgrid AB	13
Continental Europe	50Hertz	35
	Amprion GmbH	74
	APG-Austrian Power Grid AG	10
	CEPS	49
	CGES	84
	ELES	4
	Elia	12
	EMS JSC	32
	Energinet (CE)	6
	ESO EAD	29
	HOPS	6
	IPTO	26
	ISO BiH	
	MAVIR ZRt	262
	MEPSO	4
	NOSBiH	80
	PSE	100
	REE	93
	REN	17
	RTE	246
	SEPS	6
	Swissgrid	23
	Tennet TSO B.V.	106
	TenneT TSO GmbH	39
	TERNA	63
	Transelectrica	226
	TransnetBW GmbH	18
	Frequency events for all TSOs	963
Great Britain	National Grid ESO	250
Ireland	EirGrid	23
	SONI	2
Isolated systems	Cyprus TSO	
	Landsnet	15
Nordic	Energinet (Nordic)	5
	Fingrid Oyj	13
	Statnett	30
	Svenska Kraftnät	51
Grand Total		3,030

11.1 Overview of incidents per TSOs in Continental Europe

11.1.1 Incidents reported by 50Hertz

This section presents incidents for 50Hertz. Table 42 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 43 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 28 presents the number of incidents grouped by duration in 2018.

Table 42. Monthly distribution of incidents per dominating criterion in 2018 for 50Hertz

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	3	4	1	1	8	3	6	1		1	2		30
	Total	3	4	1	1	8	3	6	1		1	2		30
Scale 1	N-1 violation (ON1)				5									5
	Total				5									5
Grand Total		3	4	1	6	8	3	6	1		1	2		35

Table 43 Annual number of incidents per dominating criterion during 2014–2018 for 50Hertz

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)	1				
	Incidents on load (L0)	1				
	Incidents on power generating facilities (G0)	1			1	
	Incidents on transmission network elements (T0)	9	17	12	17	30
	Total	12	17	12	18	30
Scale 1	Incidents on transmission network elements (T1)	1	7	3	1	
	Loss of tools and facilities (LT1)				1	
	N-1 violation (ON1)		11	15	16	5
	Total	1	18	18	18	5
Grand Total		13	35	30	36	35

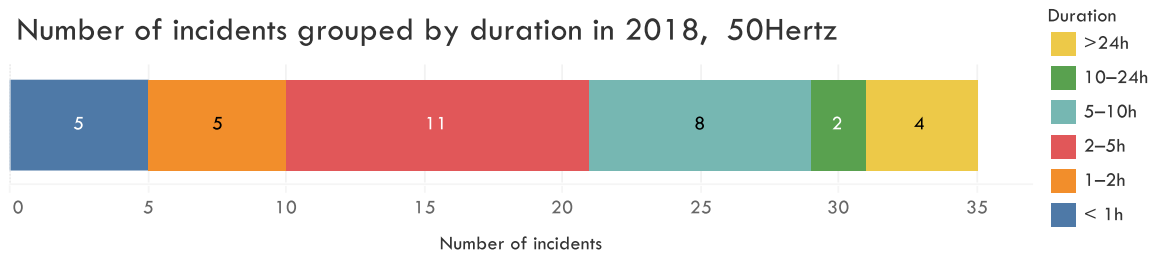

Figure 28 Number of incidents grouped by duration in 2018 for 50Hertz

11.1.2 Incidents reported by Amprion GmbH

This section presents incidents for Amprion GmbH. Table 44 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 45 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 29 presents the number of incidents grouped by duration in 2018.

Table 44. Monthly distribution of incidents per dominating criterion in 2018 for Amprion GmbH

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..	1	1	2	1	2	1			3		1	1	13
	Incidents on transmission network elements (T0)	4	2	1	6	6	6	4	3	3	8	1	3	47
	Total	5	3	3	7	8	7	4	3	6	8	2	4	60
Scale 1	Incidents on transmission network elements (T1)												1	1
	Loss of tools and facilities (LT1)					1			1		2	2		6
	N-1 violation (ON1)				1	1			1	1	2	1		7
	Total				1	2			2	1	4	3	1	14
Grand Total		5	3	3	8	10	7	4	5	7	12	5	5	74

Table 45 Annual number of incidents per dominating criterion during 2014–2018 for Amprion GmbH

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)	34	35	20	19	13
	Incidents on transmission network elements (T0)	14	14	12	25	47
	Total	48	49	32	44	60
Scale 1	Incidents on transmission network elements (T1)			1	4	1
	Loss of tools and facilities (LT1)				4	6
	N-1 violation (ON1)			3	9	7
	Total			4	17	14
Grand Total		48	49	36	61	74

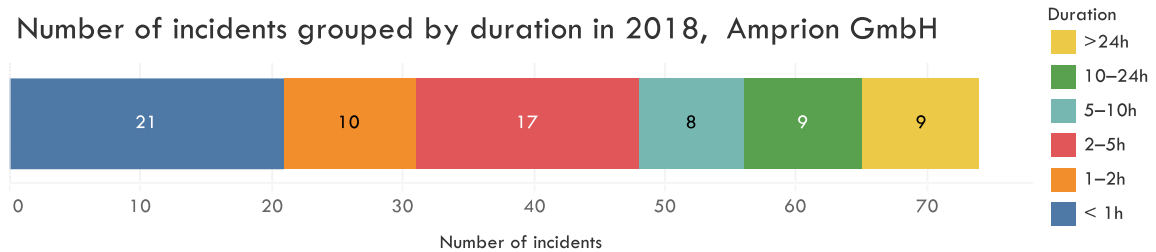

Figure 29 Number of incidents grouped by duration in 2018 for Amprion GmbH

11.1.3 Incidents reported by Austrian Power Grid AG

This section presents incidents for Austrian Power Grid AG. Table 46 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 47 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 30 presents the number of incidents grouped by duration in 2018.

Table 46. Monthly distribution of incidents per dominating criterion in 2018 for Austrian Power Grid AG

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	1			1			3	1	2	1	1		10
	Total	1			1			3	1	2	1	1		10
Grand Total		1			1			3	1	2	1	1		10

Table 47 Annual number of incidents per dominating criterion during 2014–2018 for Austrian Power Grid AG

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)	23	26	27	24	10
	Total	23	26	27	24	10
Scale 1	Incidents on transmission network elements (T1)	6	3	5	3	
	N-1 violation (ON1)	1	3			
	Total	7	6	5	3	
Grand Total		30	32	32	27	10

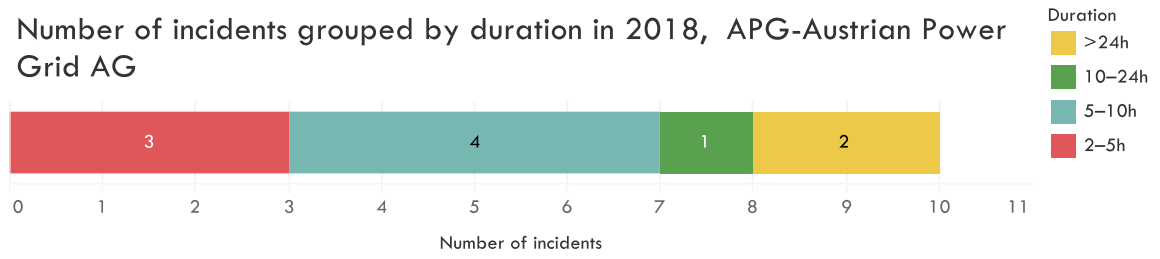

Figure 30 Number of incidents grouped by duration in 2018 for Austrian Power Grid AG

11.1.4 Incidents reported by CEPS

This section presents incidents for CEPS. Table 48 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 49 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 31 presents the number of incidents grouped by duration in 2018.

Table 48. Monthly distribution of incidents per dominating criterion in 2018 for CEPS

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..										2			2
	Incidents on transmission network elements (T0)										1		1	2
	Violation of standards on voltage (OV0)	2	1	8	2	5	2	7		1		1	2	31
	Total	2	1	8	2	5	2	7		1	3	1	3	35
Scale 1	Loss of tools and facilities (LT1)										1			1
	N-1 violation (ON1)			2					2		2			6
	Violation of standards on voltage (OV1)			2	1	3							1	7
	Total			4	1	3			2		3		1	14
Grand Total		2	1	12	3	8	2	7	2	1	6	1	4	49

Table 49 Annual number of incidents per dominating criterion during 2014–2018 for CEPS

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on load (L0)	3				
	Incidents on power generating facilities (G0)	1	4	4		2
	Incidents on transmission network elements (T0)	2	14	6	12	2
	Violation of standards on voltage (OV0)	1				31
	Total	7	18	10	12	35
Scale 1	Incidents on load (L1)			1		
	Incidents on transmission network elements (T1)			4	3	
	Loss of tools and facilities (LT1)	1		2	3	1
	N-1 violation (ON1)	12	57	27	3	6
	Reduction of reserve capacity (RRC1)			1	2	
	Violation of standards on voltage (OV1)					7
	Total	13	57	35	11	14
Grand Total		20	75	45	23	49

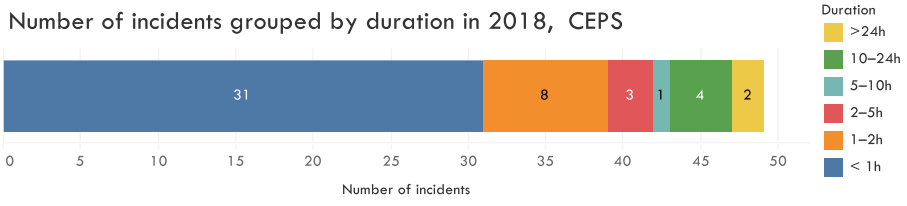

Figure 31 Number of incidents grouped by duration in 2018 for CEPS

11.1.5 Incidents reported by CGES

This section presents incidents for CGES. Table 50 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 51 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 32 presents the number of incidents grouped by duration in 2018.

