2017 Incident Classification Scale
ANNUAL REPORT

25 September 2018

entsoe
European Network of
Transmission System Operators
for Electricity

ABOUT ENTSO-E

ENTSO-E, the European Network of Transmission System Operators for Elecricity, represents 43 electricity transmission system operators (TSOs) from 36 countries across Europe.

ENTSO-E was established and given legal mandates by the EU's third legislative package for the internal energy market in 2009, which aims to further liberalise the gas and electricity markets in the EU.

Any question? Contact us:

@ENTSO_E | info@entsoe.eu | +32 2 741 09 50 | www.entsoe.eu

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INTRODUCTION

The 2017 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 1 to 3 at a synchronous area level and a high-level summary of scale 0 incidents.

The 2017 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 the System Frequency subgroup under the System Operations Committee.
An update of the ICS methodology started in mid-2016 and was implemented from the beginning of 2018. In addition, an annual workshop took place to ensure continual high quality of reporting starting from 2018 for all TSOs.

INCIDENT CLASSIFICATION SCALE

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 of the incidents which occurred in 2017, 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 anomalous, 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. Incident classification scale

Scale 0 Anomaly		Scale 1 Noteworthy incidents		Scale 2 Extensive incidents		Scale 3 Major or widespread incidents	
Priority / Short definition		Priority / Short definition		Priority / Short definition		Short definition	
#17	Incidents leading to frequency degradation (F0)	#9	Incidents on load (L1)	#2	Incidents on load (L2)	#1	Blackout (OB3)
#18	Incidents on transmission network elements (T0)	#10	Incidents leading to frequency degradation (F1)	#3	Incidents leading to frequency degradation (F2)		
#19	Incidents on power generating facilities (G0)	#11	Incidents on transmission network elements (T1)	#4	Incidents on transmission network elements (T2)		
#20	Violation of standards on voltage (OV0)	#12	Incidents on power generating facilities (G1)	#5	Incidents on power generating facilities (G2)		
#21	Lack of reserve (OR0)	#13	N-1 violation (ON1)	#6	N violation (ON2)		
		#14	Violation of standards on voltage (OV1)	#7	Separation from the grid (RS2)		
		#15	Lack of reserve (OR1)	#8	Loss of tools and facilities (LT2)		
		#16	Loss of tools and facilities (LT1)				

GLOBAL OVERVIEW

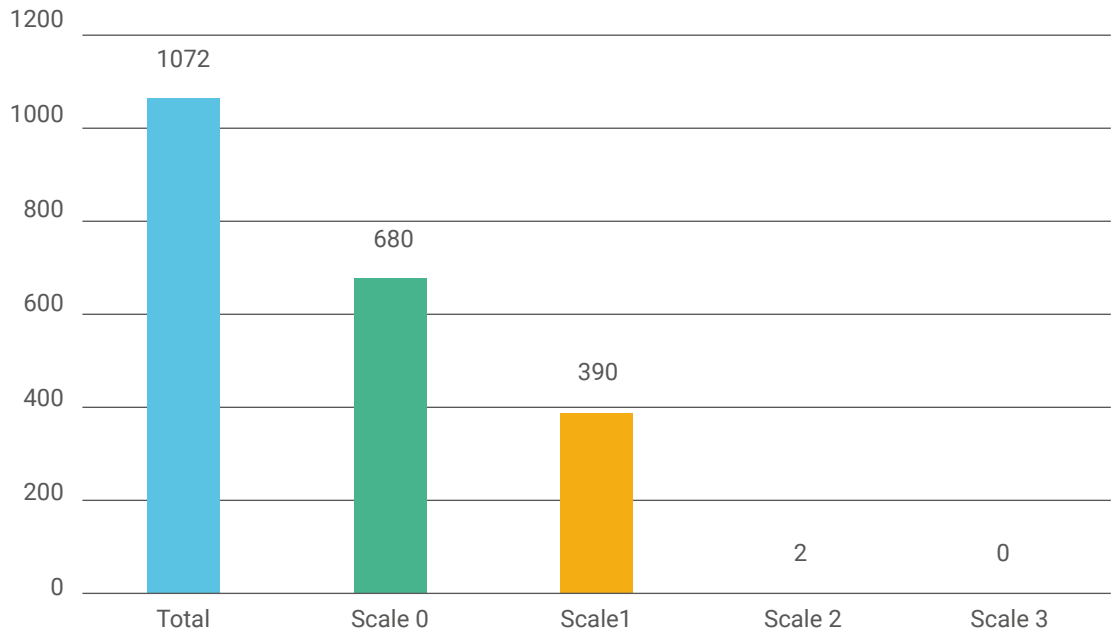
SIGNIFICANT CHANGES IN THE POWER SYSTEM

During 2017, 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 (NGC) of renewables increased by 5.6 % from 2016 to 2017, the installed capacities of non-renewables decreased by 2.3 %. The overall NGC increased by 1.2 % [3].

The following chapters give the statistical overview of the incidents which occurred at the pan- European level in 2017.

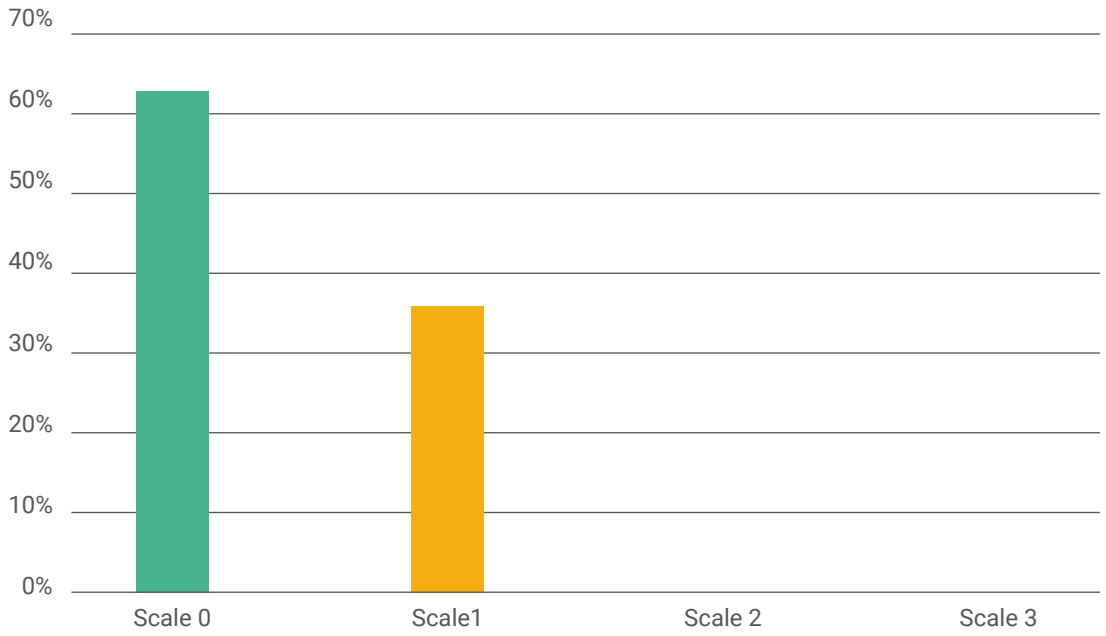
NUMBER OF CLASSIFIED INCIDENTS

Figure 1. Classified incidents in 2017 by scale



There were a total of 1072 incidents reported by TSOs in 2017, of which 680 were reported to be of scale 0, 390 of scale 1, and 2 of scale 2. No incident of scale 3 was reported.

Figure 2. Percentage of classified incidents by scale



As shown in Figure 2, the distribution of incidents by scale in 2017 was: 63.4 % of the reported incidents were of scale 0, 36.4 % of scale 1, and 0.2 % of scale 2.

Table 2 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. There were 8 TSOs which didn't report any scale 0 incidents. Also, there were 9 TSOs which had more incidents at scale 1 than at scale 0. This type of situation (like the previous two mentioned above) will be monitored for improvement.

Table 2. Number of incidents per TSO and scale

TSO	Scale 0 incidents	Scale 1 incidents	Scale 2 incidents	Sum of all incidents
50Hertz	18	18		36
Amprion GmbH	44	17		61
APG-Austrian Power Grid AG	24	3		27
AS Augstsprieguma tīkls	6			6
CEPS	12	11		23
CGES	22	52		74
Cyprus TSO		4	1	5
EirGrid	26	4		30
Elering AS	5	3		8
ELES	5	2		7
ELIA	7	10		17
EMS JSC	16	5		21
Energinet		13		13
ESO EAD	24	12		36
Fingrid OyJ		4		4
HOPS		11		11
IPTO	8	17		25
NOS BiH	5			5
Landsnet	6	11	1	18
Litgrid AB	6	8		14
MAVIR ZRt		3		3
MEPSO		4		4
National Grid	126	10		136
PSE	40	5		45
REE	2	15		17
REN	38	2		40
RTE	84	23		107
SEPS		5		5
SONI	1	4		5
Statnett	2	13		15
Svenska kraftnät	4	17		21
Swissgrid AG	10	7		17
TenneT TSO B.V.	31	24		55
TenneT TSO GmbH	28	19		47
TERNA		17		17
Transelectrica	51	6		57
TransnetBW GmbH	29	11		40
Total	680	390	2	1072

Figure 3. Number of incidents per synchronous area

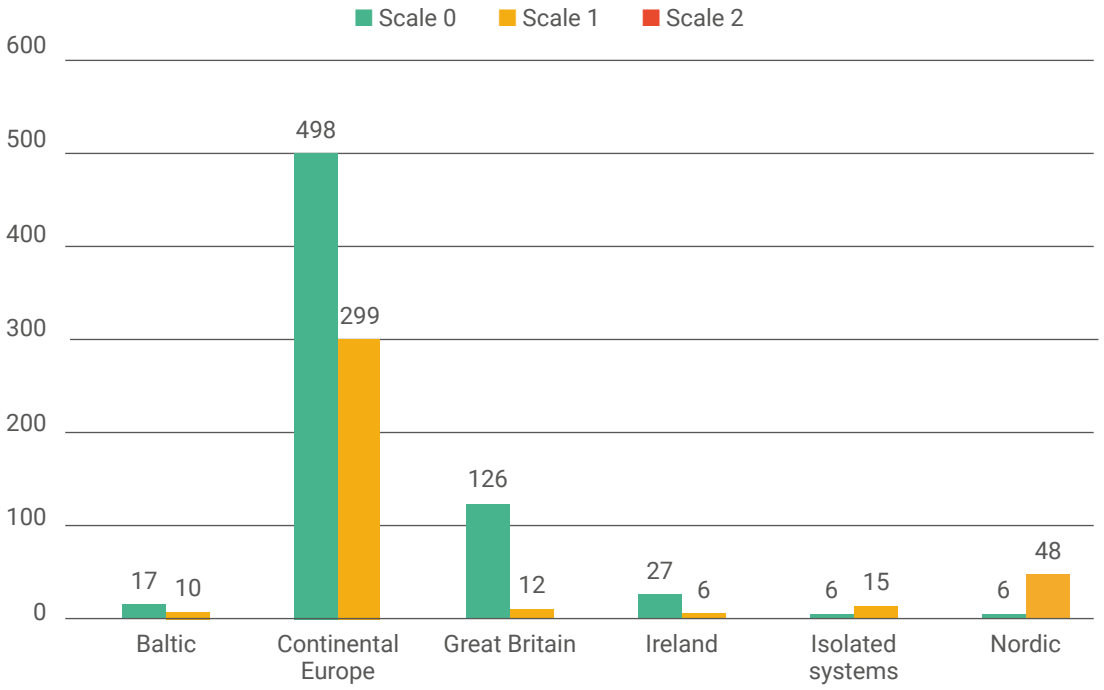


Figure 4. Distribution of incidents per synchronous area

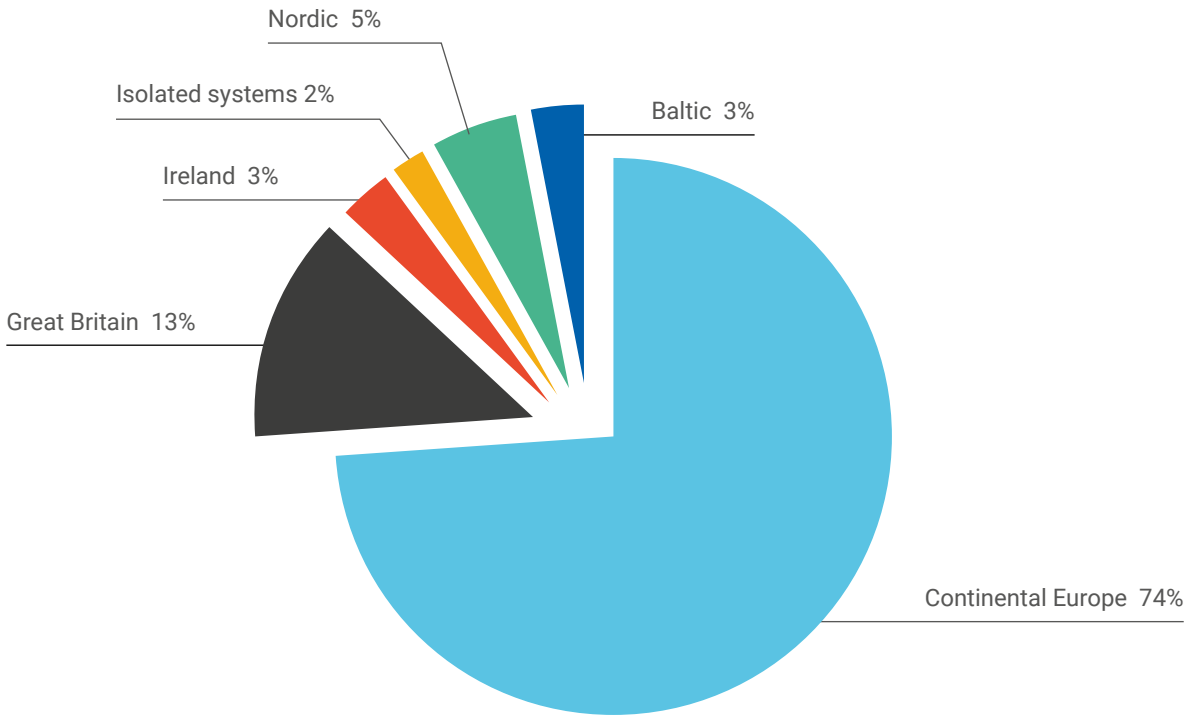
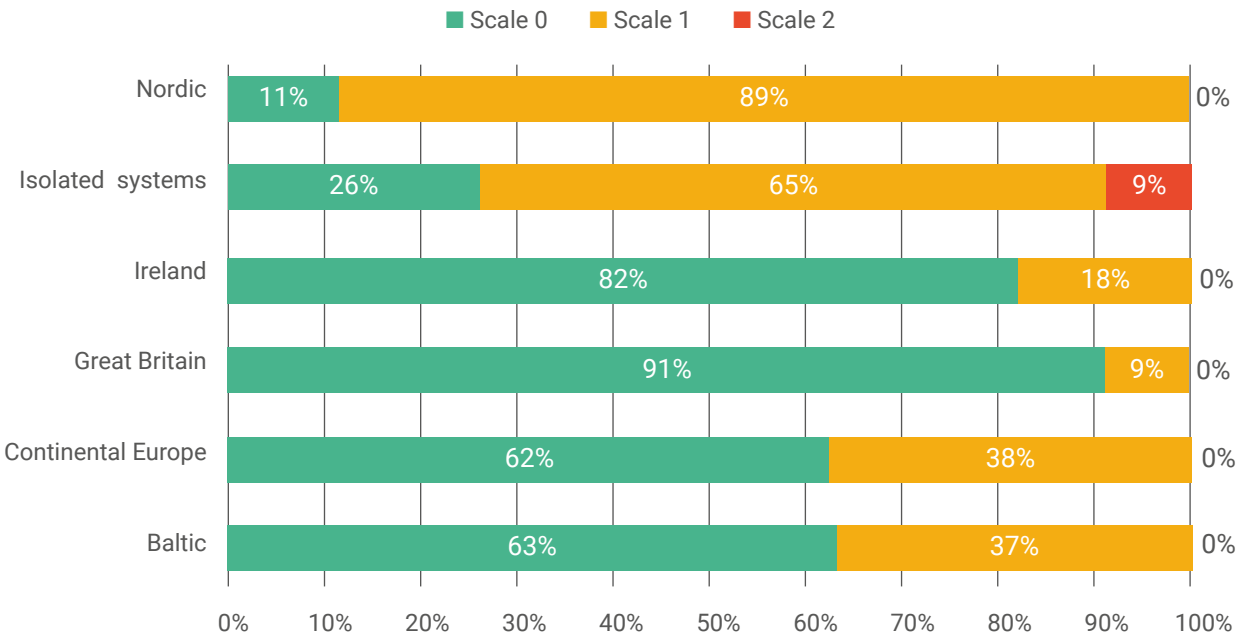


Figure 5. Proportions of scale 0, 1, and 2 incidents per synchronous area



In the Nordic synchronous area, the number of reported scale 1 incidents was much larger than the number of scale 0 incidents. There were many scale 1 incidents on HVDC interconnectors leading to the reduction of the cross-border exchange capacity. Ireland and Great Britain had a similar ratio of scale 0 to scale 1 incidents. In the Continental Europe and Baltic synchronous areas, the ratios were also similar. Isolated systems were the only ones with scale 2 incidents. The incidents per criteria are shown in Table 3. Most incidents occured on transmission network elements (73 % of all incidents).

Table 3. Number of incidents per criteria

Scale 0 Anomaly		Scale 1 Noteworthy incidents		Scale 2 Extensive incidents		Scale 3 Major or widespread incidents	
# of incidents / incident type		# of incidents / incident type		# of incidents / incident type		# of incidents / incident type	
11	Incidents leading to frequency degradation (F0)	10	Incidents on load (L1)	2	Incidents on load (L2)	0	Blackout (OB3)
530	Incidents on transmission network elements (T0)	0	Incidents leading to frequency degradation (F1)	0	Incidents leading to frequency degradation (F2)		
111	Incidents on power generating facilities (G0)	255	Incidents on transmission network elements (T1)	0	Incidents on transmission network elements (T2)		
27	Violation of standards on voltage (OV0)	2	Incidents on power generating facilities (G1)	0	Incidents on power generating facilities (G2)		
1	Lack of reserve (OR0)	21	Violation of standards on voltage (OV1)	0	N violation (ON2)		
		12	Lack of reserve (OR1)	0	Separation from the grid (RS2)		
		66	N-1 violation (ON1)	0	Loss of tools and facilities (LT2)		
		24	Loss of tools and facilities (LT1)				

Table 4 displays the reported incidents per synchronous area. All synchronous areas reported incidents on transmission Network Elements (T0 and T1). Incidents on power Generating Facilities at scale 1 (G1) only occurred in isolated systems. These are the types of incidents which were reported only by TSOs in Continental Europe: Lack of reserve (OR0 and OR1), Violation of standards on voltage (OV0 and OV1), Disturbance leading to frequency degradation(F0) and an N-1 violation (N-1).

Table 4. Summary of incidents in 2017 per synchronous area

Incident type	Baltic	Continental Europe	Great Britain	Ireland	Isolated Systems	Nordic	Grand Total
Lack of reserve (OR0)		1					1
Incidents on power generating facilities (G0)		84	2	24	1		111
Violation of standards on voltage (OV0)		27					27
Incidents on transmission network elements (T0)	17	375	124<	3	5	6	530
Disturbance leading to frequency degradation (F0)		11					11
Loss of tools and facilities (LT1)		18	2	2		2	24
Lack of reserve (OR1)		12					12
Violation of standards on voltage (OV1)		21					21
N-1 violation (ON1)		66					66
Incidents on power generating facilities (G1)					2		2
Incidents on transmission network elements (T1)	10	181	8	6	6	44	255
Events on load (L1)		1			7	2	10
Events on load (L2)					2		2
Grand Total	27	797	136	35	23	54	1072

INCIDENTS PER LENGTH OF CIRCUIT AND ENERGY CONSUMPTION

The figures below show the ratio between the number of incidents and annual consumption and the ratio between the number of incidents and total length of circuits.

Information about the length of circuits on 31 December 2017 and the energy consumption in 2017 is based on ENTSO-E statistical data [4].

Figure 6 shows the number of incidents per 1 TWh of energy consumption. For scale 0, the minimum value is 0.02 TWh-1 for Nordic, and the maximum value is 0.73 TWh-1 for Ireland. For scale 1, the minimum value is 0.04 TWh-1 for GB, and the maximum value is 0.64 TWh-1 for Isolated Systems (which is the only synchronous area which had scale 2 incidents).

The number of incidents per 100 km of circuits at or above 220 kV (Figure 7) are quite small for the synchronous areas of Baltic, Continental Europe, and Nordic, while Great Britain and Ireland have the highest values for scale 0 incidents per length of circuits. The highest value for scale 1 incidents per length of circuits can be found in Isolated Systems. The number of incidents resulting in final tripping of transmission network equipment per 100 km of circuit at or above 220 kV is shown in Figure 8.

Figure 6. Number of incidents per 1 TWh of energy consumption

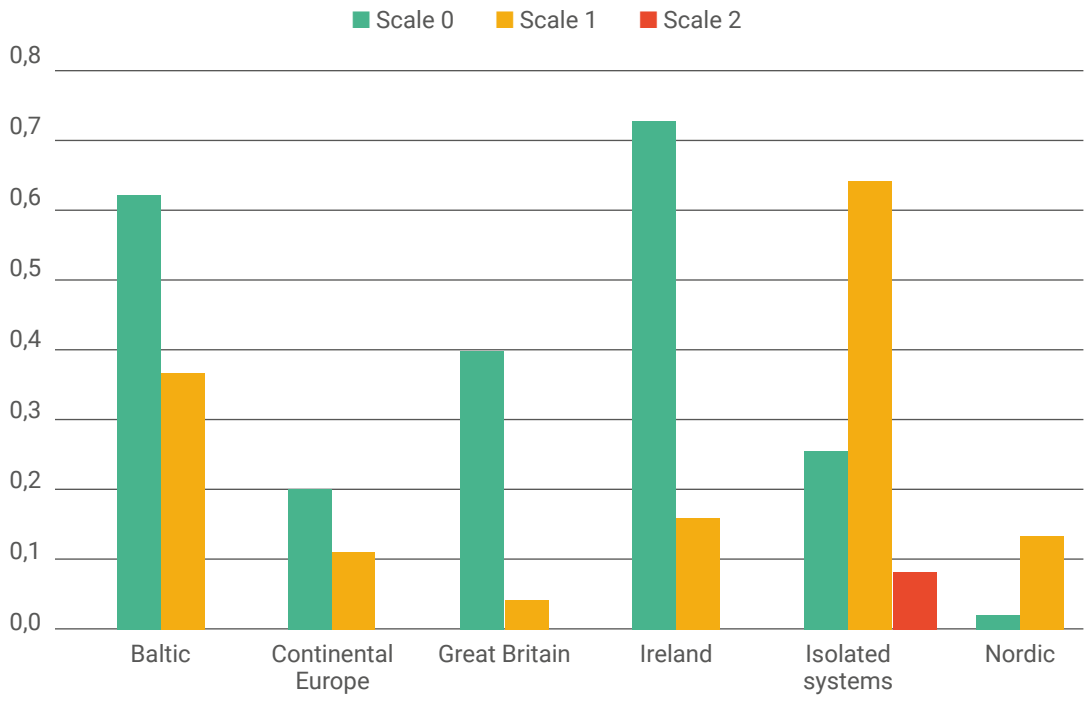


Figure 7. Number of incidents per 100 km of circuit at or above 220 kV

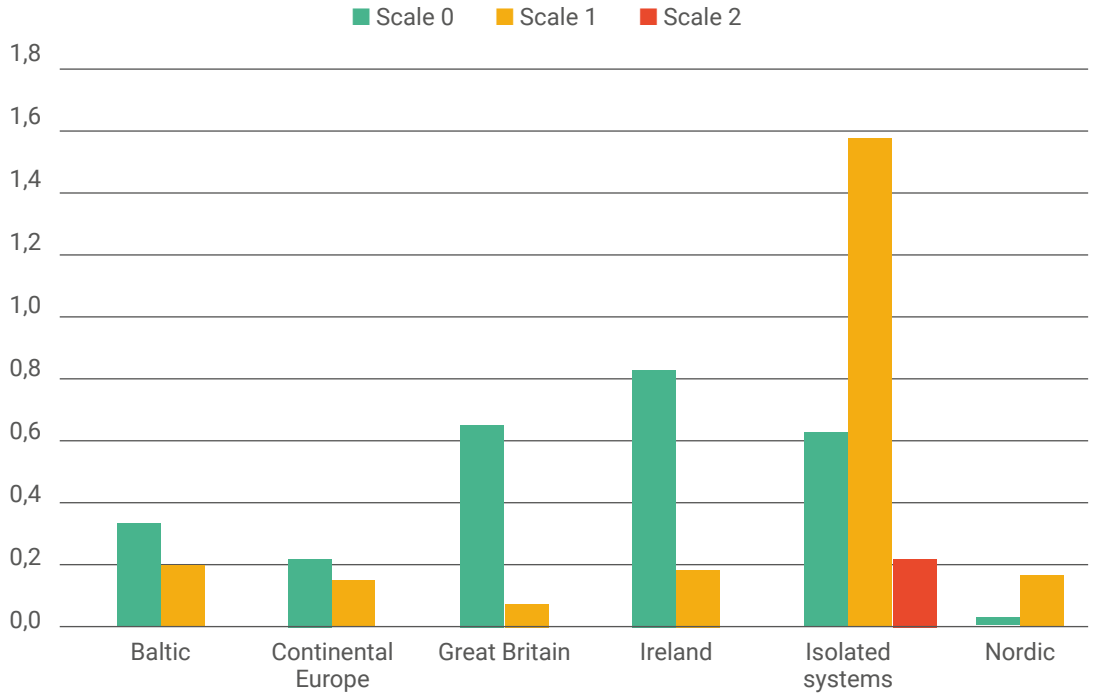
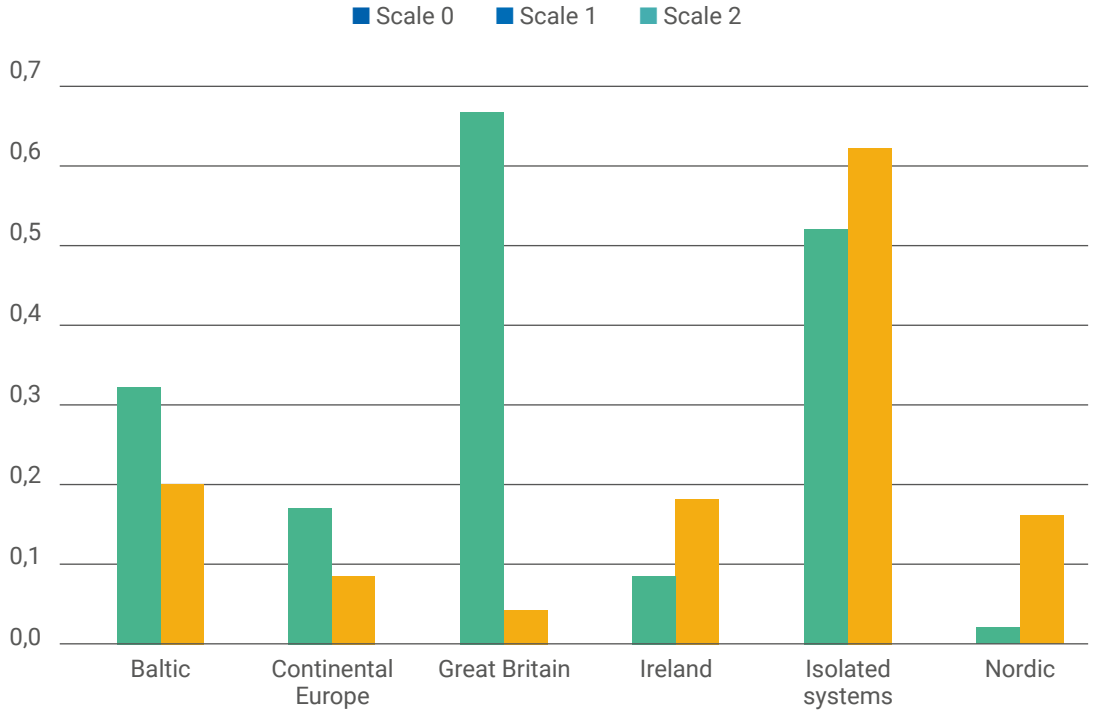


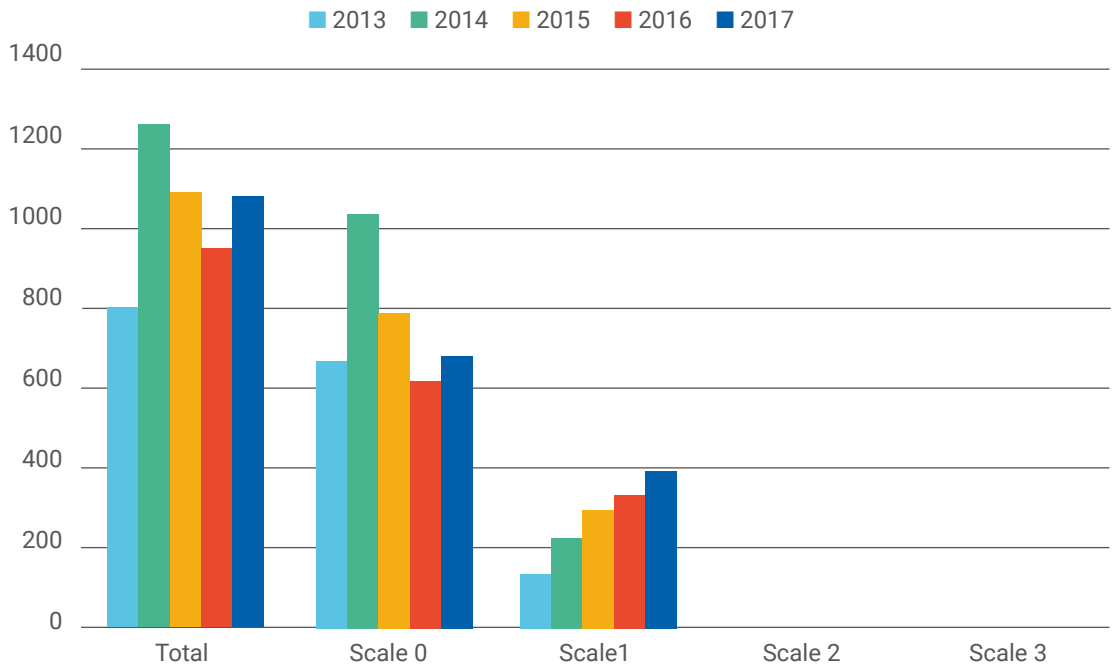
Figure 8. Number of incidents resulting in final tripping of transmission network equipment per 100 km of circuit at or above 220 kV



EVOLUTION TO 2017

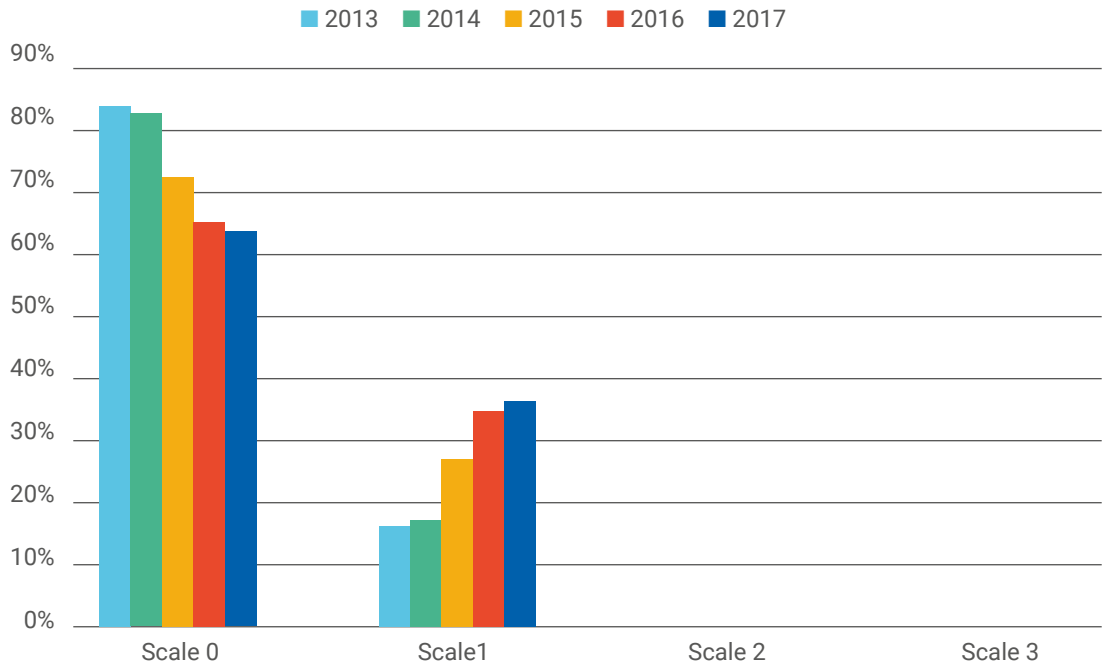
The figures below show the changes in the number of incidents from 2013 to 2017. For the years 2013-2014, a previous version of the methodology, that was approved by ENTSO-E System Operations Committee in January 2013 [5], applied.