Table 50. Monthly distribution of incidents per dominating criterion in 2018 for CGES

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)		10	9	6	14	19		10	6	6	2	2	84
	Total		10	9	6	14	19		10	6	6	2	2	84
Grand Total			10	9	6	14	19		10	6	6	2	2	84

Table 51 Annual number of incidents per dominating criterion during 2014–2018 for CGES

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)	6	2			
	Incidents on transmission network elements (T0)	78	49	26	22	84
	Violation of standards on voltage (OV0)	1				
	Total	85	51	26	22	84
Scale 1	Incidents on transmission network elements (T1)			26	52	
	Total			26	52	
Grand Total		85	51	52	74	84

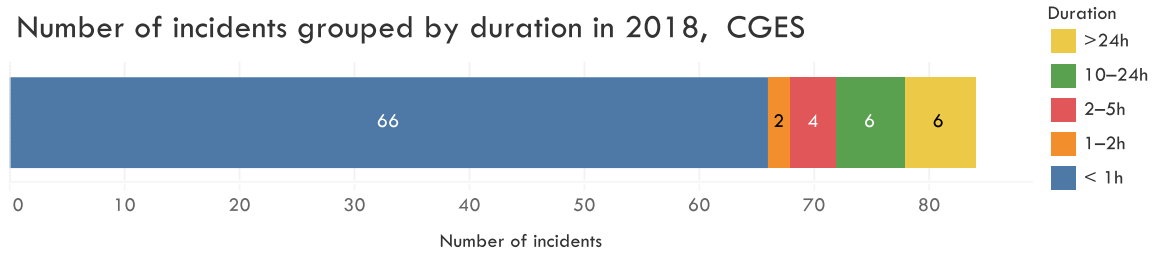

Figure 32 Number of incidents grouped by duration in 2018 for CGES

11.1.6 Incidents reported by ELES

This section presents incidents for ELES. Table 52 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 53 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 33 presents the number of incidents grouped by duration in 2018.

Table 52. Monthly distribution of incidents per dominating criterion in 2018 for ELES

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	2	1								1			4
	Total	2	1								1			4
Grand Total		2	1								1			4

Table 53 Annual number of incidents per dominating criterion during 2014–2018 for ELES

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)	1	13	2	5	4
	Total	1	13	2	5	4
Scale 1	Incidents on transmission network elements (T1)	9			2	
	Total	9			2	
Grand Total		10	13	2	7	4

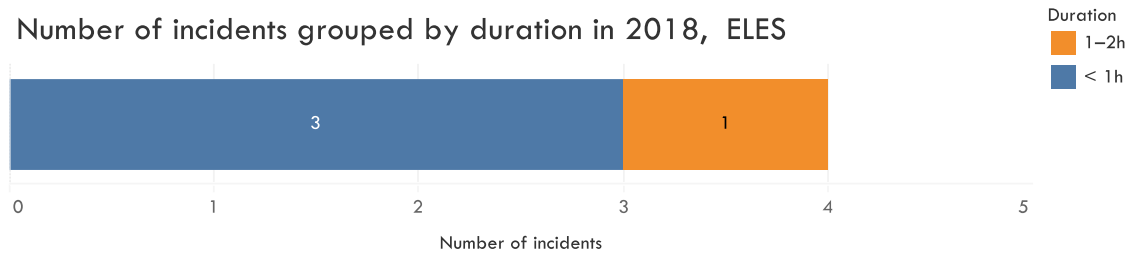

Figure 33 Number of incidents grouped by duration in 2018 for ELES

11.1.7 Incidents reported by Elia

This section presents incidents for Elia. Table 54 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 55 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 34 presents the number of incidents grouped by duration in 2018.

Table 54. Monthly distribution of incidents per dominating criterion in 2018 for Elia

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..							1						1
	Incidents on transmission network elements (T0)	1		1	1			1			1			5
	Violation of standards on voltage (OV0)										1			1
	Total	1		1	1			2			2			7
Scale 1	Loss of tools and facilities (LT1)			1	1		1		1					4
	N-1 violation (ON1)		1											1
	Total		1	1	1		1		1					5
Grand Total		1	1	2	2		1	2	1		2			12

Table 55 Annual number of incidents per dominating criterion during 2014–2018 for Elia

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)	2	5	6	6	1
	Incidents on transmission network elements (T0)	2	4	2	1	5
	Violation of standards on voltage (OV0)		1	1		1
	Total	4	10	9	7	7
Scale 1	Incidents on transmission network elements (T1)	1			1	
	Loss of tools and facilities (LT1)		4	1	3	4
	N-1 violation (ON1)	1	1		3	1
	Reduction of reserve capacity (RRC1)				3	
	Total	2	5	1	10	5
Grand Total		6	15	10	17	12

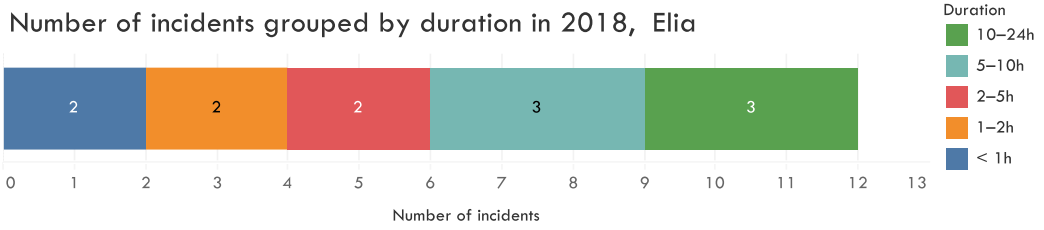

Figure 34 Number of incidents grouped by duration in 2018 for Elia

11.1.8 Incidents reported by EMS JSC

This section presents incidents for EMS JSC. Table 56 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 57 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 35 presents the number of incidents grouped by duration in 2018.

Table 56. Monthly distribution of incidents per dominating criterion in 2018 for EMS JSC

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..	5	3	2	1	1	1	5	3	3	1	2	1	28
	Incidents on transmission network elements (T0)	1		1			1			1				4
	Total	6	3	3	1	1	2	5	3	4	1	2	1	32
Grand Total		6	3	3	1	1	2	5	3	4	1	2	1	32

Table 57 Annual number of incidents per dominating criterion during 2014–2018 for EMS JSC

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on load (L0)	7				
	Incidents on power generating facilities (G0)	10	46	2		28
	Incidents on transmission network elements (T0)	7	14	2	4	4
	Violation of standards on voltage (OV0)	13	5	10	12	
	Total	37	65	14	16	32
Scale 1	Incidents on load (L1)		1	1	1	
	Incidents on power generating facilities (G1)	1				
	Incidents on transmission network elements (T1)				3	
	Reduction of reserve capacity (RRC1)				1	
	Total	1	1	1	5	
Grand Total		38	66	15	21	32

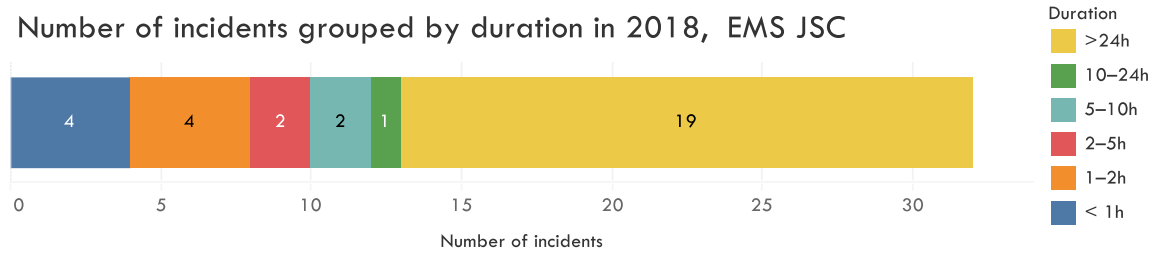

Figure 35 Number of incidents grouped by duration in 2018 for EMS JSC

11.1.9 Incidents reported by Energinet (CE)

This section presents incidents for Energinet (CE). Table 58 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 59 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 36 presents the number of incidents grouped by duration in 2018.

Table 58. Monthly distribution of incidents per dominating criterion in 2018 for Energinet (CE)

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	1	2	1							1	1		6
	Total	1	2	1							1	1		6
Grand Total		1	2	1							1	1		6

Table 59 Annual number of incidents per dominating criterion during 2014–2018 for Energinet (CE)

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)		2			6
	Total		2			6
Scale 1	Incidents on transmission network elements (T1)		3			
	Total		3			
Grand Total			5			6

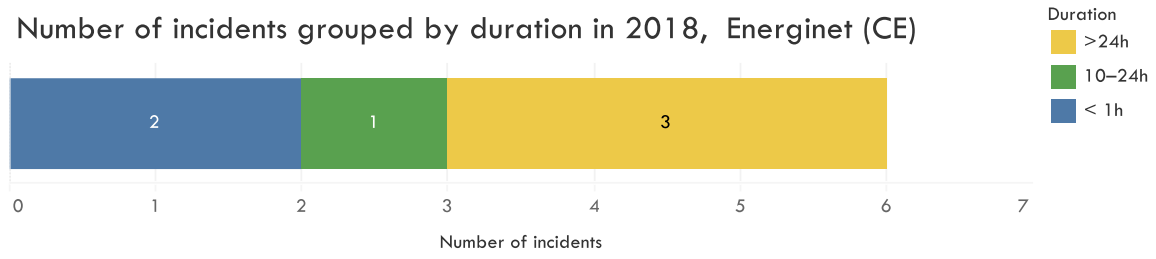

Figure 36 Number of incidents grouped by duration in 2018 for Energinet (CE)

11.1.10 Incidents reported by ESO EAD

This section presents incidents for ESO EAD. Table 60 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 61 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 37 presents the number of incidents grouped by duration in 2018.

Table 60. Monthly distribution of incidents per dominating criterion in 2018 for ESO EAD

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)		3	1			4	8	4		4	4	1	29
	Total		3	1			4	8	4		4	4	1	29
Grand Total			3	1			4	8	4		4	4	1	29

Table 61 Annual number of incidents per dominating criterion during 2014–2018 for ESO EAD

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)		35	16	25	29
	Total		35	16	25	29
Scale 1	Incidents on transmission network elements (T1)		1	10	11	
	Total		1	10	11	
Grand Total			36	26	36	29

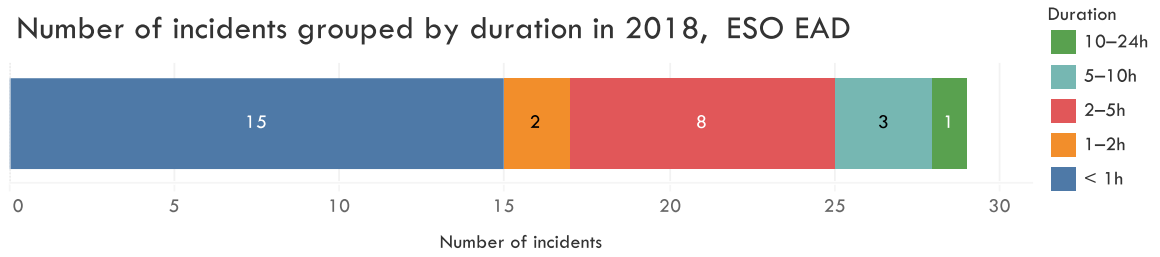

Figure 37 Number of incidents grouped by duration in 2018 for ESO EAD

11.1.11 Incidents reported by HOPS

This section presents incidents for HOPS. Table 62 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 63 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 38 presents the number of incidents grouped by duration in 2018.

Table 62. Monthly distribution of incidents per dominating criterion in 2018 for HOPS

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)		2	2				1				1		6
	Total		2	2				1				1		6
Grand Total			2	2				1				1		6

Table 63 Annual number of incidents per dominating criterion during 2014–2018 for HOPS

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)					6
	Total					6
Scale 1	N-1 violation (ON1)				11	
	Total				11	
Grand Total					11	6

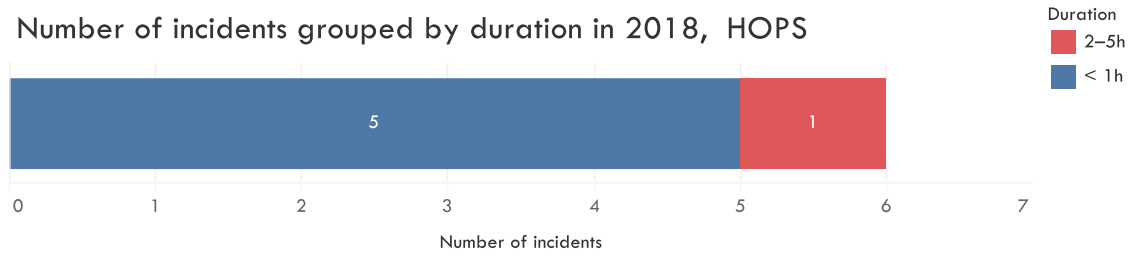

Figure 38 Number of incidents grouped by duration in 2018 for HOPS

11.1.12 Incidents reported by IPTO

This section presents incidents for IPTO. Table 64 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 65 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 39 presents the number of incidents grouped by duration in 2018.

Table 64. Monthly distribution of incidents per dominating criterion in 2018 for IPTO

		2018											
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	3	1	1	4	2	2	2	1	1	4		1	22
	Violation of standards on voltage (OV0)			2										2
	Total	3	1	3	4	2	2	2	1	1	4		1	24
Scale 1	Incidents on load (L1)								1					1
	Violation of standards on voltage (OV1)				1									1
	Total				1				1					2
Grand Total		3	1	3	5	2	2	2	2	1	4		1	26

Table 65 Annual number of incidents per dominating criterion during 2014–2018 for IPTO

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)	4		16	8	22
	Violation of standards on voltage (OV0)					2
	Total	4		16	8	24
Scale 1	Incidents on load (L1)	1				1
	Incidents on transmission network elements (T1)	1	20	8	17	
	Violation of standards on voltage (OV1)		15	4		1
	Total	2	35	12	17	2
Grand Total		6	35	28	25	26

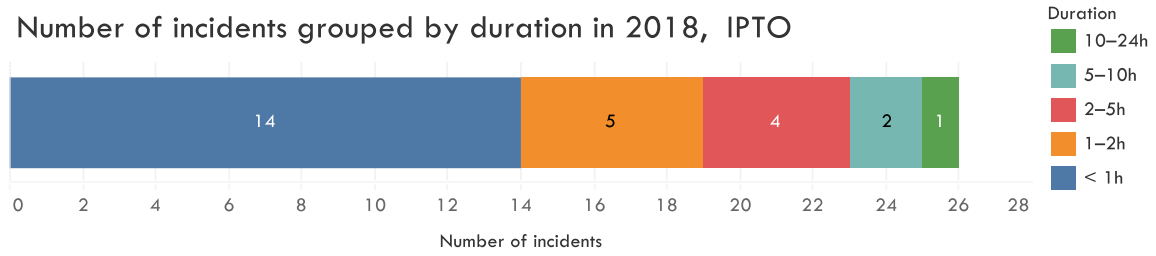

Figure 39 Number of incidents grouped by duration in 2018 for IPTO

11.1.13 Incidents reported by MAVIR ZRt

This section presents incidents for MAVIR ZRt. Table 66 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 67 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 40 presents the number of incidents grouped by duration in 2018.

Table 66. Monthly distribution of incidents per dominating criterion in 2018 for MAVIR ZRt

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	2	4	6	8	11	16	3	7	2	5	1	7	72
	Violation of standards on voltage (OV0)	3				22	6		8	7		27	4	77
	Total	5	4	6	8	33	22	3	15	9	5	28	11	149
Scale 1	N-1 violation (ON1)						1							1
	Reduction of reserve capacity (RRC1)	5	5	13	9	16	14	3	7	7	7	12	14	112
	Total	5	5	13	9	16	15	3	7	7	7	12	14	113
Grand Total		10	9	19	17	49	37	6	22	16	12	40	25	262

Table 67 Annual number of incidents per dominating criterion during 2014–2018 for MAVIR ZRt

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)	18	10			72
	Violation of standards on voltage (OV0)					77
	Total	18	10			149
Scale 1	Incidents on transmission network elements (T1)	1	1			
	Loss of tools and facilities (LT1)	3		1		
	N-1 violation (ON1)		3			1
	Reduction of reserve capacity (RRC1)				3	112
	Total	4	4	1	3	113
Scale 2	Separation from the grid (RS2)			1		
	Total			1		
Grand Total		22	14	2	3	262

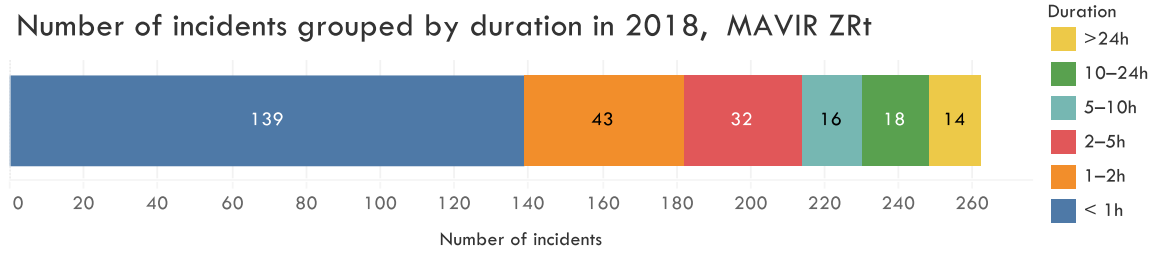

Figure 40 Number of incidents grouped by duration in 2018 for MAVIR ZRt

11.1.14 Incidents reported by MEPSO

This section presents incidents for MEPSO. Table 68 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 69 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 41 presents the number of incidents grouped by duration in 2018.

Table 68. Monthly distribution of incidents per dominating criterion in 2018 for MEPSO

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)				2					1	1			4
	Total				2					1	1			4
Grand Total					2					1	1			4

Table 69 Annual number of incidents per dominating criterion during 2014–2018 for MEPSO

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)	1	4	1		4
	Total	1	4	1		4
Scale 1	Incidents on transmission network elements (T1)		1	3	4	
	Total		1	3	4	
Grand Total		1	5	4	4	4

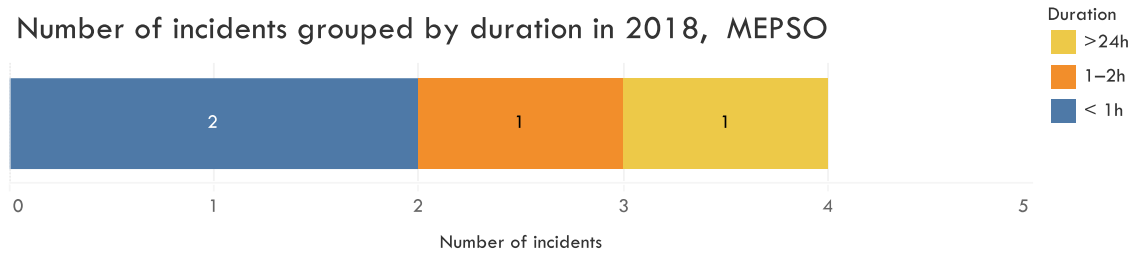

Figure 41 Number of incidents grouped by duration in 2018 for MEPSO

11.1.15 Incidents reported by NOSBiH

This section presents incidents for NOSBiH. Table 70 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 71 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 42 presents the number of incidents grouped by duration in 2018.

Table 70. Monthly distribution of incidents per dominating criterion in 2018 for NOSBiH

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)			16	14			8	29	6	7			80
	Total			16	14			8	29	6	7			80
Grand Total				16	14			8	29	6	7			80

Table 71 Annual number of incidents per dominating criterion during 2014–2018 for NOSBiH

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)					80
	Violation of standards on voltage (OV0)		1			
	Total		1			80
Grand Total			1			80

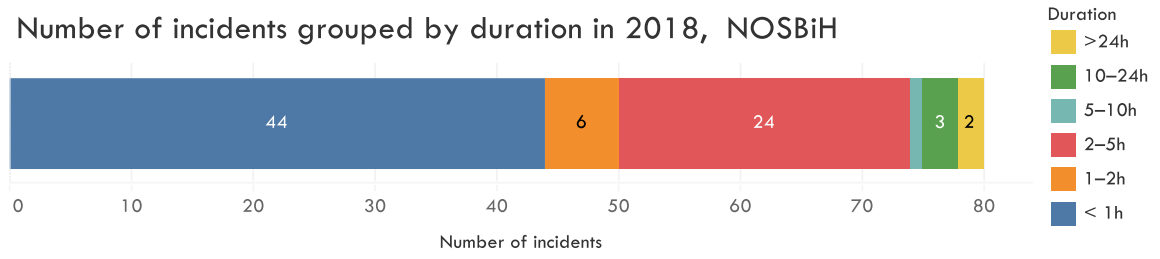

Figure 42 Number of incidents grouped by duration in 2018 for NOSBiH

11.1.16 Incidents reported by PSE

This section presents incidents for PSE. Table 72 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 73 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 43 presents the number of incidents grouped by duration in 2018.