Figure 9. Evolution of absolute numbers of incidents 2015-2017



The total number of reported incidents decreased from 1084 in 2015 to 942 incidents in 2016, i.e., by 13 %. The overall number increased in 2017 by 125, i.e., another 13 %. The number of reported scale 0 incidents decreased significantly from 783 to 614 between 2015 and 2016, but increased to 680 in 2017 again. Whereas, the number of scale 1 incidents increased slightly from 297 to 326 between 2015 and 2016, then increased again in 2017, when 390 incidents of scale 1 were reported.

Figure 10. Evolution of relative number of incidents 2015-2017 compared to the overall number per year



The number of incidents, relative to the overall amount reported per year, is shown in Figure 10, from which can be seen that the relative amount of scale 0 incidents decreased, while the relative amount of scale 1 incidents increased over the last 3 years.

Figure 11. Number of scale 0 incidents per 100km of circuit at or above 220 kV

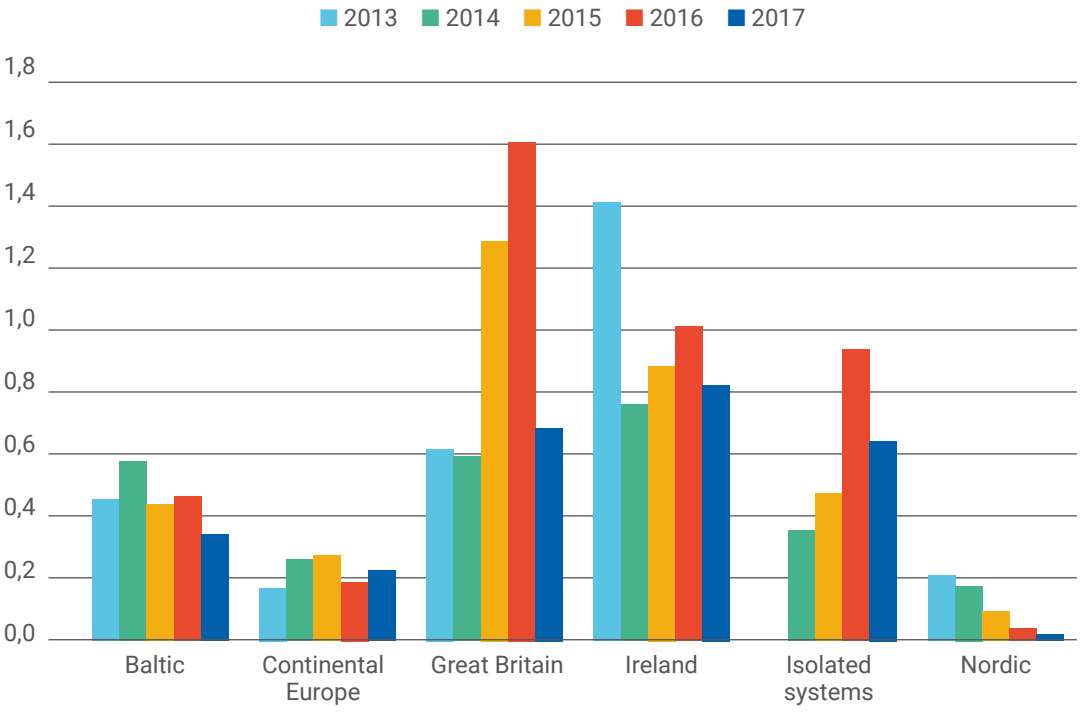


Figure 12. Number of scale 0 incidents with transmission network equipment per 100km of circuit at or above 220 kV

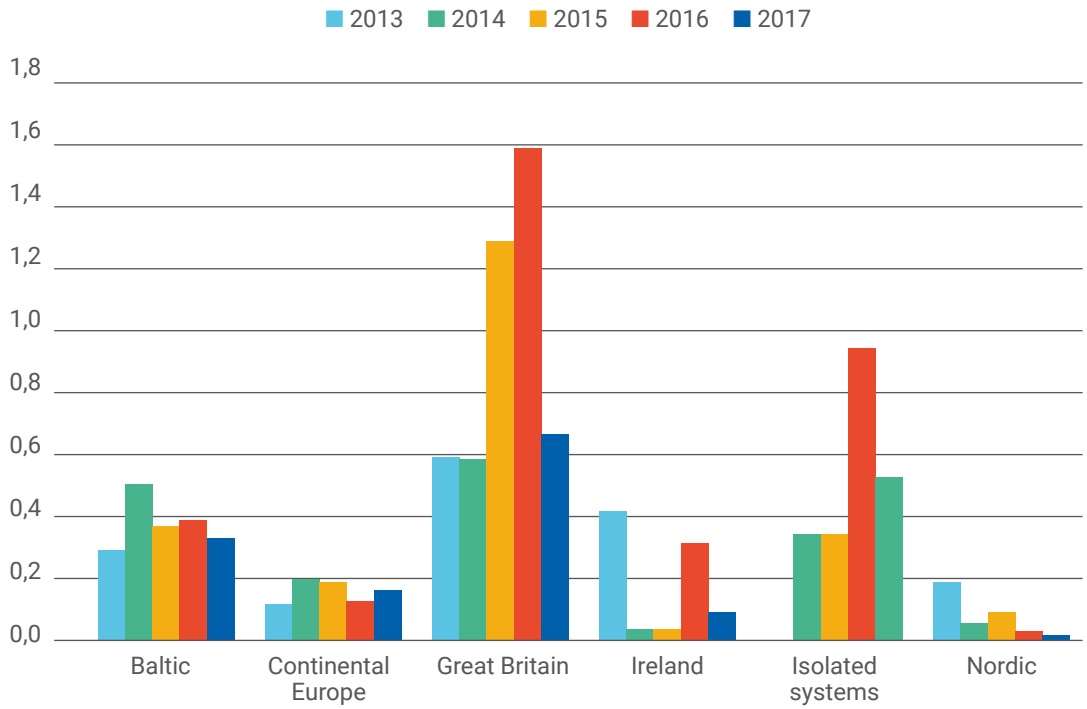


Figure 13. Number of scale 0 incidents per 1 TWh of energy consumption

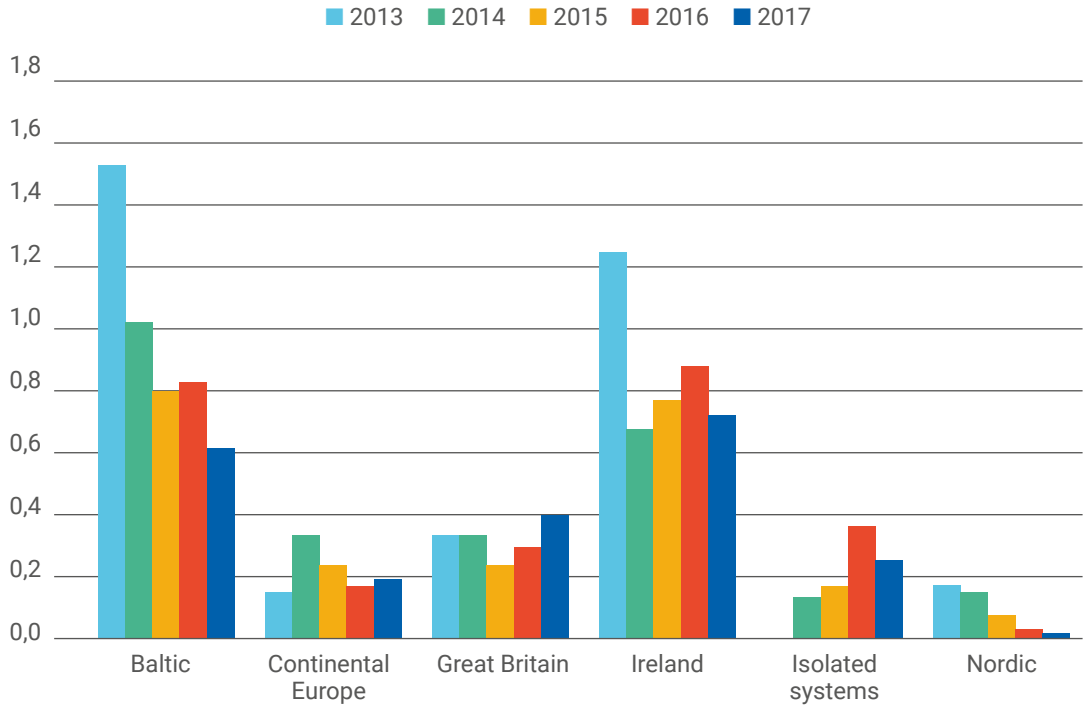


Figure 14. Number of scale 1 incidents per 100km of circuit at or above 220 kV

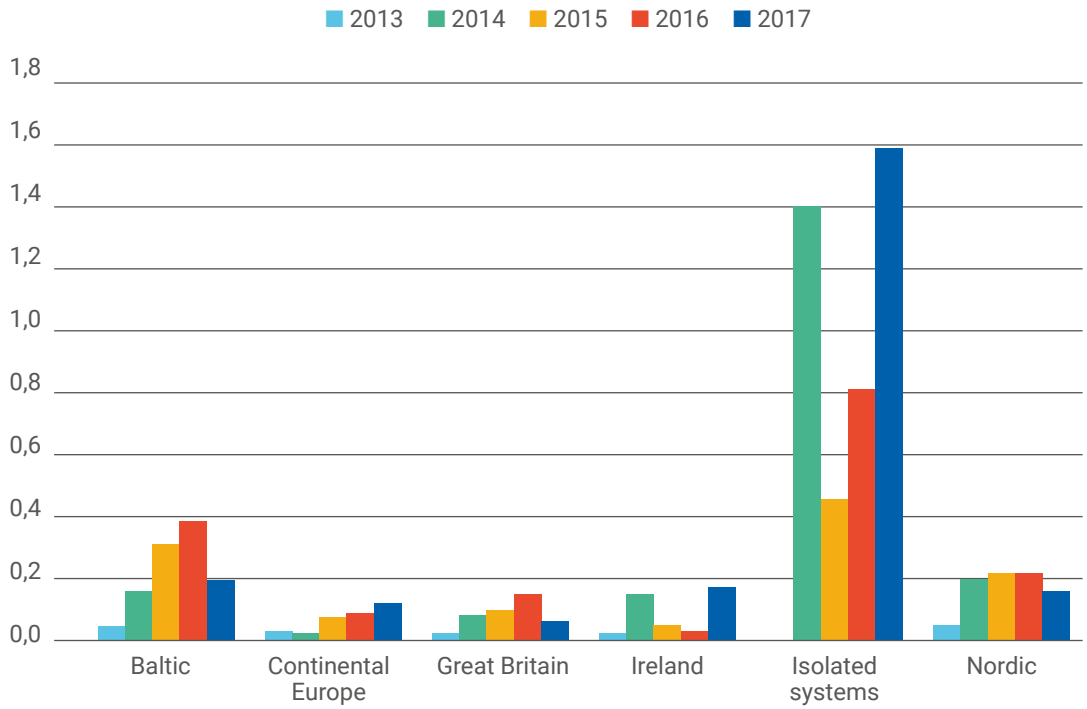


Figure 15. Number of scale 1 incidents with transmission network equipment per 100km of circuit at or above 220 kV

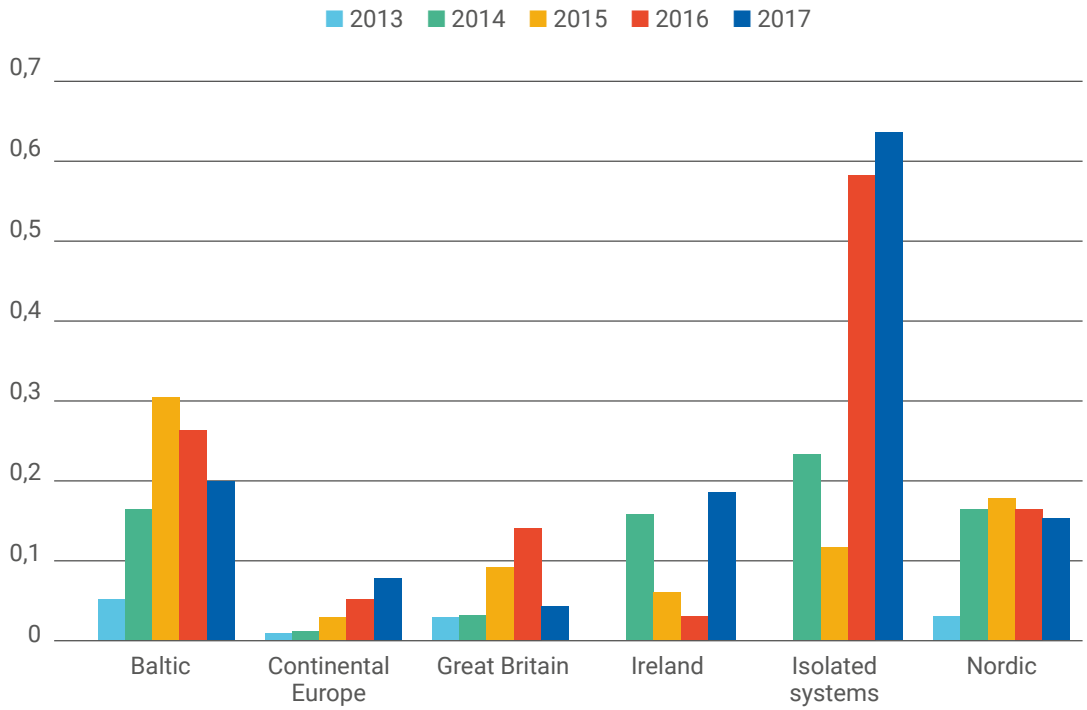
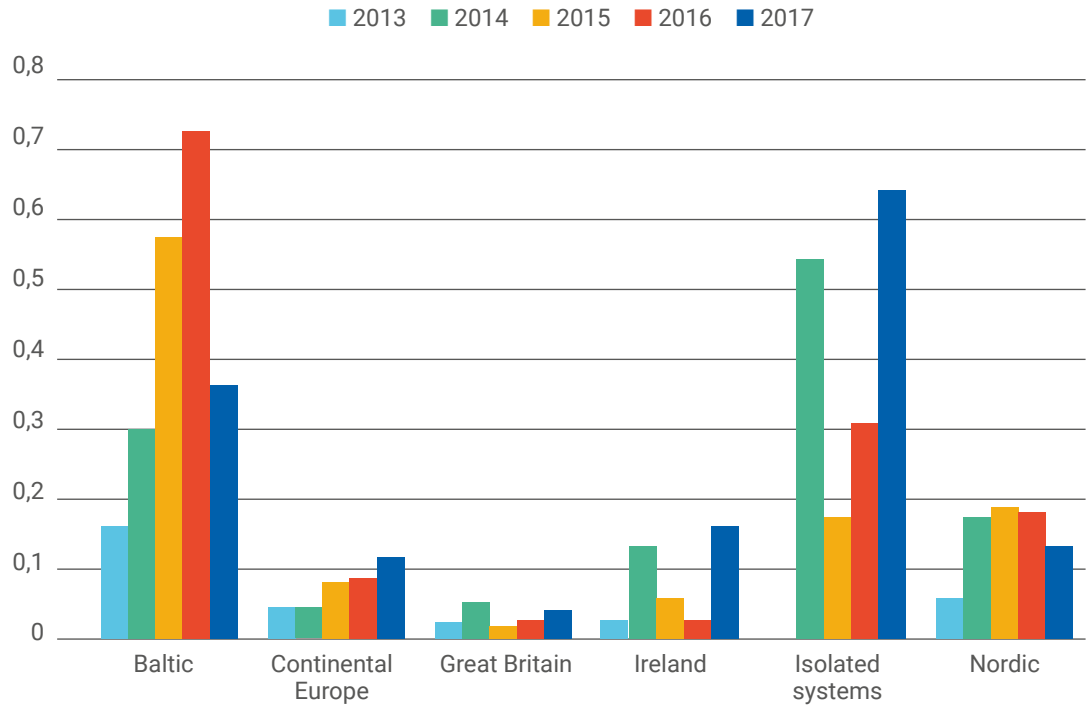


Figure 16. Number of scale 1 incidents per 1 TWh of energy consumption



Due to inherent differences in the way networks have been designed and are operated across different synchronous areas, interpretation of the trend and impact on the system must be done according to specific considerations.