Table 72. Monthly distribution of incidents per dominating criterion in 2018 for PSE

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..	2	3	1	2		2		1		1		2	14
	Incidents on transmission network elements (T0)	11	4	9	7	11	4	8	7	12	5	3	5	86
	Total	13	7	10	9	11	6	8	8	12	6	3	7	100
Grand Total		13	7	10	9	11	6	8	8	12	6	3	7	100

Table 73 Annual number of incidents per dominating criterion during 2014–2018 for PSE

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)	8	1	1		14
	Incidents on transmission network elements (T0)	76	110	69	40	86
	Total	84	111	70	40	100
Scale 1	Incidents on load (L1)		3			
	Incidents on transmission network elements (T1)	5	13	14	5	
	N-1 violation (ON1)		3	1		
	Reduction of reserve capacity (RRC1)		1			
	Total	5	20	15	5	
Grand Total		89	131	85	45	100

The increase of number of incidents on power generating facilities (G0) is a consequence of commissioning new units with installed power above 600 MW (Scale 0 for CE).

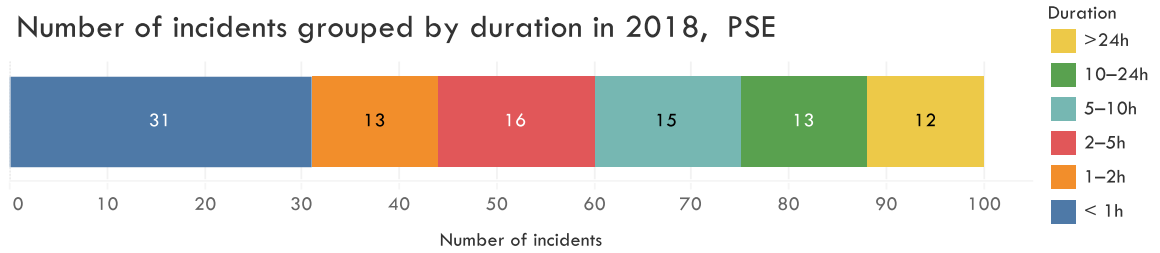

Figure 43 Number of incidents grouped by duration in 2018 for PSE

11.1.17 Incidents reported by REE

This section presents incidents for REE. Table 74 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 75 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 44 presents the number of incidents grouped by duration in 2018.

Table 74. Monthly distribution of incidents per dominating criterion in 2018 for REE

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	6	11	13	4	3	5	11	7	5	10	12	3	90
	Loss of tools and facilities (LT0)						1							1
	Total	6	11	13	4	3	6	11	7	5	10	12	3	91
Scale 1	Incidents on load (L1)						1							1
	Loss of tools and facilities (LT1)									1				1
	Total						1			1				2
Grand Total		6	11	13	4	3	7	11	7	6	10	12	3	93

Table 75 Annual number of incidents per dominating criterion during 2014–2018 for REE

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on load (L0)	2				
	Incidents on power generating facilities (G0)	4			2	
	Incidents on transmission network elements (T0)	239				90
	Loss of tools and facilities (LT0)					1
	Violation of standards on voltage (OV0)	1				
	Total	246			2	91
Scale 1	Incidents on load (L1)					1
	Incidents on transmission network elements (T1)				14	
	Loss of tools and facilities (LT1)				1	1
	Total				15	2
Grand Total		246			17	93

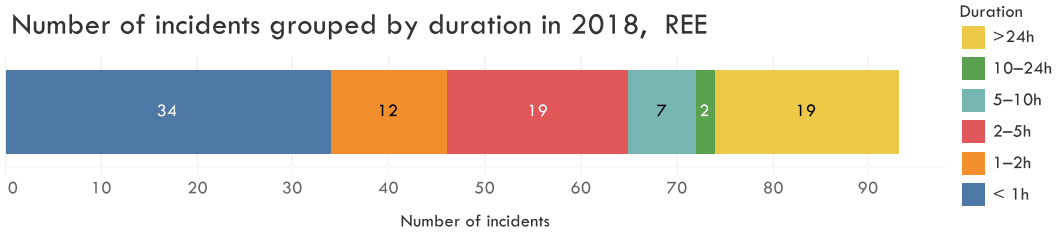

Figure 44 Number of incidents grouped by duration in 2018 for REE

11.1.18 Incidents reported by REN

This section presents incidents for REN. Table 76 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 77 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 45 presents the number of incidents grouped by duration in 2018.

Table 76. Monthly distribution of incidents per dominating criterion in 2018 for REN

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..			1										1
	Incidents on transmission network elements (T0)		4	1					6		4			15
	Loss of tools and facilities (LT0)				1									1
	Total		4	2	1				6		4			17
Grand Total			4	2	1				6		4			17

Table 77 Annual number of incidents per dominating criterion during 2014–2018 for REN

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)			1		1
	Incidents on transmission network elements (T0)	45	16	23	38	15
	Loss of tools and facilities (LT0)					1
	Total	45	16	24	38	17
Scale 1	Incidents on transmission network elements (T1)			8	2	
	Total			8	2	
Grand Total		45	16	32	40	17

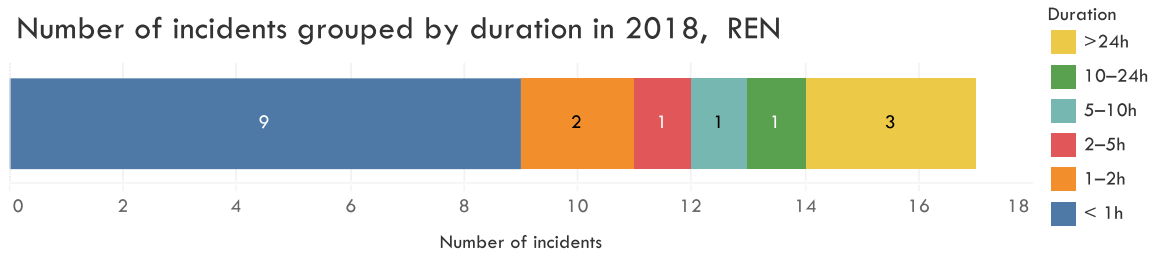

Figure 45 Number of incidents grouped by duration in 2018 for REN

11.1.19 Incidents reported by RTE

This section presents incidents for RTE. Table 78 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 79 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 46 presents the number of incidents grouped by duration in 2018.

Table 78. Monthly distribution of incidents per dominating criterion in 2018 for RTE

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..	4	4	2	4	2	1	2	2	4	3		2	30
	Incidents on transmission network elements (T0)	6	9	5	5	3	7	12	12	3	6	6	1	75
	Loss of tools and facilities (LT0)		3	3	1	2			2		1		2	14
	Violation of standards on voltage (OV0)	1	1	9	6	9	6	3	4	3	17	7	2	68
	Total	11	17	19	16	16	14	17	20	10	27	13	7	187
Scale 1	Incidents on transmission network elements (T1)			1		2		1						4
	Loss of tools and facilities (LT1)			1			1		2		2	1	1	8
	N-1 violation (ON1)						2	1	1					4
	Reduction of reserve capacity (RRC1)		2	1					2					5
	Violation of standards on voltage (OV1)			3	13	5	3	3	5	1	2	1	2	38
	Total		2	6	13	7	6	5	10	1	4	2	3	59
Grand Total		11	19	25	29	23	20	22	30	11	31	15	10	246

Table 79 Annual number of incidents per dominating criterion during 2014–2018 for RTE

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)	3	4	15	11	
	Incidents on power generating facilities (G0)	2		27	32	30
	Incidents on transmission network elements (T0)	1	5	16	38	75
	Loss of tools and facilities (LT0)					14
	Violation of standards on voltage (OV0)				3	68
	Total	6	9	58	84	187
Scale 1	Incidents on power generating facilities (G1)	2				
	Incidents on transmission network elements (T1)	2	12	11	21	4
	Loss of tools and facilities (LT1)	5	1	3		8
	N-1 violation (ON1)			1		4
	Reduction of reserve capacity (RRC1)	2	2		1	5
	Violation of standards on voltage (OV1)				1	38
	Total	11	15	15	23	59
Grand Total		17	24	73	107	246

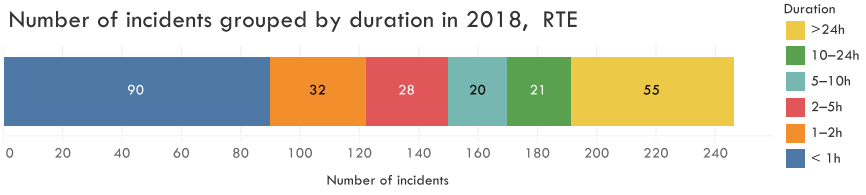

Figure 46 Number of incidents grouped by duration in 2018 for RTE

11.1.20 Incidents reported by SEPS

This section presents incidents for SEPS. Table 80 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 81 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 47 presents the number of incidents grouped by duration in 2018.