OPERATIONAL SECURITY INDICATORS

The operational security indicators relevant for operational security are the following:

- OS-A: number of tripped transmission system elements per year; it is calculated by adding up all transmission network elements tripped in any incident of scale 1, 2 or 3.

- OS-B: number of tripped power generation facilities per year; it is calculated by adding up all power generation facilities tripped in any incident of scale 1, 2 or 3 with dominating or subsidiary criterion G1 or G2.

- OS-C: energy not supplied per year due to unscheduled disconnection of demand facilities; it is calculated by adding up all energy not supplied in any incident of scale 1, 2 or 3 with dominating or subsidiary criterion L1 or L2.

- OS-D: time duration of being in operational states other than normal; it is calculated by adding up all of the time that a TSO has declared to have been in alert, emergency, blackout, or restoration states. If two or more transmission system operators have been in an operational state other than normal at the same time, the time is considered separately for each TSO.

- OS-E: time duration within which a lack of reserves was identified; it is calculated by adding up all of the time in which a lack of reserves was identified in any incident of scale 1, 2 or 3 with dominating or subsidiary criterion OR1.

- OS-F: the number of voltage deviations exceeding the voltage thresholds for the normal state; it is calculated by adding up the number of incidents of scale 1, 2 or 3 with dominating or subsidiary criteria OV1.

- OS-G1: number of events within which there was a frequency deviation per synchronous area; it is calculated by adding up all the incidents of scale 1, 2 or 3 with dominating or subsidiary criteria F1 or F2. The incidents are calculated once per synchronous area. In the case where two TSOs have reported frequency deviations at the same time, such an event is counted once.

- OS-G2: time duration within which there was a frequency deviation per synchronous area; it is calculated by adding up all the time with frequency deviations in any incident of scale 1, 2 or 3 with dominating or subsidiary criteria F1 or F2. The incidents are calculated once per synchronous area. In the case where two TSOs have reported frequency deviations at the same time, such an event is counted once.

- OS-H: number of system-split, separations or local blackouts; it is calculated by adding up all the incidents of scale 2 or 3 with dominating or subsidiary criteria RS2.

- OS-I: number of blackouts involving two or more TSOs; it is calculated by adding up all of the incidents with criteria OB3.

The above described operational security indicators for each synchronous area for the year 2017 are shown in table 5.

Table 5. Operational security indicators relevant for the operational security of each synchronous area

	Indicator	Continental Europe	Nordic	Great Britain	Baltic	Ireland	Isolated systems
1	OS-A [Tripped elements]	221	54	9	10	6	29
2	OS-B [Tripped PGF]	0	0	0	0	0	3
3	OS-C [Energy not supplied MWh]	226	487	0	0	0	874
4	OS-D [minutes]	11718	0	3	0	345	101
5	OS-E [minutes]	3233	0	0	0	0	0
6	OS-F [Incidents]	21	0	0	0	0	0
7	OS-G1 [Incidents]	0	0	0	0	0	0
8	OS-G2 [minutes]	0	0	0	0	0	0
9	OS-H [Incidents]	0	0	0	0	0	0
10	OS-I [Blackouts]	0	0	0	0	0	0

The operational security indicators relevant for operational planning and scheduling are the following:

- OPS-1A: the number of events in which an incident contained in the contingency list led to a degradation of system operation conditions; it is calculated by adding up all incidents of scale 1, 2 or 3, with a dominating or subsidiary criteria of the loss of one transmission system element.

- OPS-1B: the number of events in which a degradation of system operation conditions occurred as a result of unexpected discrepancies from demand or generation forecast; it is calculated by adding up all incidents of scale 1, 2 or 3 outside the normal state and with an initial event based on unexpected discrepancies in demand or generation forecast.

- OPS-2A: the number of events in which there was a degradation in system operation conditions due to an out-of-range contingency; it is calculated by adding up all incidents of scale 1, 2 or 3 with any dominating or subsidiary criteria of the loss of more than one transmission system element.

- OPS-2B: the number of events counted by indicator OPS-2A in which a degradation of system operation conditions occurred as a result of unexpected discrepancies in demand or generation forecast; it is calculated by adding up all incidents of scale 1, 2 or 3 with dominating or subsidiary criteria OR1 and the loss of more than one transmission system element.

- OPS-3: the number of events leading to a degradation in system operation conditions due to lack of active power reserves; it is calculated by adding up all incidents with lack of reserves identified in any incident of scale 1, 2 or 3 with dominating or subsidiary criteria OR1.

The above described operational security indicators for each synchronous area for the year 2017 are shown in table 6.

Table 6. Operational security indicators relevant for operational planning and scheduling for each synchronous area

	Indicator	Continental Europe	Nordic	Great Britain	Baltic	Ireland	Isolated systems
1	OPS-1A [Incidents]	189	48	8	10	6	17
2	OPS-1B [Incidents]	9	0	0	0	0	0
3	OPS-2A [Incidents]	11	1	1	0	0	4
4	OPS-2B [Incidents]	0	0	0	0	0	0
5	OPS-3 [Incidents]	12	0	0	0	0	0

EVOLUTION FROM 2013 TO 2017

Figure 17 to Figure 22 show, as far as possible, the non-zero comparisons between the values calculated for 2013, 2014, 2015, 2016 and 2017. The values for 2013 can be considered as the starting point for analysing trends in the following years.