Table 80. Monthly distribution of incidents per dominating criterion in 2018 for SEPS

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)			3	1							1	1	6
	Total			3	1							1	1	6
Grand Total				3	1							1	1	6

Table 81 Annual number of incidents per dominating criterion during 2014–2018 for SEPS

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)	1				
	Incidents on transmission network elements (T0)	2	1			6
	Total	3	1			6
Scale 1	Incidents on transmission network elements (T1)		2		2	
	N-1 violation (ON1)	1	3	4	2	
	Reduction of reserve capacity (RRC1)				1	
	Total	1	5	4	5	
Grand Total		4	6	4	5	6

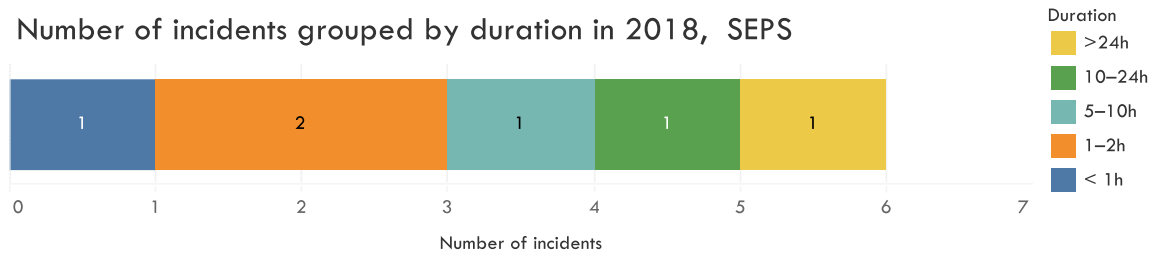

Figure 47 Number of incidents grouped by duration in 2018 for SEPS

11.1.21 Incidents reported by Swissgrid

This section presents incidents for Swissgrid. Table 82 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 83 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 48 presents the number of incidents grouped by duration in 2018.

Table 82. Monthly distribution of incidents per dominating criterion in 2018 for Swissgrid

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..			1										1
	Incidents on transmission network elements (T0)	3			2		1	1			3	1	1	12
	Loss of tools and facilities (LT0)					2	1					1	1	5
	Total	3		1	2	2	2	1			3	2	2	18
Scale 1	Incidents on load (L1)							1						1
	N-1 violation (ON1)										1			1
	Total							1			1			2
Scale 2	N violation (ON2)								1	2				3
	Total								1	2				3
Grand Total		3		1	2	2	2	2	1	2	4	2	2	23

Table 83 Annual number of incidents per dominating criterion during 2014–2018 for Swissgrid

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on load (L0)	4				
	Incidents on power generating facilities (G0)	1	2		2	1
	Incidents on transmission network elements (T0)	56	12	14	7	12
	Loss of tools and facilities (LT0)					5
	Violation of standards on voltage (OV0)			1	1	
	Total	61	14	15	10	18
Scale 1	Incidents on load (L1)					1
	Incidents on power generating facilities (G1)			1		
	Incidents on transmission network elements (T1)	1		4	2	
	Loss of tools and facilities (LT1)	6	4	2	1	
	N-1 violation (ON1)	27		1	3	1
	Reduction of reserve capacity (RRC1)				1	
	Total	34	4	8	7	2
Scale 2	N violation (ON2)					3
	Total					3
Grand Total		95	18	23	17	23

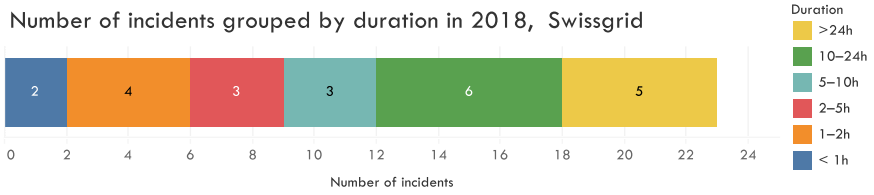

Figure 48 Number of incidents grouped by duration in 2018 for Swissgrid

11.1.22 Incidents reported by TenneT TSO B.V.

This section presents incidents for TenneT TSO B.V. Table 84 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 85 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 49 presents the number of incidents grouped by duration in 2018.

Table 84. Monthly distribution of incidents per dominating criterion in 2018 for TenneT TSO B.V.

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..	1		3			3	1	3	4		1	3	19
	Incidents on transmission network elements (T0)	2		4	1	2	1	1		1	1			13
	Loss of tools and facilities (LT0)	6	10	7	10	3	11	8		8	2	3		68
	Total	9	10	14	11	5	15	10	3	13	3	4	3	100
Scale 1	Loss of tools and facilities (LT1)		1				1				1			3
	N-1 violation (ON1)						1					1	1	3
	Total		1				2				1	1	1	6
Grand Total		9	11	14	11	5	17	10	3	13	4	5	4	106

Table 85 Annual number of incidents per dominating criterion during 2014–2018 for TenneT TSO B.V.

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)	23	31	20	16	19
	Incidents on transmission network elements (T0)	12	5	10	4	13
	Loss of tools and facilities (LT0)					68
	Violation of standards on voltage (OV0)		6	3	11	
	Total	35	42	33	31	100
Scale 1	Incidents on load (L1)		1			
	Incidents on transmission network elements (T1)	1		9	4	
	Loss of tools and facilities (LT1)	4		3		3
	N-1 violation (ON1)	1		3	1	3
	Violation of standards on voltage (OV1)		6	11	19	
	Total	6	7	26	24	6
Grand Total		41	49	59	55	106

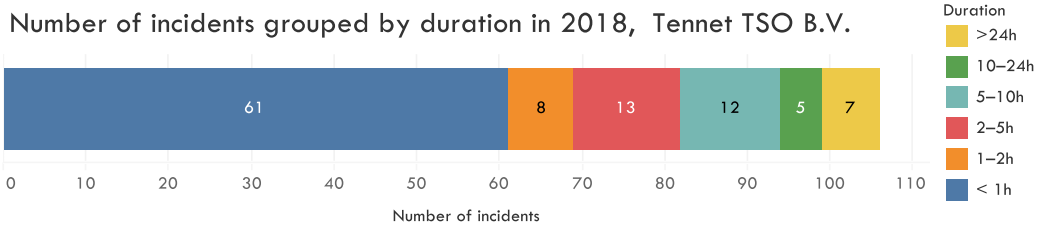

Figure 49 Number of incidents grouped by duration in 2018 for TenneT TSO B.V.

11.1.23 Incidents reported by TenneT TSO GmbH

This section presents incidents for TenneT TSO GmbH. Table 86 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 87 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 50 presents the number of incidents grouped by duration in 2018.

Table 86. Monthly distribution of incidents per dominating criterion in 2018 for TenneT TSO GmbH

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	1	1		2	1	4	3		3	4	3	2	24
	Loss of tools and facilities (LT0)		2	2		2	1		1		1	1		10
	Total	1	3	2	2	3	5	3	1	3	5	4	2	34
Scale 1	N-1 violation (ON1)								1					1
	Violation of standards on voltage (OV1)					4								4
	Total					4			1					5
Grand Total		1	3	2	2	7	5	3	2	3	5	4	2	39

Table 87 Annual number of incidents per dominating criterion during 2014–2018 for TenneT TSO GmbH

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)	4	3	3	2	
	Incidents on transmission network elements (T0)	4	11	13	26	24
	Loss of tools and facilities (LT0)					10
	Violation of standards on voltage (OV0)			4		
	Total	8	14	20	28	34
Scale 1	Incidents on transmission network elements (T1)	2	6		2	
	Loss of tools and facilities (LT1)	1	2	3	3	
	N-1 violation (ON1)	2	12	11	13	1
	Violation of standards on voltage (OV1)				1	4
	Total	5	20	14	19	5
Grand Total		13	34	34	47	39

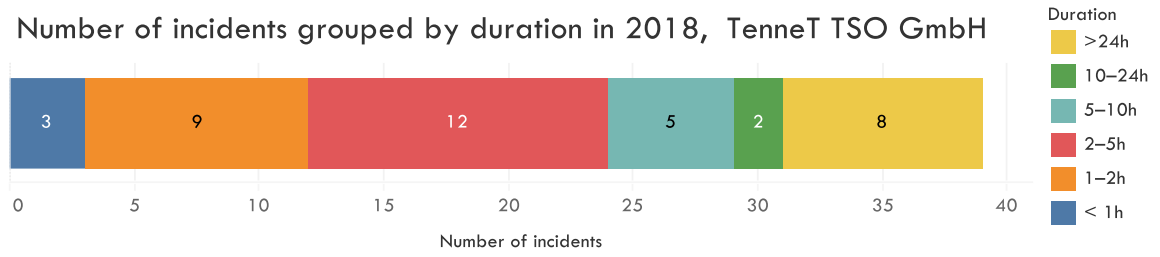

Figure 50 Number of incidents grouped by duration in 2018 for TenneT TSO GmbH

11.1.24 Incidents reported by TERNA

This section presents incidents for TERNA. Table 88 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 89 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 51 presents the number of incidents grouped by duration in 2018.

Table 88. Monthly distribution of incidents per dominating criterion in 2018 for TERNA

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	7	1	1	3	1	2	7	7	5	23	4	2	63
	Total	7	1	1	3	1	2	7	7	5	23	4	2	63
Grand Total		7	1	1	3	1	2	7	7	5	23	4	2	63

Table 89 Annual number of incidents per dominating criterion during 2014–2018 for TERNA

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)	16	14	1		63
	Total	16	14	1		63
Scale 1	Incidents on transmission network elements (T1)	2	1	19	17	
	Total	2	1	19	17	
Grand Total		18	15	20	17	63

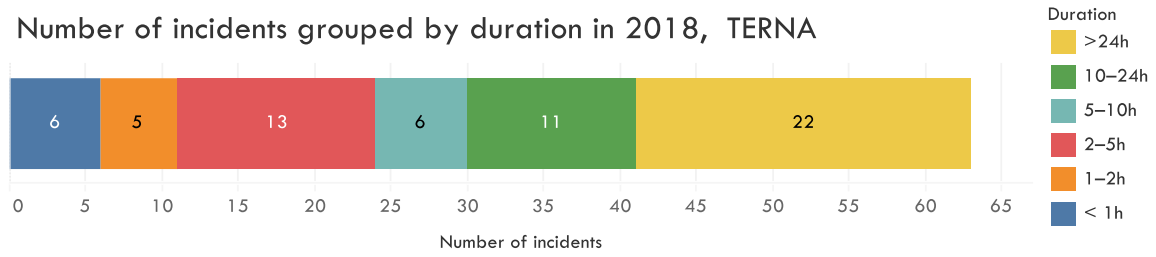

Figure 51 Number of incidents grouped by duration in 2018 for TERNA

11.1.25 Incidents reported by Transelectrica

This section presents incidents for Transelectrica. Table 90 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 91 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 52 presents the number of incidents grouped by duration in 2018.

Table 90. Monthly distribution of incidents per dominating criterion in 2018 for Transelectrica

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..			2				1	1					4
	Incidents on transmission network elements (T0)	6	2	3	2	3	8	13	14	6	2	2	3	64
	Violation of standards on voltage (OV0)	2			4	59	7	17	28	16	6	3	15	157
	Total	8	2	5	6	62	15	31	43	22	8	5	18	225
Scale 1	Reduction of reserve capacity (RRC1)			1										1
	Total			1										1
Grand Total		8	2	6	6	62	15	31	43	22	8	5	18	226

Table 91 Annual number of incidents per dominating criterion during 2014–2018 for Transelectrica

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)	1	1	1	3	4
	Incidents on transmission network elements (T0)	46	47	22	47	64
	Reduction of reserve capacity (RRC0)			2	1	
	Violation of standards on voltage (OV0)					157
	Total	47	48	25	51	225
Scale 1	Incidents on transmission network elements (T1)	3			6	
	Reduction of reserve capacity (RRC1)					1
	Total	3			6	1
Grand Total		50	48	25	57	226

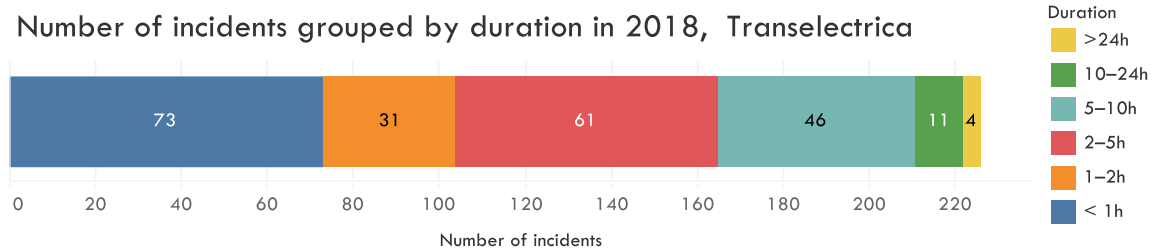

Figure 52 Number of incidents grouped by duration in 2018 for Transelectrica

11.1.26 Incidents reported by TransnetBW GmbH

This section presents incidents for TransnetBW GmbH. Table 92 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 93 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 53 presents the number of incidents grouped by duration in 2018.

Table 92. Monthly distribution of incidents per dominating criterion in 2018 for TransnetBW GmbH

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	4				2	1		3	1		2	1	14
	Total	4				2	1		3	1		2	1	14
Scale 1	Loss of tools and facilities (LT1)										1	1		2
	N-1 violation (ON1)					1					1			2
	Total					1					2	1		4
Grand Total		4				3	1		3	1	2	3	1	18

Table 93 Annual number of incidents per dominating criterion during 2014–2018 for TransnetBW GmbH

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)	5	1		1	
	Incidents on transmission network elements (T0)	11	28	29	28	14
	Total	16	29	29	29	14
Scale 1	Incidents on transmission network elements (T1)	1		1	4	
	Loss of tools and facilities (LT1)	1			2	2
	N-1 violation (ON1)			2	5	2
	Total	2		3	11	4
Grand Total		18	29	32	40	18

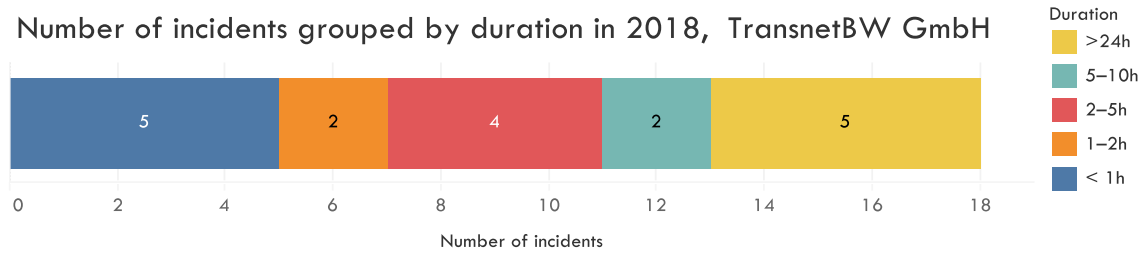

Figure 53 Number of incidents grouped by duration in 2018 for TransnetBW GmbH

11.2 Overview of incidents in the Nordic synchronous area

11.2.1 Incidents reported by Energinet (Nordic)

This section presents incidents for Energinet (Nordic). Table 94 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 95 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 54 presents the number of incidents grouped by duration in 2018.

Table 94. Monthly distribution of incidents per dominating criterion in 2018 for Energinet (Nordic)

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)		1	1										2
	Total		1	1										2
Scale 1	Incidents on transmission network elements (T1)							1						1
	Loss of tools and facilities (LT1)			1					1					2
	Total			1				1	1					3
Grand Total			1	2				1	1					5

Table 95 Annual number of incidents per dominating criterion during 2014–2018 for Energinet (Nordic)

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on transmission network elements (T0)			1		2
	Violation of standards on voltage (OV0)	43				
	Total	43		1		2
Scale 1	Incidents on transmission network elements (T1)	19	4	9	13	1
	Loss of tools and facilities (LT1)	4		3		2
	Violation of standards on voltage (OV1)	3				
	Total	26	4	12	13	3
Grand Total		69	4	13	13	5

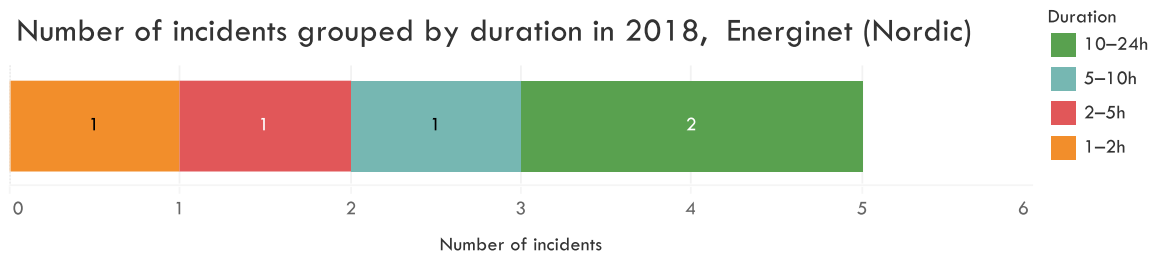

Figure 54 Number of incidents grouped by duration in 2018 for Energinet (Nordic)

11.2.2 Incidents reported by Fingrid Oyj

This section presents incidents for Fingrid Oyj. Table 96 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 97 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 55 presents the number of incidents grouped by duration in 2018.

Table 96. Monthly distribution of incidents per dominating criterion in 2018 for Fingrid Oyj

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..					1								1
	Incidents on transmission network elements (T0)						1	2				1		4
	Violation of standards on voltage (OV0)			1	4									5
	Total			1	4	1	1	2				1		10
Scale 1	Incidents on transmission network elements (T1)								1			1	1	3
	Total								1			1	1	3
Grand Total				1	4	1	1	2	1			2	1	13

Table 97 Annual number of incidents per dominating criterion during 2014–2018 for Fingrid Oyj

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)	1				
	Incidents on power generating facilities (G0)					1
	Incidents on transmission network elements (T0)	4	5			4
	Violation of standards on voltage (OV0)	1				5
	Total	6	5			10
Scale 1	Incidents on transmission network elements (T1)	16	10	9	4	3
	N-1 violation (ON1)		10	8		
	Total	16	20	17	4	3
Grand Total		22	25	17	4	13

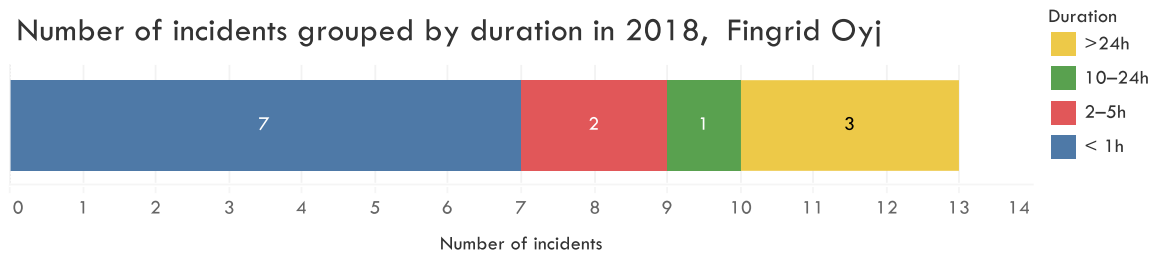

Figure 55 Number of incidents grouped by duration in 2018 for Fingrid Oyj

11.2.3 Incidents reported by Statnett

This section presents incidents for Statnett. Table 98 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 99 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 56 presents the number of incidents grouped by duration in 2018.

Table 98. Monthly distribution of incidents per dominating criterion in 2018 for Statnett

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	5		2		2	2	2	1	3	3	1	2	23
	Total	5		2		2	2	2	1	3	3	1	2	23
Scale 1	Incidents on load (L1)	1	1						1					3
	Incidents on transmission network elements (T1)				1						1			2
	N-1 violation (ON1)							2						2
	Total	1	1		1			2	1		1			7
Grand Total		6	1	2	1	2	2	4	2	3	4	1	2	30

Table 99 Annual number of incidents per dominating criterion during 2014–2018 for Statnett

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on load (L0)	3				
	Incidents on transmission network elements (T0)	8	12	7	2	23
	Total	11	12	7	2	23
Scale 1	Incidents on load (L1)		3	2	2	3
	Incidents on power generating facilities (G1)			1		
	Incidents on transmission network elements (T1)	12	16	6	9	2
	Loss of tools and facilities (LT1)				2	
	N-1 violation (ON1)			1		2
	Total	12	19	10	13	7
Grand Total		23	31	17	15	30

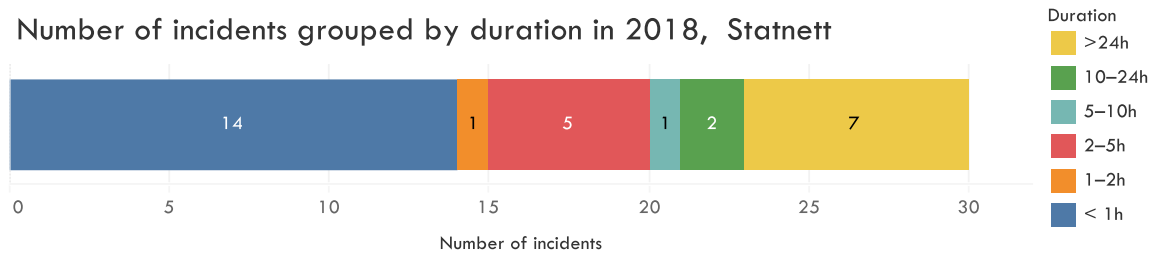

Figure 56 Number of incidents grouped by duration in 2018 for Statnett

11.2.4 Incidents reported by Svenska Kraftnät

This section presents incidents for Svenska Kraftnät. Table 100 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 101 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 57 presents the number of incidents grouped by duration in 2018.