Figure 17. Operational security indicator OS-A

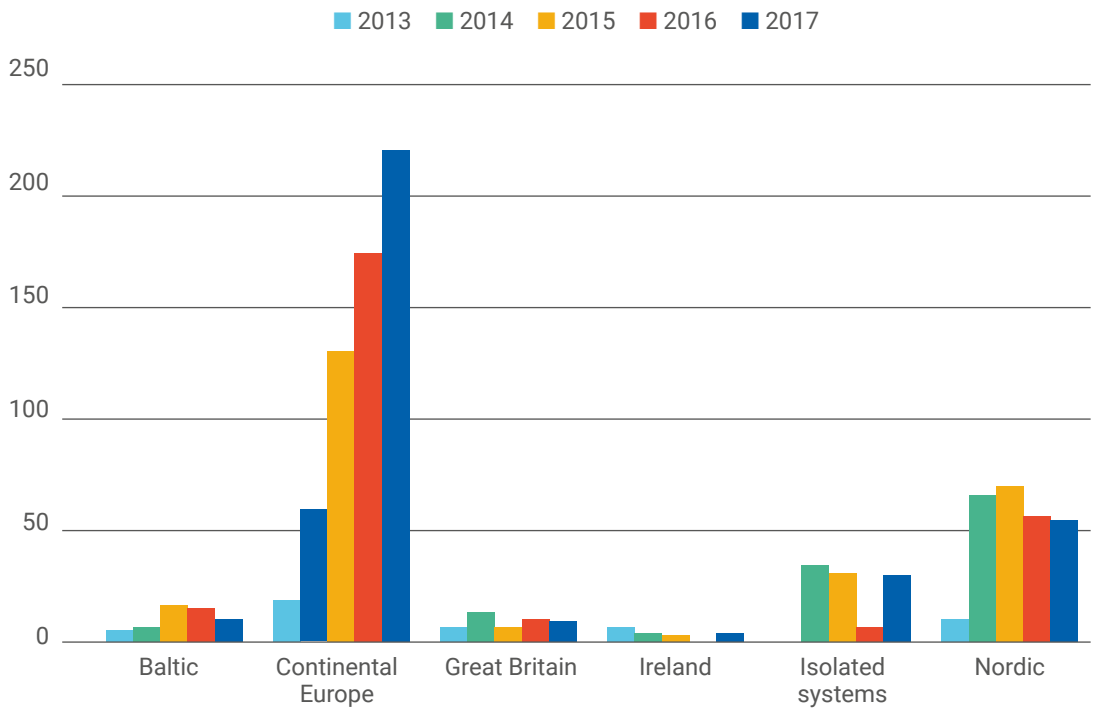


Figure 18. Operational security indicator OS-D

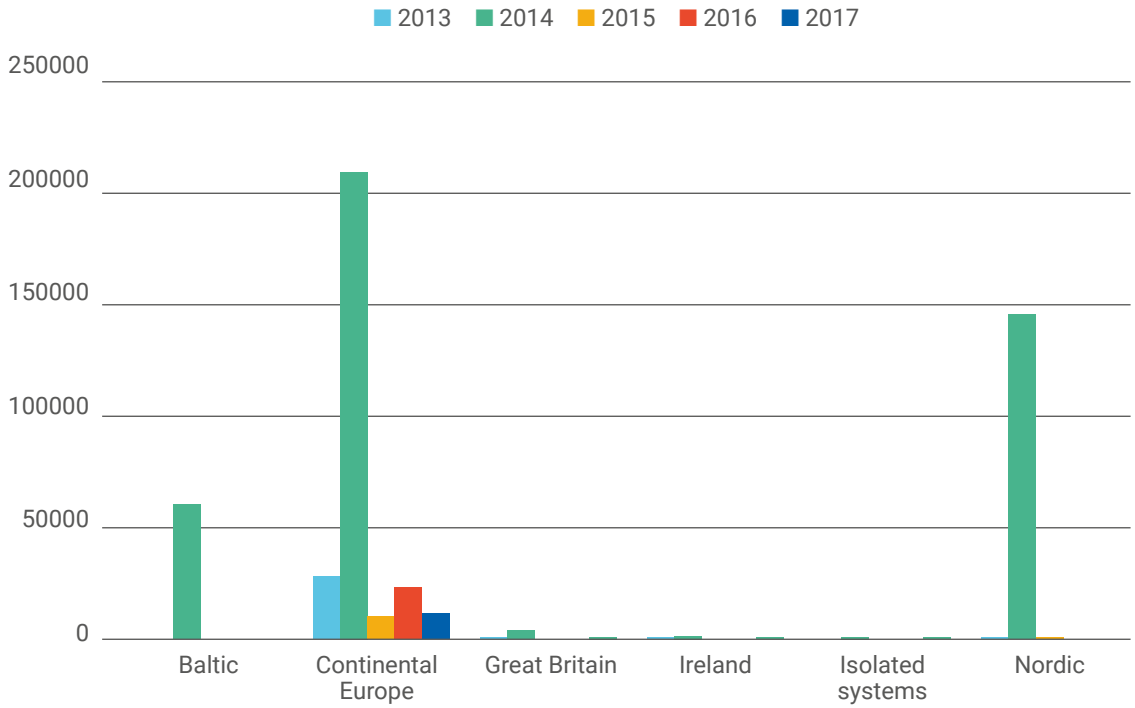


Figure 19. Operational security indicator OS-C

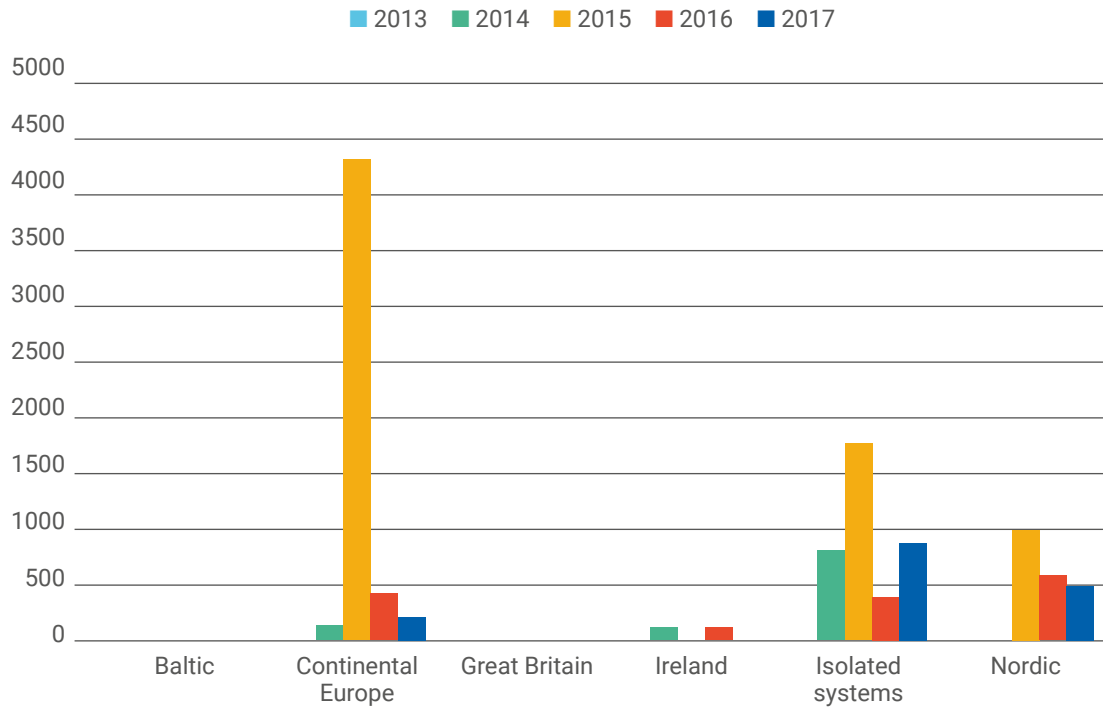


Figure 20. Operational security indicator OPS-1A

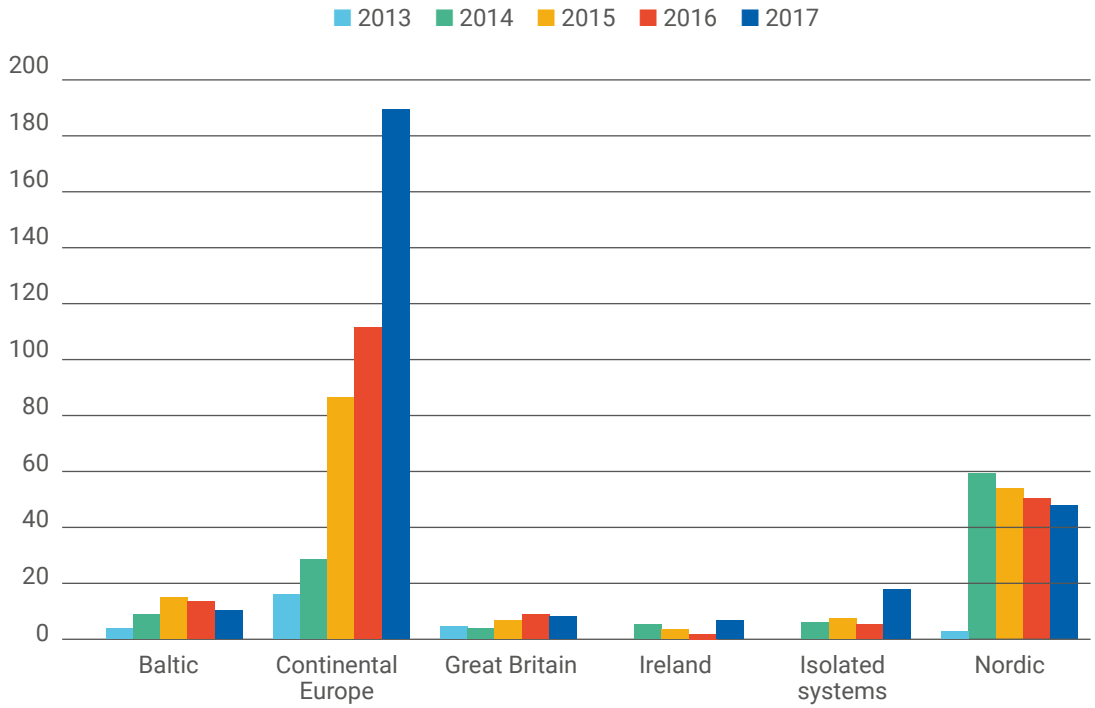


Figure 21. Operational security indicator OPS-2A

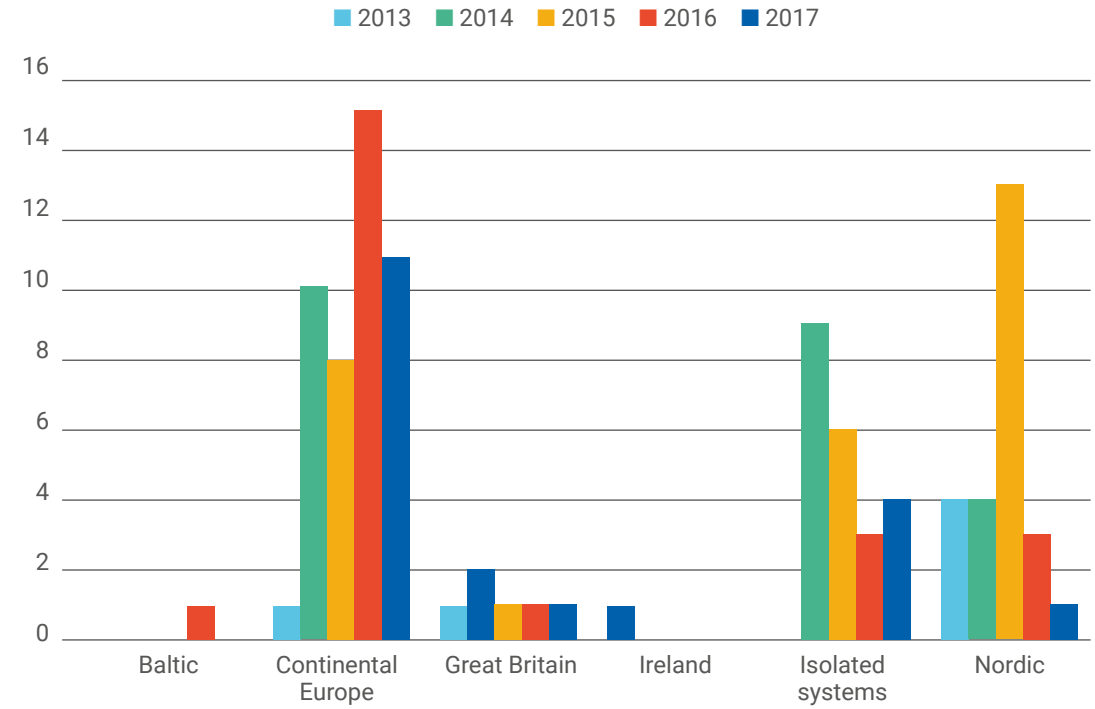
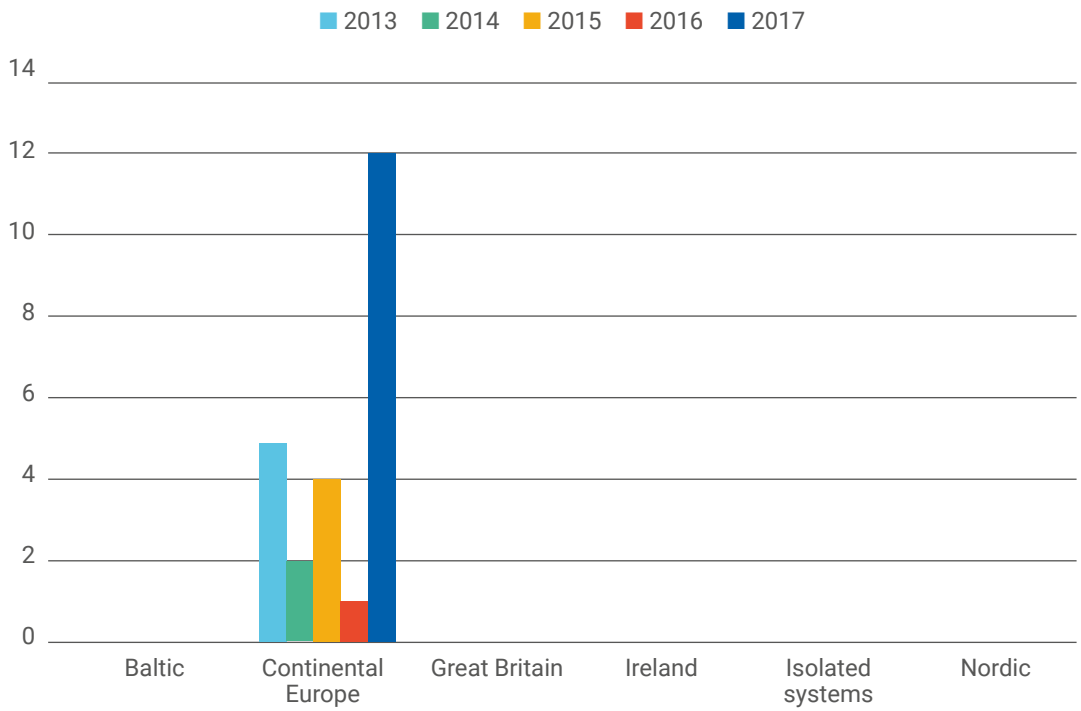


Figure 22. Operational security indicator OPS-3



Figures 17 and 20 show a clear trend in Continental Europe. The grid is more stressed and degradation of system operation conditions increased.

INCIDENTS IN CONTINENTAL EUROPE

SEASONAL ADEQUACY REVIEW FOR THE REGION

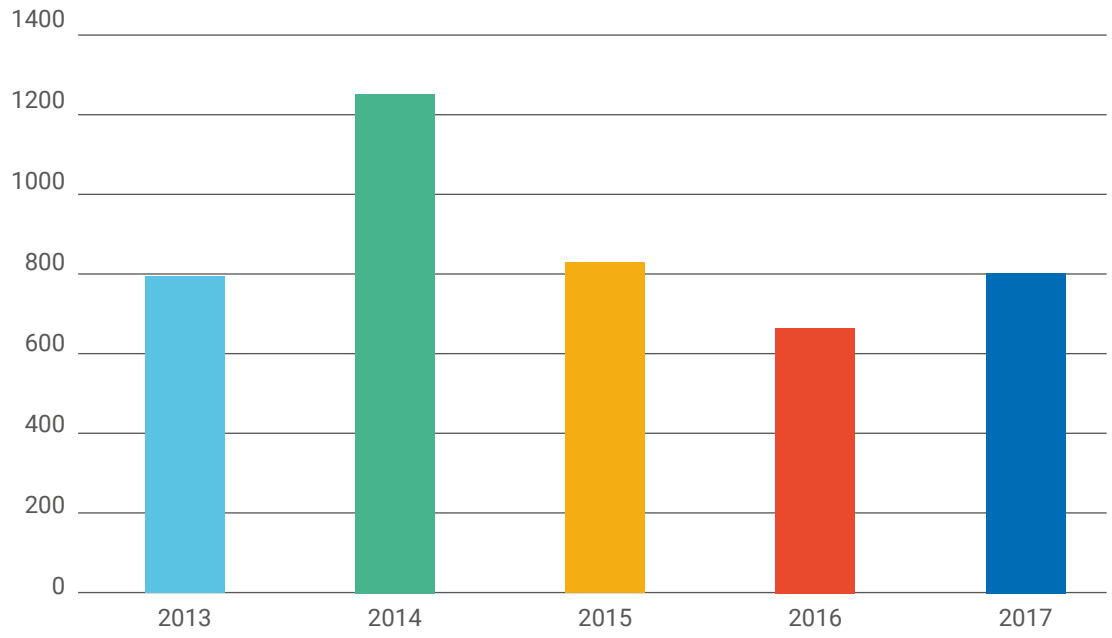
In 2017, the installed capacities of conventional power plants (lignite, hard coal, nuclear and other thermal capacities) decreased, whereas the installed capacity of renewables increased. The installed capacity of renewables cannot replace the equivalent capacity of dispatchable generation: wind or solar produce during certain periods only, which are not always correlated to consumption needs or with network topology in different periods (e.g., N - 1 violation situations caused mainly by unscheduled flows).

Under severe conditions, the demand of several countries increased while generation availability might have been lower due to, for instance, unfavourable meteorological conditions (high temperature during the summer and also in the begining of autumn).

Even under severe conditions, demand was met and reserves were maintained across all of Europe thanks to energy surpluses in most regions and available interconnector capacity, depending on imports, despite incidents on HVAC or HVDC.

REPORTED INCIDENTS 2013 – 2017

Figure 23. Reported incidents 2013 – 2017



INCIDENTS BY DOMINATING CRITERIA

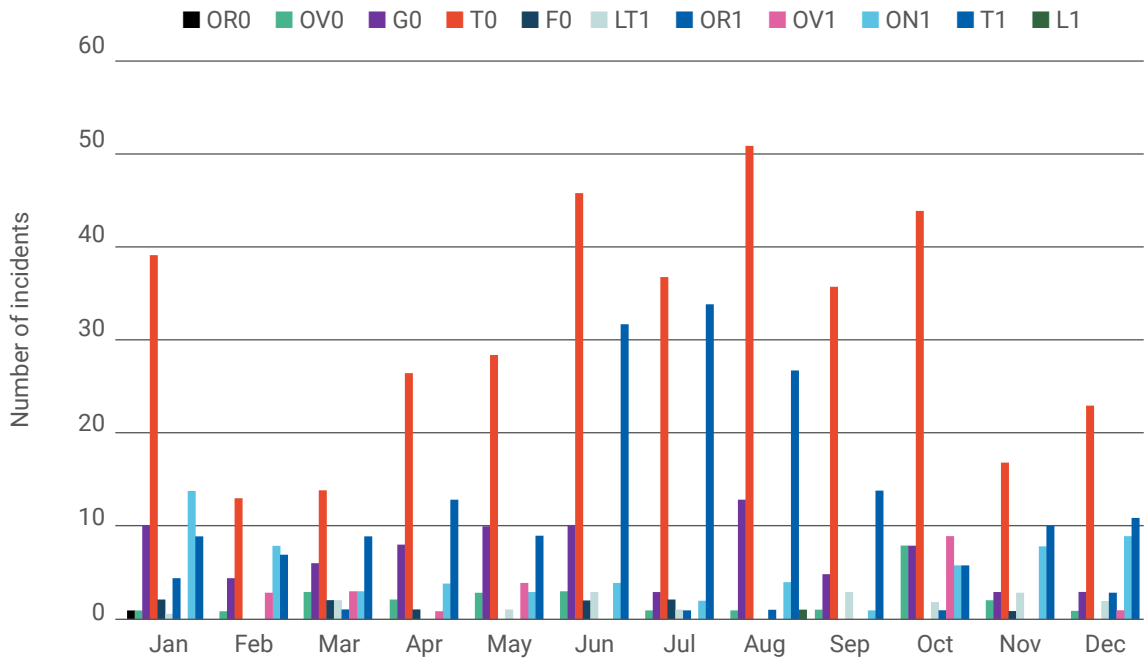
In 2017, 797 incidents were reported in Continental Europe. The reported incidents covered the total quantity of criteria for scale 0 and scale 1 (no incident of Scale 2 and Scale 3).

Table 7.Number of incidents reported for 2017 in Continental Europe

Dominant criteria	Number of
Lack of reserve (OR0)	1
Violation of standards on voltage (OV0)	27
Incidents on power generating facilities (G0)	84
Incidents on transmission network elements (T0)	375
Incidents leading to frequency degradation (F0)	11
Loss of tools and facilities (LT1)	18
Lack of reserve (OR1)	12
Violation of standards on voltage (OV1)	21
N-1 violation (ON1)	66
Incidents on transmission network elements (T1)	181
Incidents on load (L1)	1
Total	797

Disturbances on transmission network elements (T0 and T1) were the most common type of incident. The next largest groups of incidents were disturbances at power generating facilities (G0) and N - 1 violations (ON1).
The number of incidents recorded in 2017 has a uniform distribution across the year, with two exceptions – incidents on transmission network elements (T0 and T1). These showed a significant increase from June to October and also in January due to weather conditions. In all cases, severe weather conditions were the main cause.

Figure 24. Monthly distribution of incidents by dominating criteria in 2017



Legend of criteria

- OR0 Lack of reserve
- OV0 Violation of standards of voltage
- G0 Anomaly on power generating facilities
- T0 Anomaly on transmission network elements
- F0 Incidents leading to frequency degradation
- LT1 Loss of tools and facilities
- OR1 Lack of reserve
- OV1 Violation of standards on voltage
- ON1 N-1 violation
- T1 Noteworhy incidents on transmission network elements
- L1 Incidents on load

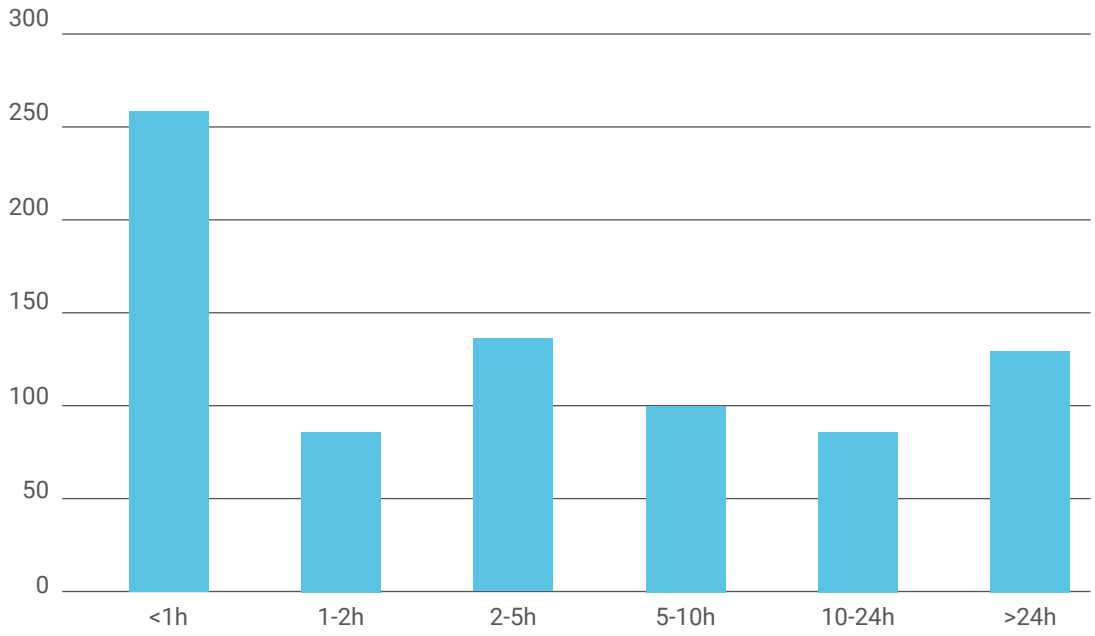
Reported deviations of frequency (F0) were not connected with reported tripping of generators (G0). The biggest violations were reported during changes in the schedules around full hours.

Incidents on transmission network elements (T0 & T1) were mainly due to:

- Weather conditions (strong wind, snowstorms, heat waves). Weather caused 49 T0 incidents and 23 T1 incidents. In January, a snowstorm caused the tripping of 50 elements in Amprion's area.
- Technical issues on grid elements (96 T0 and 18 T1 incidents).
- Environmental issues, such as tree falls, fires, birds. These issues caused 79 T0 and 12 T1 incidents. Among them, 23 were due to large fires in REN's area.