Table 100. Monthly distribution of incidents per dominating criterion in 2018 for Svenska Kraftnät

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents leading to frequency degradatio..						1						1	2
	Incidents on transmission network elements (T0)	1	3	4	3	2	5	12	9	2	2	3	2	48
	Total	1	3	4	3	2	6	12	9	2	2	3	3	50
Scale 1	Incidents on transmission network elements (T1)												1	1
	Total												1	1
Grand Total		1	3	4	3	2	6	12	9	2	2	3	4	51

Table 101 Annual number of incidents per dominating criterion during 2014–2018 for Svenska Kraftnät

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)		1			2
	Incidents on transmission network elements (T0)	5	10	2	4	48
	Total	5	11	2	4	50
Scale 1	Incidents on transmission network elements (T1)	16	24	27	17	1
	Violation of standards on voltage (OV1)	1				
	Total	17	24	27	17	1
Grand Total		22	35	29	21	51

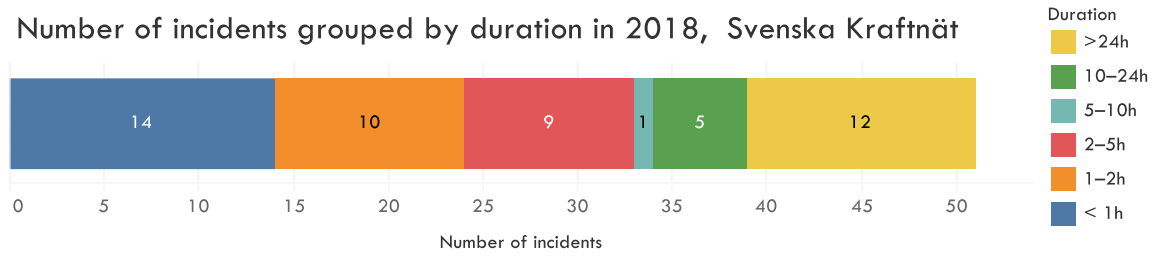

Figure 57 Number of incidents grouped by duration in 2018 for Svenska Kraftnät

11.3 Overview of incidents in Great Britain

11.3.1 Incidents reported by National Grid ESO

This section presents incidents for National Grid ESO. Table 102 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 103 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 58 presents the number of incidents grouped by duration in 2018.

Table 102. Monthly distribution of incidents per dominating criterion in 2018 for National Grid ESO

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents leading to frequency degradatio..	5	8	7	3	1	4	8	5	3	6	5	3	58
	Incidents on power generating facilities (..						1	1		1				3
	Incidents on transmission network elements (T0)	14	14	20	15	13	11	11	8	7	19	16	8	156
	Loss of tools and facilities (LT0)	4	6	2	4		1	1	3	1	2	3	4	31
	Total	23	28	29	22	14	17	21	16	12	27	24	15	248
Scale 1	N-1 violation (ON1)		2											2
	Total		2											2
Grand Total		23	30	29	22	14	17	21	16	12	27	24	15	250

Table 103 Annual number of incidents per dominating criterion during 2014–2018 for National Grid ESO

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)					58
	Incidents on power generating facilities (G0)	1		1	2	3
	Incidents on transmission network elements (T0)	108	82	101	124	156
	Loss of tools and facilities (LT0)					31
	Total	109	82	102	126	248
Scale 1	Incidents on transmission network elements (T1)	6	5	9	10	
	Loss of tools and facilities (LT1)	3	1	1	2	
	N-1 violation (ON1)					2
	Violation of standards on voltage (OV1)	7				
	Total	16	6	10	12	2
Grand Total		125	88	112	138	250

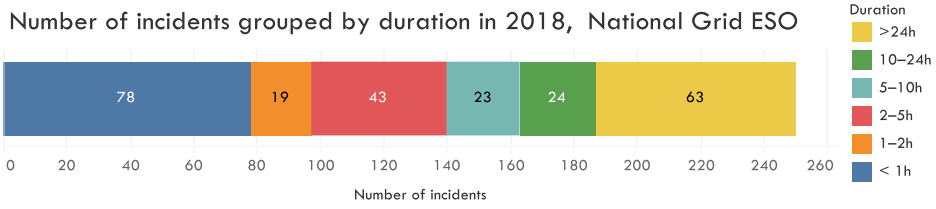

Figure 58 Number of incidents grouped by duration in 2018 for National Grid ESO

11.4 Overview of incidents in the Baltic area

11.4.1 Incidents reported by AS Augstsprieguma tīkls

This section presents incidents for AS Augstsprieguma tīkls. Table 104 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 105 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 59 presents the number of incidents grouped by duration in 2018.

Table 104. Monthly distribution of incidents per dominating criterion in 2018 for AS Augstsprieguma tīkls

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)		1				1	1	3		1			7
	Total		1				1	1	3		1			7
Scale 1	Loss of tools and facilities (LT1)												1	1
	Total												1	1
Grand Total			1				1	1	3		1		1	8

Table 105 Annual number of incidents per dominating criterion during 2014–2018 for AS Augstsprieguma tīkls

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on load (L0)	1				
	Incidents on transmission network elements (T0)	11	5	6	6	7
	Total	12	5	6	6	7
Scale 1	Incidents leading to frequency degradation (F1)			1		
	Incidents on power generating facilities (G1)			1		
	Loss of tools and facilities (LT1)					1
	Total			2		1
Grand Total		12	5	8	6	8

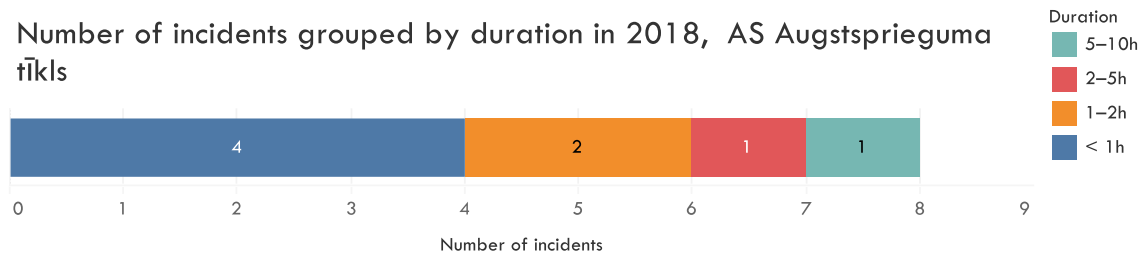

Figure 59 Number of incidents grouped by duration in 2018 for AS Augstsprieguma tīkls

11.4.2 Incidents reported by Elering AS

This section presents incidents for Elering AS. Table 106 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 107 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 60 presents the number of incidents grouped by duration in 2018.

Table 106. Monthly distribution of incidents per dominating criterion in 2018 for Elering AS

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..											1		1
	Incidents on transmission network elements (T0)		1			2	1			1	1			6
	Total		1			2	1			1	1	1		7
Grand Total			1			2	1			1	1	1		7

Table 107 Annual number of incidents per dominating criterion during 2014–2018 for Elering AS

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)					1
	Incidents on transmission network elements (T0)	8	5	2	5	6
	Total	8	5	2	5	7
Scale 1	Incidents on transmission network elements (T1)	8	15	4	3	
	Loss of tools and facilities (LT1)			1		
	Total	8	15	5	3	
Grand Total		16	20	7	8	7

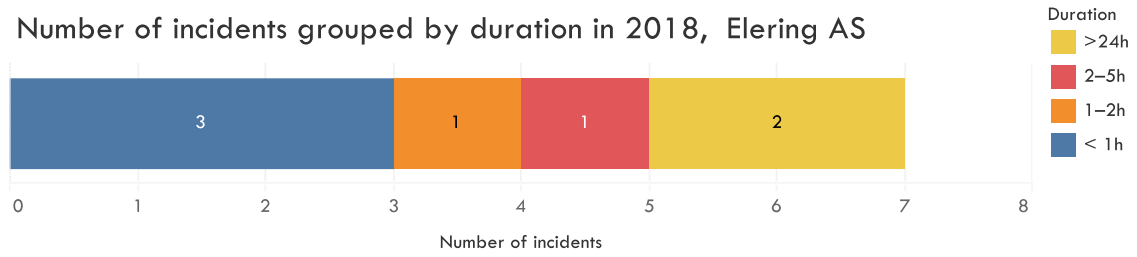

Figure 60 Number of incidents grouped by duration in 2018 for Elering AS

11.4.3 Incidents reported by Litgrid AB

This section presents incidents for Litgrid AB. Table 108 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 109 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 61 presents the number of incidents grouped by duration in 2018.

Table 108. Monthly distribution of incidents per dominating criterion in 2018 for Litgrid AB

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on power generating facilities (..								1					1
	Incidents on transmission network elements (T0)		1	2	2	1	1	2	1		1	1		12
	Total		1	2	2	1	1	2	2		1	1		13
Grand Total			1	2	2	1	1	2	2		1	1		13

Table 109 Annual number of incidents per dominating criterion during 2014–2018 for Litgrid AB

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)	2	3	3		1
	Incidents on transmission network elements (T0)	5	8	11	6	12
	Total	7	11	14	6	13
Scale 1	Incidents on transmission network elements (T1)			9	8	
	Loss of tools and facilities (LT1)			3		
	Total			12	8	
Grand Total		7	11	26	14	13

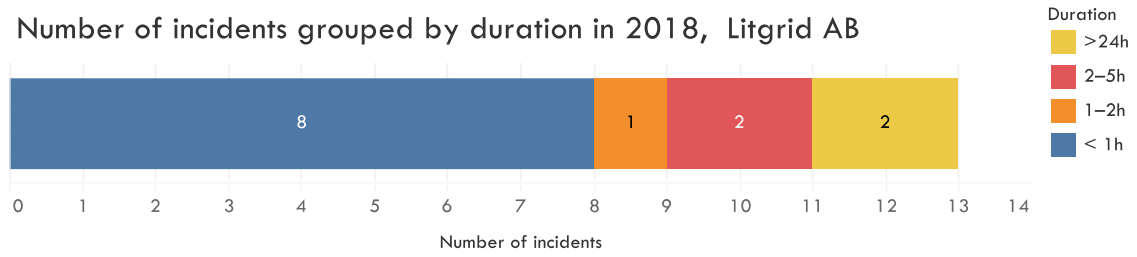

Figure 61 Number of incidents grouped by duration in 2018 for Litgrid AB

11.5 Overview of incidents Ireland

11.5.1 Incidents reported by EirGrid

This section presents incidents for EirGrid. Table 110 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 111 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 62 presents the number of incidents grouped by duration in 2018.

Table 110. Monthly distribution of incidents per dominating criterion in 2018 for EirGrid

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents leading to frequency degradatio..		1				1	1		1		2	1	7
	Incidents on power generating facilities (..		2	2		1			1			1		7
	Incidents on transmission network elements (T0)	1		2			1	1			1	2		8
	Total	1	3	4		1	2	2	1	1	1	5	1	22
Scale 2	Incidents leading to frequency degradatio..	1												1
	Total	1												1
Grand Total		2	3	4		1	2	2	1	1	1	5	1	23

Table 111 Annual number of incidents per dominating criterion during 2014–2018 for EirGrid

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)					7
	Incidents on power generating facilities (G0)	22	25	17	23	7
	Incidents on transmission network elements (T0)	1	1	7	3	8
	Violation of standards on voltage (OV0)			1		
	Total	23	26	25	26	22
Scale 1	Incidents on transmission network elements (T1)	4	2	1	2	
	Loss of tools and facilities (LT1)				2	
	Total	4	2	1	4	
Scale 2	Incidents leading to frequency degradation (F2)					1
	Total					1
Grand Total		27	28	26	30	23

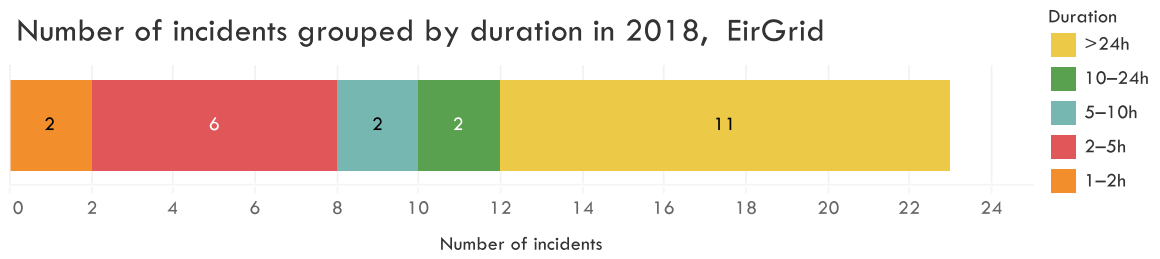

Figure 62 Number of incidents grouped by duration in 2018 for EirGrid

11.5.2 Incidents reported by SONI

This section presents incidents for SONI. Table 112 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 113 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 63 presents the number of incidents grouped by duration in 2018.

Table 112. Monthly distribution of incidents per dominating criterion in 2018 for SONI

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents leading to frequency degradatio..											1		1
	Incidents on transmission network elements (T0)			1										1
	Total			1								1		2
Grand Total				1								1		2

Table 113 Annual number of incidents per dominating criterion during 2014–2018 for SONI

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents leading to frequency degradation (F0)					1
	Incidents on power generating facilities (G0)	1	2	4	1	
	Incidents on transmission network elements (T0)			3		1
	Total	1	2	7	1	2
Scale 1	Incidents on transmission network elements (T1)	1			4	
	Total	1			4	
Scale 2	Incidents on load (L2)		1			
	Total		1			
Grand Total		2	3	7	5	2

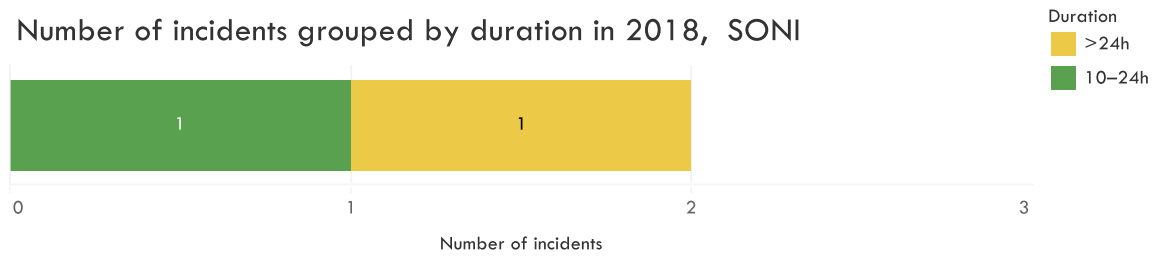

Figure 63 Number of incidents grouped by duration in 2018 for EirGrid

11.6 Overview of incidents in isolated systems

11.6.1 Incidents by Cyprus TSO

This section presents incidents for Cyprus TSO. Table 114 presents the annual number of incidents per dominating criterion during 2014–2018. Cyprus TSO had no incidents in 2018.

Table 114 Annual number of incidents per dominating criterion during 2014–2018 for Cyprus TSO

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 1	Incidents on load (L1)				4	
	Total				4	
Scale 2	Incidents on load (L2)	1			1	
	Incidents on power generating facilities (G2)			1		
	Total	1		1	1	
Grand Total		1		1	5	

11.6.2 Incidents by Landsnet

This section presents incidents for Landsnet. Table 115 presents the monthly distribution of incidents per dominating criterion in 2018 and Table 116 presents the annual number of incidents per dominating criterion during 2014–2018. Figure 64 presents the number of incidents grouped by duration in 2018.

Table 115. Monthly distribution of incidents per dominating criterion in 2018 for Landsnet

		2018												
Scale	Dominating criterion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Scale 0	Incidents on transmission network elements (T0)	1	1			2	2	1		1	1	1		10
	Total	1	1			2	2	1		1	1	1		10
Scale 1	Incidents on transmission network elements (T1)		1			1		1						3
	Total		1			1		1						3
Scale 2	Incidents on load (L2)		1											1
	Loss of tools and facilities (LT2)			1										1
	Total		1	1										2
Grand Total		1	3	1		3	2	2		1	1	1		15

Table 116 Annual number of incidents per dominating criterion during 2014–2018 for Landsnet

Scale	Dominating criterion	2014	2015	2016	2017	2018
Scale 0	Incidents on power generating facilities (G0)				1	
	Incidents on transmission network elements (T0)	3	4	8	5	10
	Total	3	4	8	6	10
Scale 1	Incidents on load (L1)	10	3	2	3	
	Incidents on power generating facilities (G1)				2	
	Incidents on transmission network elements (T1)	2	1		6	3
	Total	12	4	2	11	3
Scale 2	Incidents on load (L2)	3	3	1	1	1
	Loss of tools and facilities (LT2)					1
	Total	3	3	1	1	2
Grand Total		18	11	11	18	15

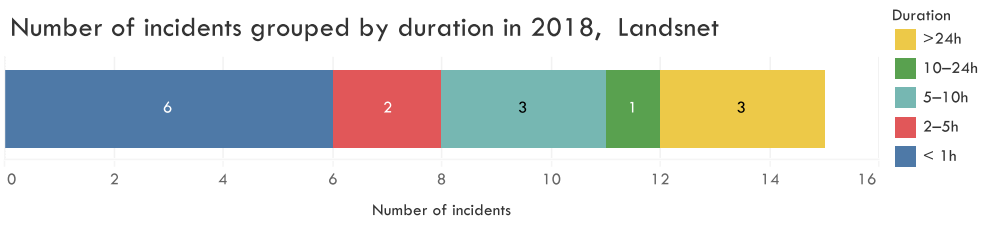

Figure 64 Number of incidents grouped by duration in 2018 for Landsnet

12 Conclusion

For the 2018 annual report on the incident classification scale, ENTSO-E members reported data on incidents to ICS sub-group. Consequently, this sub-group analysed the data and prepared this report. Compared to the 2017 report, the 2018 report for the first time provides a clear overview of the incidents that took place within each TSO.

A total of 3030 incidents were reported, which represents an increase of about 183 % compared to 2017.

Compared to the last year, the 2762 scale 0 incidents reported represent an increase of about 306 %; the 262 scale 1 incidents reported represent a decrease of about 33 % and the 6 scale 2 incidents represent a 200 % increase.

Most of the scale 0 incidents with 41 % are on transmission network elements (T0). The next largest groups of scale 0 incidents were incidents on frequency degradation (F0) and Violations of standards on voltage (OV0), which represent about 37 % and 12 % of all incidents, respectively.

The largest group of scale 1 incidents is the Reduction of reserve capacity (RRC1), which all have been reported in Continental Europe and which represents 45 % of all scale 1 incidents.

2 of the 6 scale 2 incidents took place in the isolated system, one took place in Ireland and the remaining three in Continental Europe.

All these results and trends are derived exclusively from the data reported by the individual TSOs. The increase in the total amount of reported incidents is expected to be mainly as a result of the updated Incident Classification Scale Methodology, which was introduced in 2018. The update was applied to bring the ICS in line with the SO GL. Due to the updated methodology it is difficult to compare the reported incidents with previous years. In addition, within some categories, there are still some doubts as to whether the TSOs have acquired a harmonized understanding of ICS reporting. Therefore, future workshops and further explanations on the methodology will be arranged. These improvements should be accompanied by the development of an improved reporting tool which allows for automated plausibility checks and reduction of manual handling of data.

Despite the significant number of incidents, only a few of these were significant. TSOs have in general proven secure and highly reliable grid operation.

13 References

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