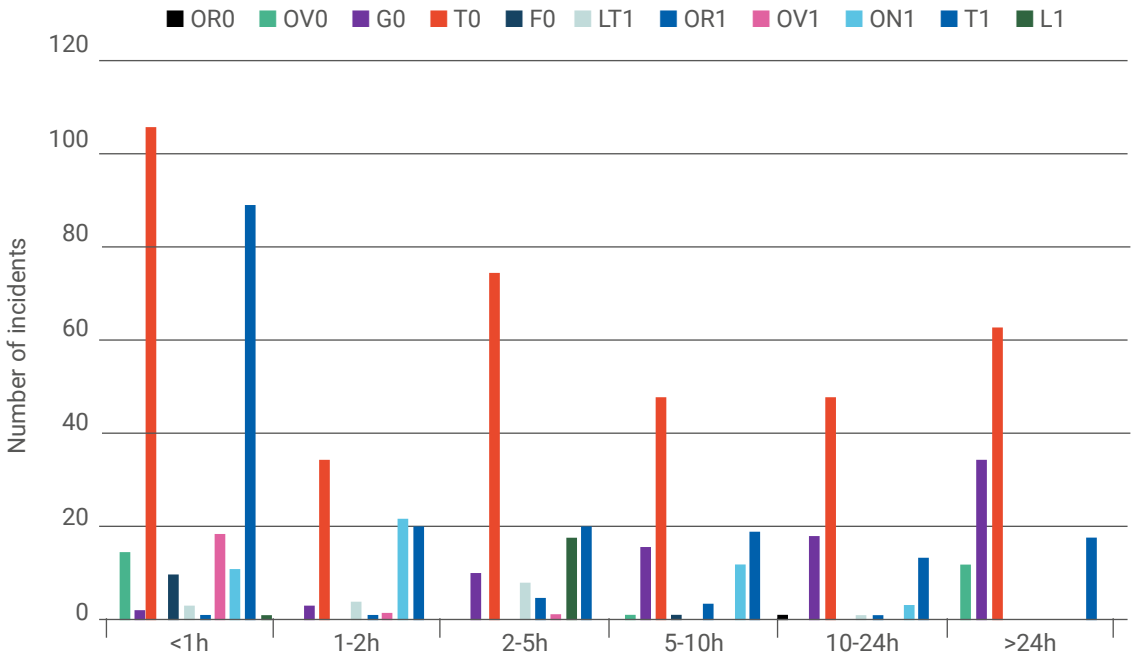
The number of incidents involving lack of reserve (OR1) increased in January and December.

Figure 25. Duration of incidents



The analysis of the distribution of incidents on the basis of duration shows the significant share of incidents with durations <1h. Other categories with duration >1h are comparable. The shares are in the range between 11 % and 17 %. G0 is also included; however, it is not the transmission element / responsibility of TSOs.

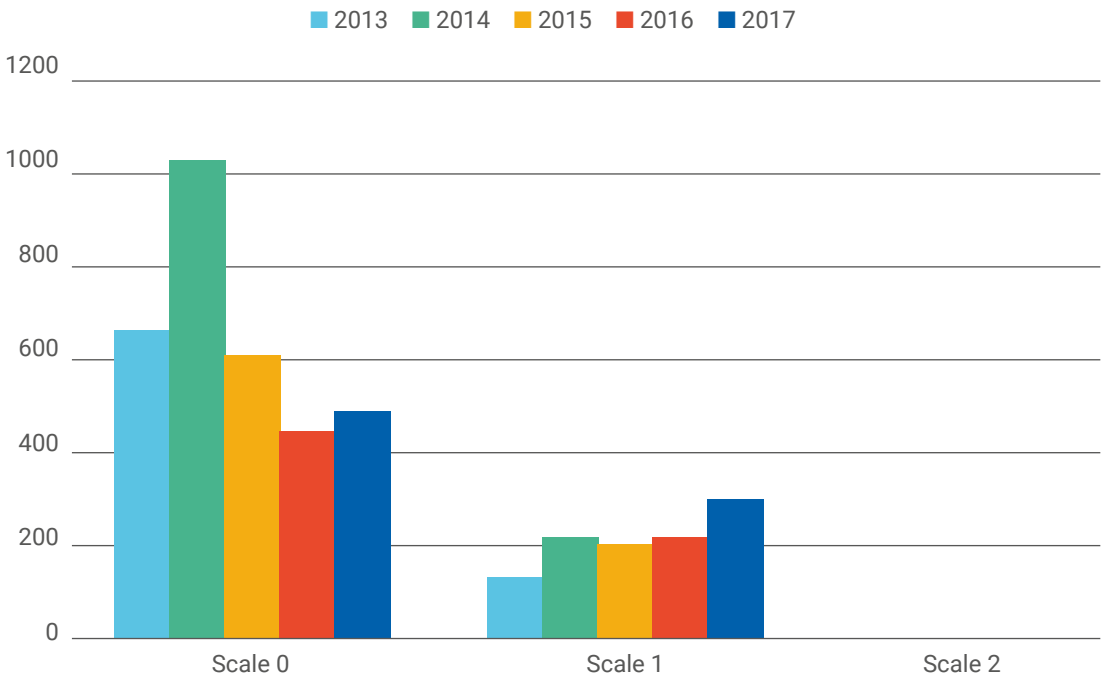
Figure 26. Duration of incidents by dominating criteria



Across Continental Europe, 80 % of incidents, regardless of criterion, were resolved in less than 24 hours. Repairs or replacement of transmission elements, after final tripping, lasted more than 24h.

INCIDENTS BY SCALE

Figure 27. Incidents by scale 2013 - 2017



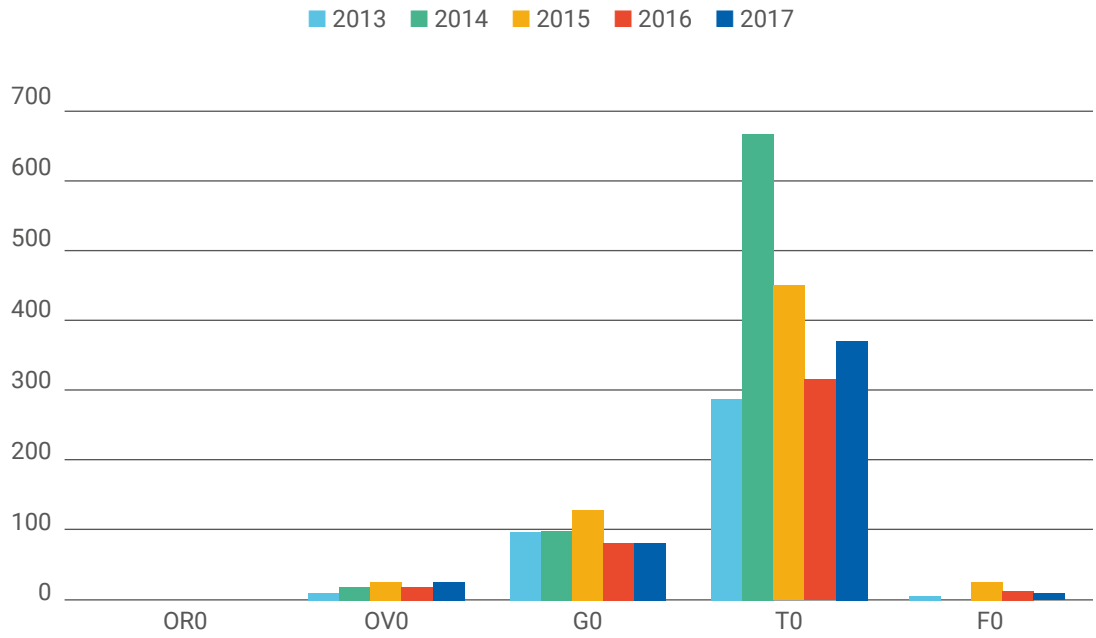
Scale 0 incidents reported in 2017 increased in comparison with 2016, but the number of incidents was still lower than in other analysed years.

Scale 1 incidents reported in 2017 increased in comparison with previous years, mainly due to outages of HVDCs and tie-lines.

No Scale 2 or Scale 3 incidents were reported in 2017.

SCALE 0 INCIDENTS

Figure 28. Scale 0 incidents by dominating criteria 2013 - 2017



Incidents on transmission network elements (T0) are the most significant category in scale 0 with 374 incidents reported, followed by Incidents on power generating facilities (G0) with 84 incidents and violations of standards of voltage (OV0) with 27 incidents in 2017.

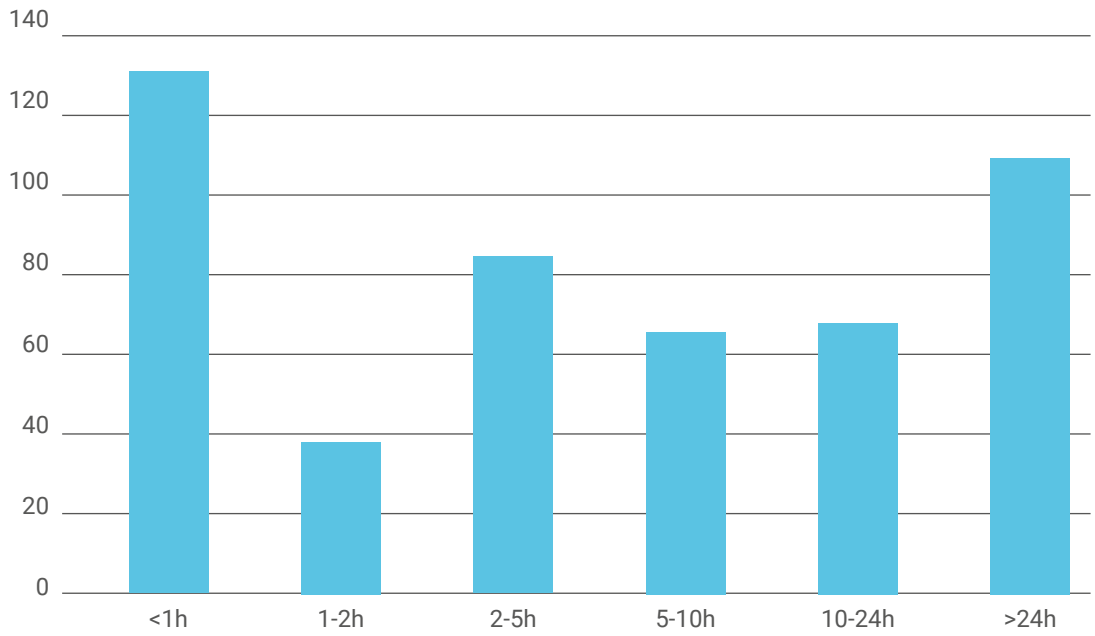
The numbers of reported incidents of scale 0 remained stable with the exception of OV0, which increased slightly. The increase was probably caused by the gradual implementation of the System Operations Guideline in some TSOs.

There were 374 incidents reported for transmission network elements (T0) in 2017, of which 6 cases (3 cases from Transelectrica) also involved load disconnections ranging from 15 to 198 MW, and 7 cases (mainly PSE) also involved generation disconnections ranging from from 39 to 750 MW.

Furthermore, 84 Incidents on power generating facilities (G0) were reported by 10 TSOs in 2017, of which 32 cases were reported by RTE, with an average generation disconnection of 907 MW.
Finally, 27 violations of standards of voltage (OV0) were reported in 2017, mainly by 2 TSOs (TenneT NL and EMS - 23 incidents in total).

The nominal voltage in the Extra High Voltage grid in the Netherlands is 380 kV, and the neighbouring grids have a nominal voltage of 400 kV. Therefore the Extra High Voltage grid in the Netherlands has a bias at the borders. The exceedances are mainly observed at Eemshaven, north of the Netherlands. The voltage violations are registered with a system separate from the SCADA EMS. An investigation is ongoing, targeted at calibrating and aligning both systems. In addition, there is a trend in more reactive power infeed from the lower- voltage grids, which increases the voltage level, in general.

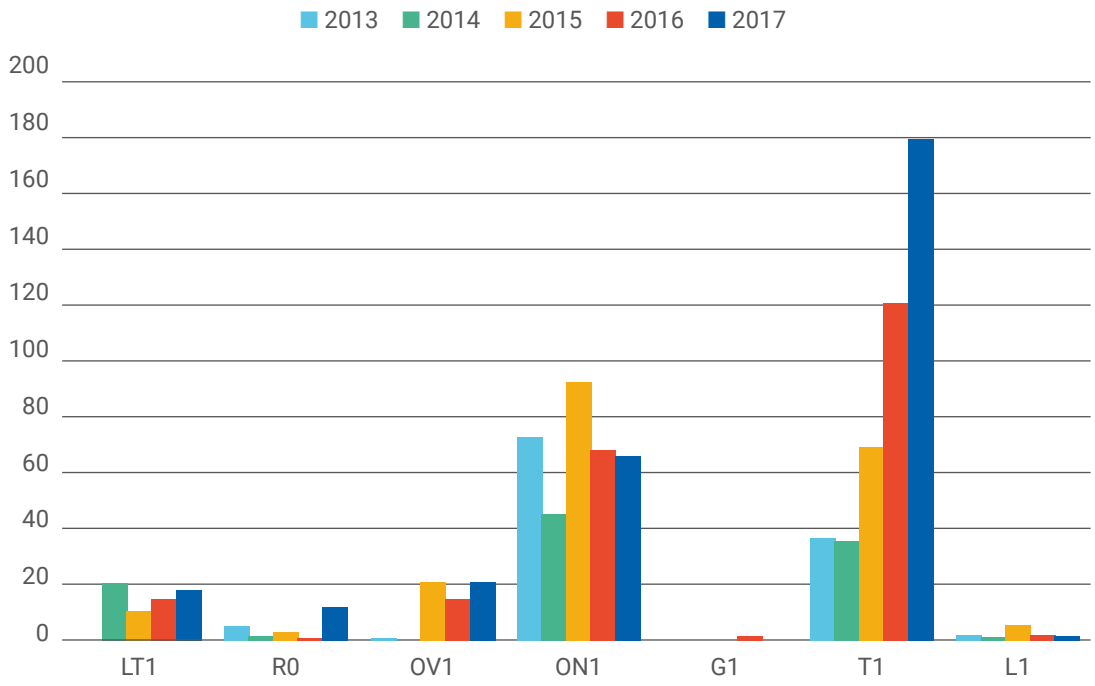
Figure 29. Duration of scale 0 incidents



The number of scale 0 incidents of duration of less than 1 h and more than 24 h are almost equal and together make up almost 50 % of the total number. There is a fairly uniform distribution of scale 0 incidents with durations 1-2 h, 2-5 h, 5-10 h, and10-24 h.

SCALE 1 INCIDENTS

Figure 30. Scale 1 incidents by dominating criteria 2013 – 2017

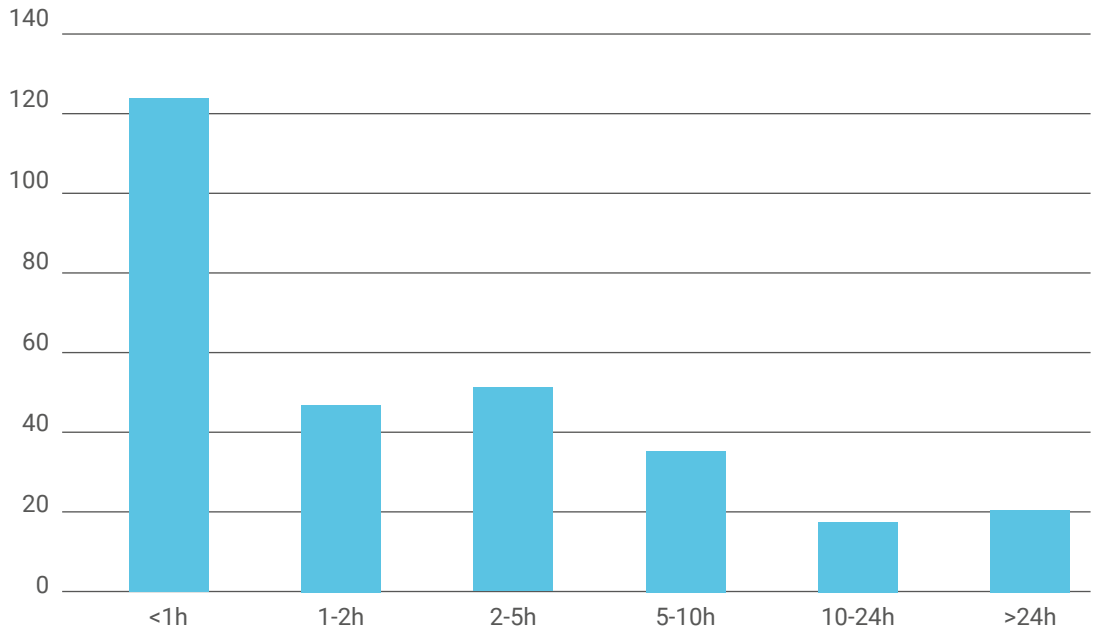


We are observing increases in incidents involving network elements (T1) and instances of lack of reserve (OR1) since 2013. At the same time, instances of loss of tools and facilities (LT1), violation of voltage standards (OV1) and violations of N-1 criteria (ON1) are almost at the same levels.

There were 181 Incidents on transmission network elements (T1), mainly HVDCs and HVACs, reported in 2017. In 10 cases (mainly HVDCs in RTE and REE), this type of incident was linked with a generation disconnection of about 600 MW. Generation disconnection cases were reported mostly in May and June 2017.

Finally, 21 Violations of standards of voltage (OV1) were reported in 2017, mainly by TenneT NL (19 incidents in total).

Figure 31. Duration of scale 1 incidents



Scale 1 incidents with short time durations predominated in 2017.

The majority of scale 1 incidents had a duration of < 1h.

N - 1 VIOLATIONS

There were 66 N-1 violations reported by 10 TSOs in 2017, mainly Central European TSOs. These are the same TSOs which reported incidents in the previous year. The total number reported is approximately equal to that of 2016, when 68 incidents were reported. Similar to previous years, unexpected/unscheduled flows were the main cause of N - 1 violations (73 %). “Other” causes represent 7 % of all reported incidents, while “Unknown” causes represent 21 % of all N – 1 violation. The majority of N – 1 violation causes had no impact on other TSOs.

Unexpected flows 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. As a consequence, 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, redispatching of power sources and measures to change network configurations.

Table 7. N-1 Violation overview

No.	TSO with reported N-1 violation incidents N-1	No. of Incidents	Other TSOs Impacted			Outside Normal State	
			No	Yes	Unknown	No	Yes
1	50Hertz	16	0	16	0	15	1
2	Amprion GmbH	9	9	0	0	0	9
3	CEPS	3	3	0	0	0	3
4	ELIA	3	2	1	0	1	2
5	HOPS	11	11	0	0	11	0
6	SEPS	2	0	0	2	0	2
7	Swissgrid AG	3	3	0	0	3	0
8	TenneT TSO B.V.	1	1	0	0	1	0
9	TenneT TSO GmbH	13	6	7	0	1	12
10	TransnetBW GmbH	5	5	0	0	1	4
Total		66	40	24	2	33	33

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. Harmonisation is also necessary in this field.

Figure 32. N - 1 violations reported in 2017 across Continental Europe

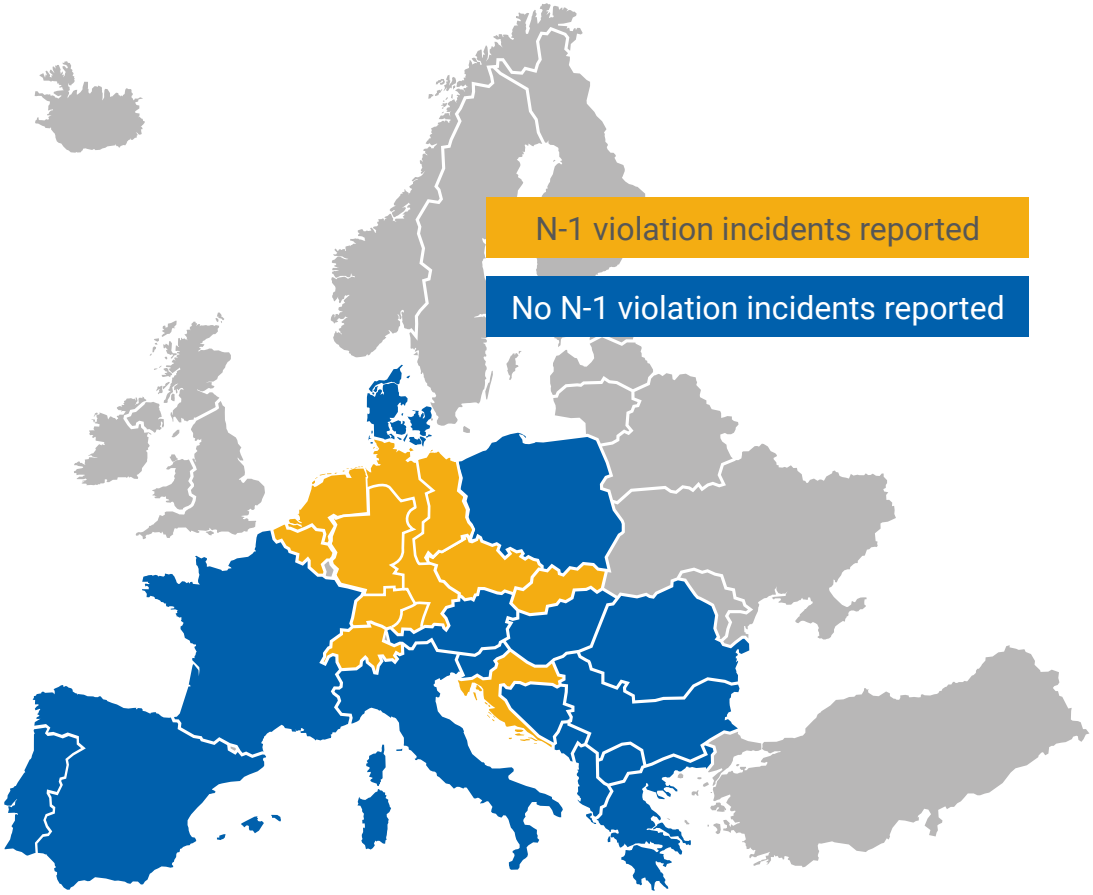


Figure 33. Duration of N - 1 violations 2017

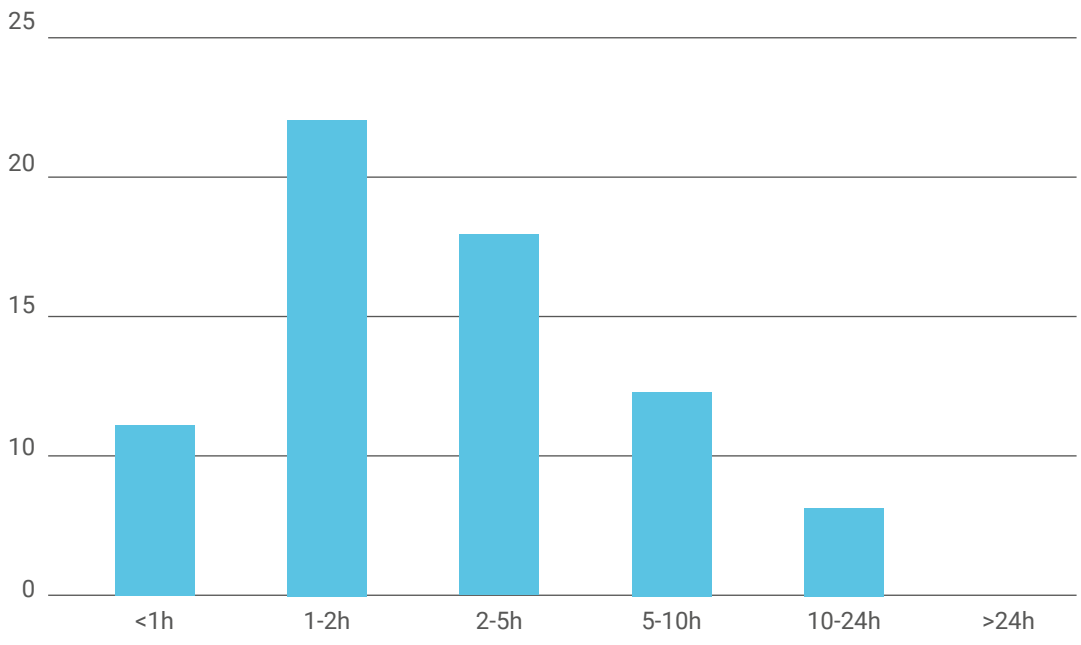


Figure 34. Causes of N - 1 violations 2017

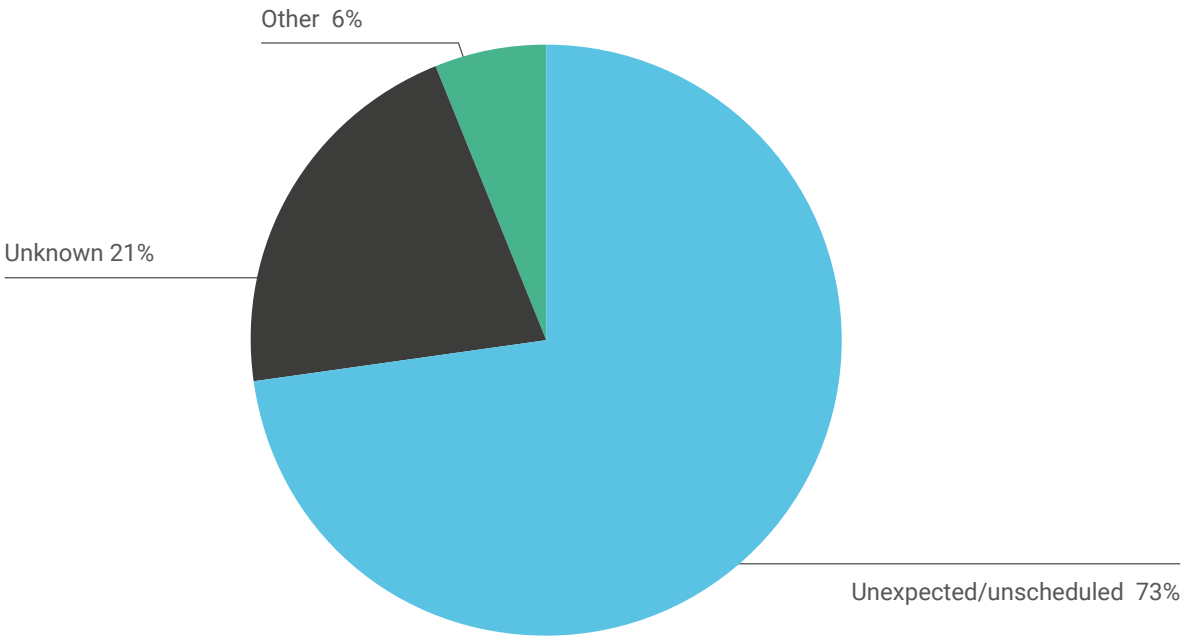


Figure 35. N - 1 violations 2013 – 2017

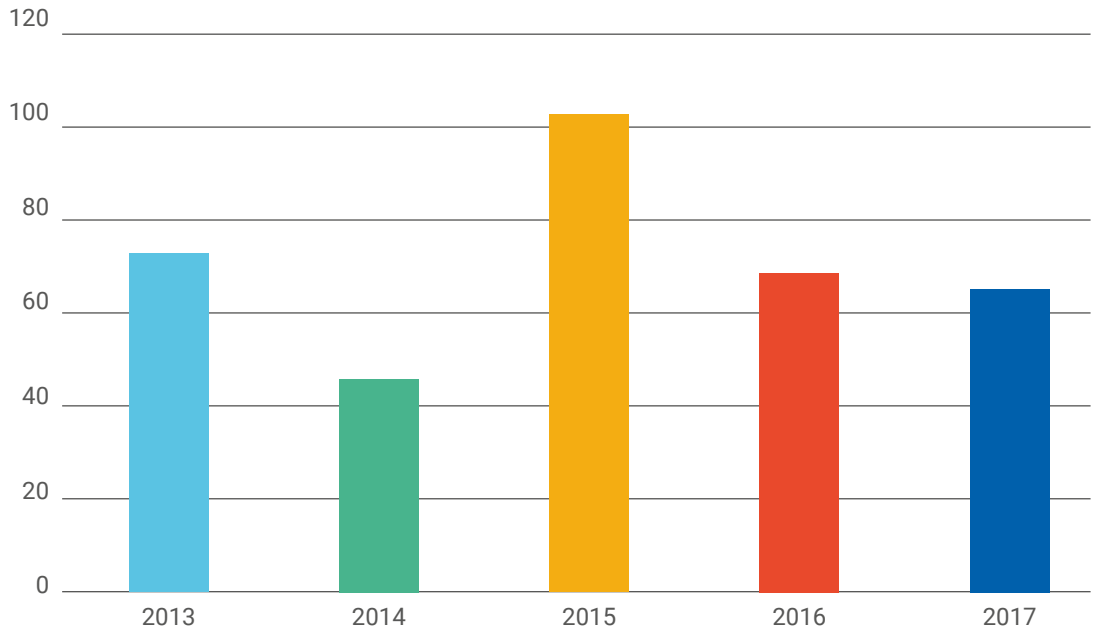
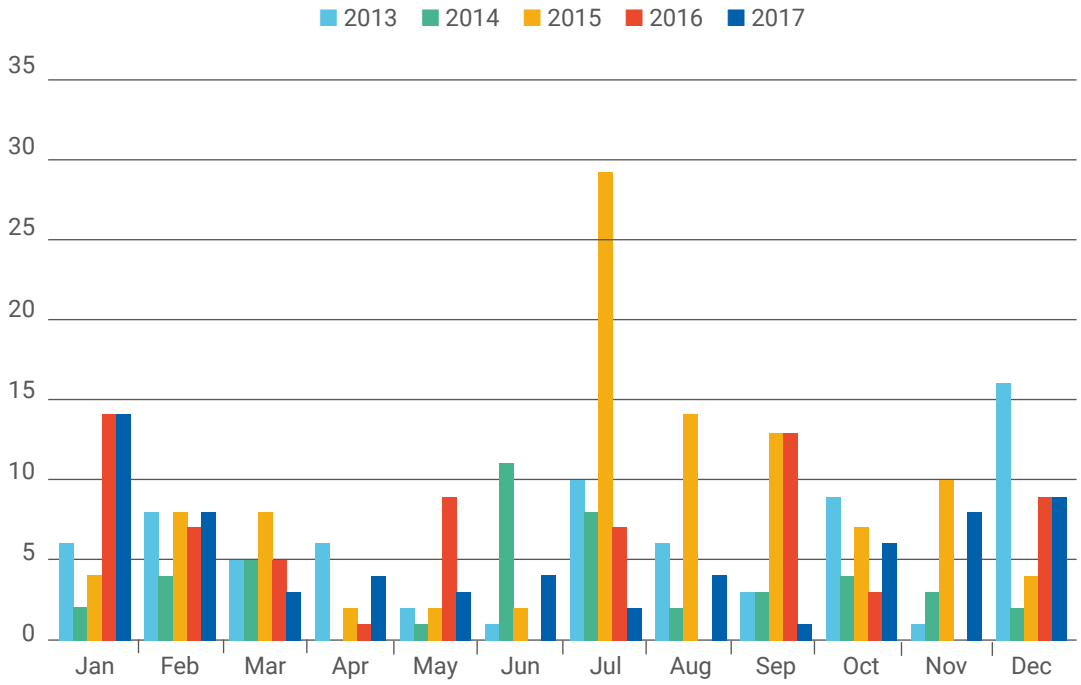
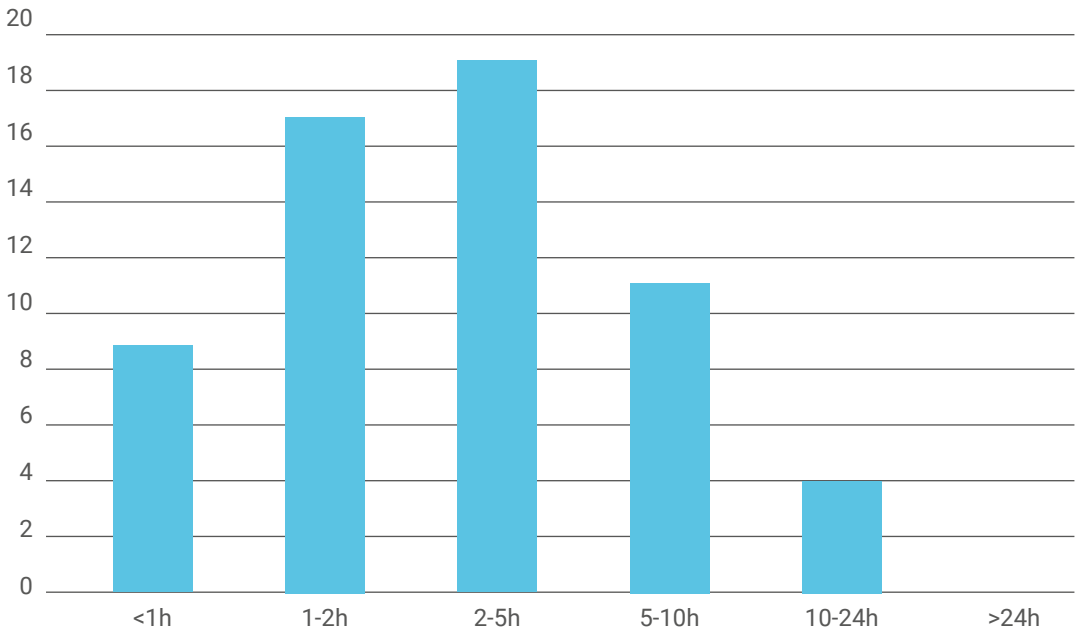


Figure 36. Monthly occurrences of reported N - 1 violations – from 2013- 2017



Almost the half of the incidents in 2017 were reported in the winter period: January, February and November, December.

Figure 37. Time outside the normal state in 2017



The majority of excursions outside the normal state were resolved in 1 to 5 hours (60 % of cases).

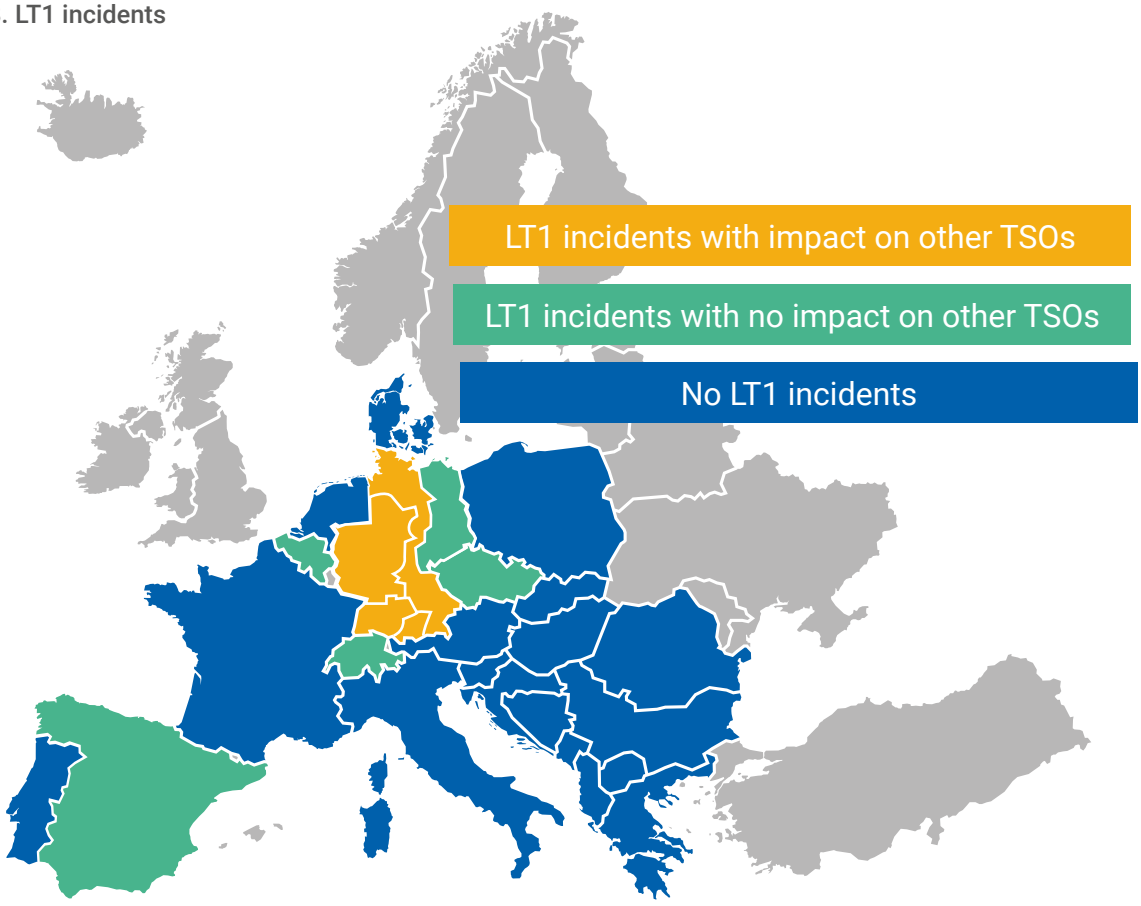
LOSS OF TOOLS OR FACILITIES

There were several cases reported by TSOs in which they lost, in real time, tools or facilities.

Table 8. Loss of tools incidents

No.	TSO with reported Loss of Tools	No. of Incidents	Other TSOs Impacted			Outside Normal State	
			No	Yes	Number of impacted TSO	No	Yes
1	50Hertz	1	1	0	0	1	
2	Amprion GmbH	4	3	1	4		4
3	CEPS	3	3	0	0	1	2
4	ELIA	3	3	0	0		3
5	REE	1	1	0	0		1
6	Swissgrid AG	1	1	0	0	1	
7	TenneT TSO GmbH	3	2	1	4		3
8	TransnetBW GmbH	2	1	1	4	1	1
Total		18	15	3		4	14

Figure 38. LT1 incidents



ANALYSIS OF SIGNIFICANT CHANGES IN TRENDS

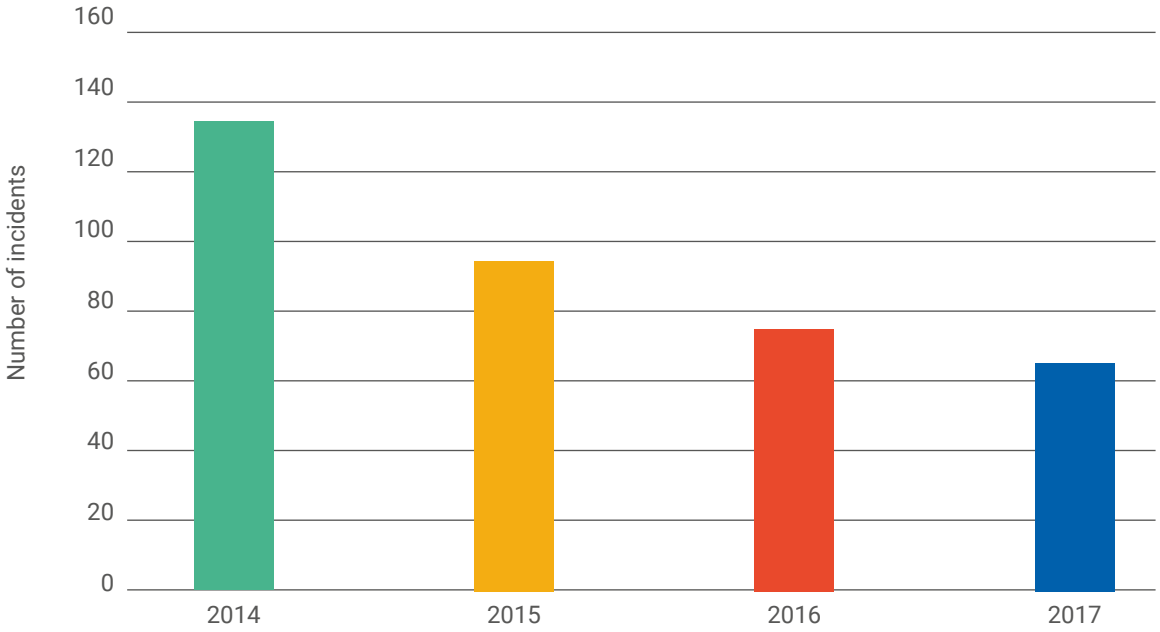
In 2017, a total of 797 incidents were reported on Continental Europe, which is an increase in comparison with 2016, when 664 incidents were reported. Dominant incidents were: Incidents on transmission network elements (T0 and T1), Incidents on power generating facilities (G0) and N - 1 violations (ON1). The number of scale 0 and scale 1 incidents increased during 2017.

The number of instances of lack of reserve (OR1) and incidents on transmission elements (T1) increased significantly. For the other type of incidents, there were no significant changes in comparison with previous years. However, there is no noteworthy decrease in other types of incidents.

INCIDENTS IN THE NORDIC AREA

REPORTED INCIDENTS 2014 - 2017

Figure 39. Reported incidents 2014 – 2017



2017 was a year with no extremes: normal weather conditions, normal electric flows and normal filling grade in the water reservoirs. These conditions resulted in the lowest number of reported incidents since the reporting started for the Nordic synchronous area. The high number of incidents in 2014 was due to 43 scale 0 violation of standards on voltage in Denmark and happened during HVDC ramping. They were a consequence of low load and low overnight reactive power demand in Denmark.

INCIDENTS BY DOMINATING CRITERIA 2017

The Nordic Area reported 66 incidents in 2017. There were 40 scale 0 incidents and 26 scale 1 incidents. No incidents of scale 2 or scale 3 were reported.

Table 9. Number of incidents reported in the Nordic Area in 2017

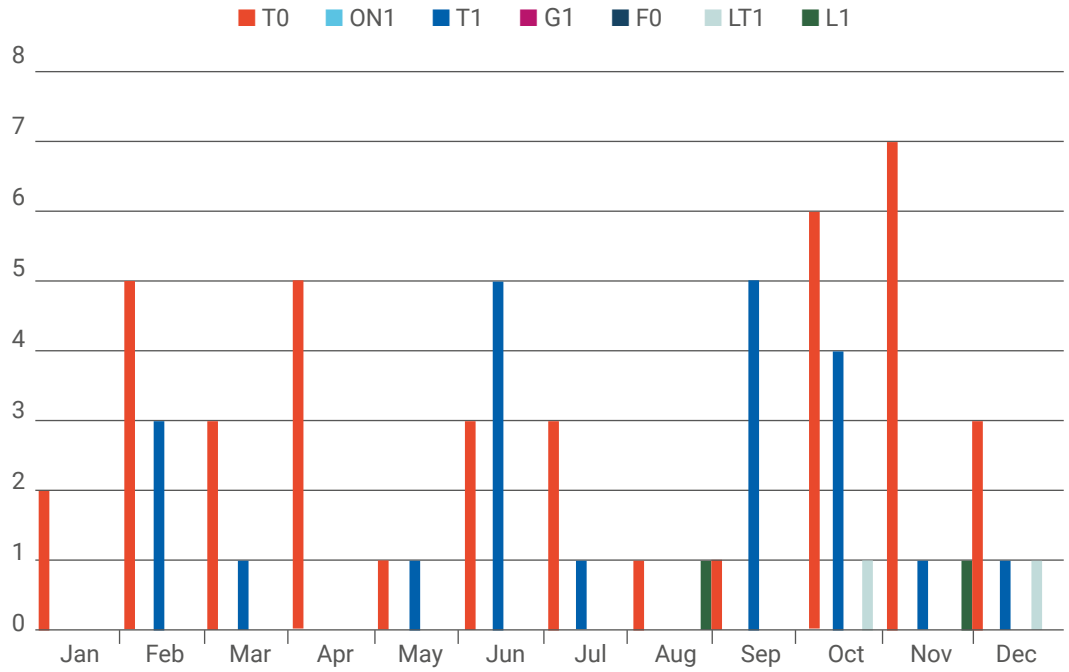
Dominant criteria	Count
Incidents on transmission network elements (T0)	40
Loss of tools and facilities (LT1)	2
N-1 violations (ON1)	0
Incidents on power generating facilities (G1)	0
Incidents on transmission network elements (T1)	22
Incidents on load (L1)	2
Total	66

Disturbances on transmission network elements (T0 and T1) made up the largest segment of the reported incidents.

MONTHLY DISTRIBUTION OF INCIDENTS BY DOMINATING CRITERIA

The monthly distribution is quite even.

Figure 40. Monthly distribution of incidents by dominant criteria in 2017

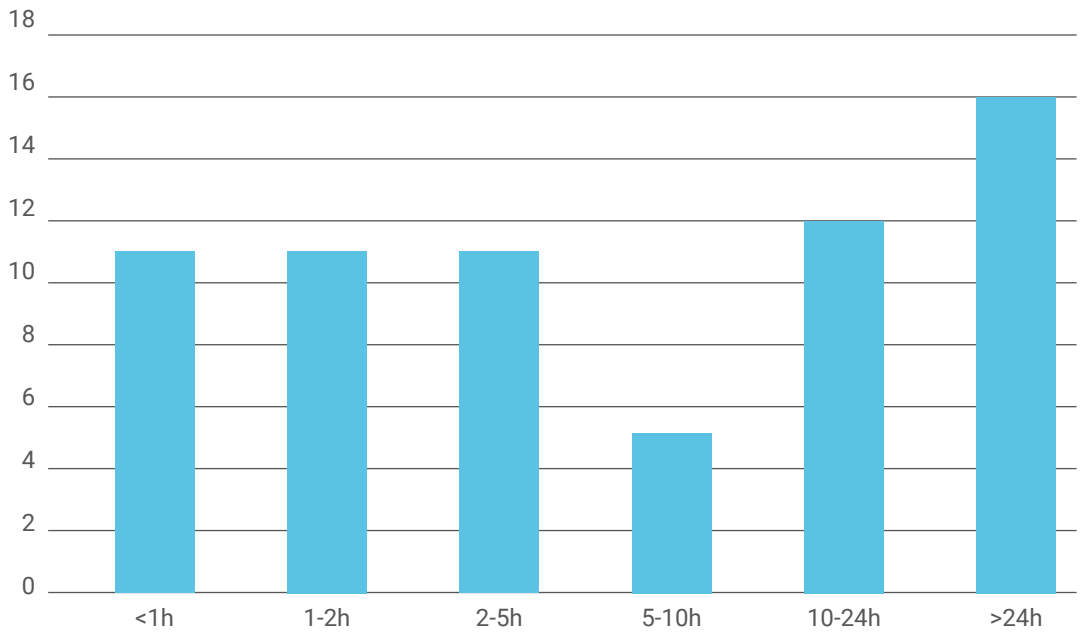


Legend of criteria

- T0 Incidents on transmission network elements
- ON1 N-1 violation
- T1 Incidents on transmission network elements
- G1 Incidents on power generating facilities
- LT1 Loss of tools and facilities
- L1 Incidents on load (L1)

DURATION OF INCIDENTS 2017

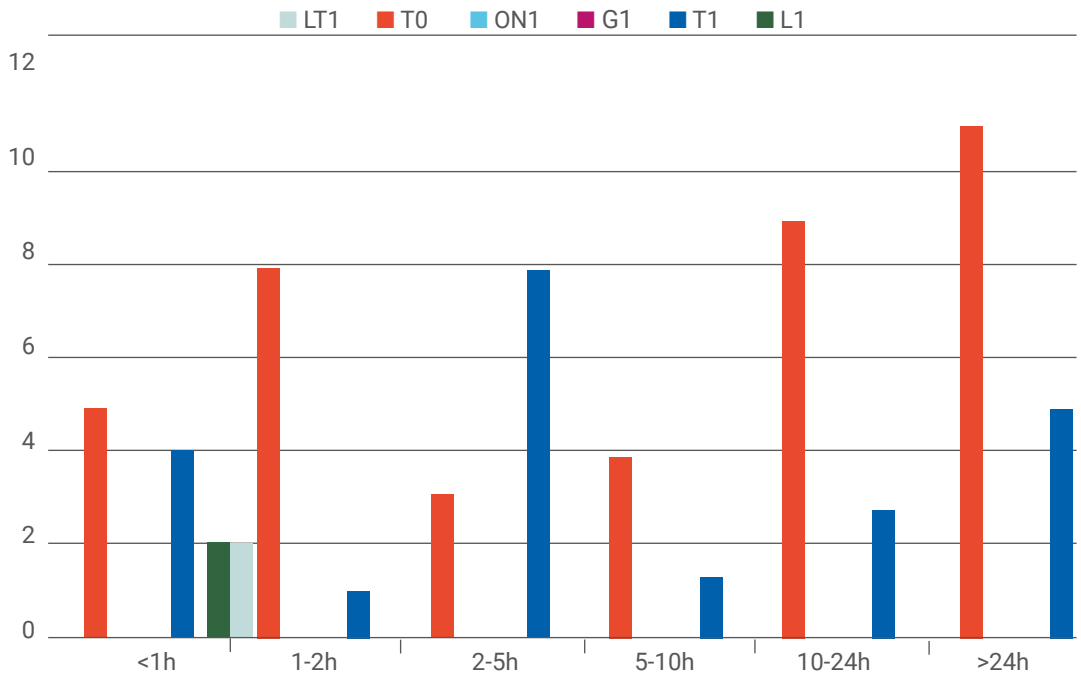
Figure 41. Duration of incidents 2017



Overall, 51 % of the incidents were of short duration, i.e., <5 h in length.

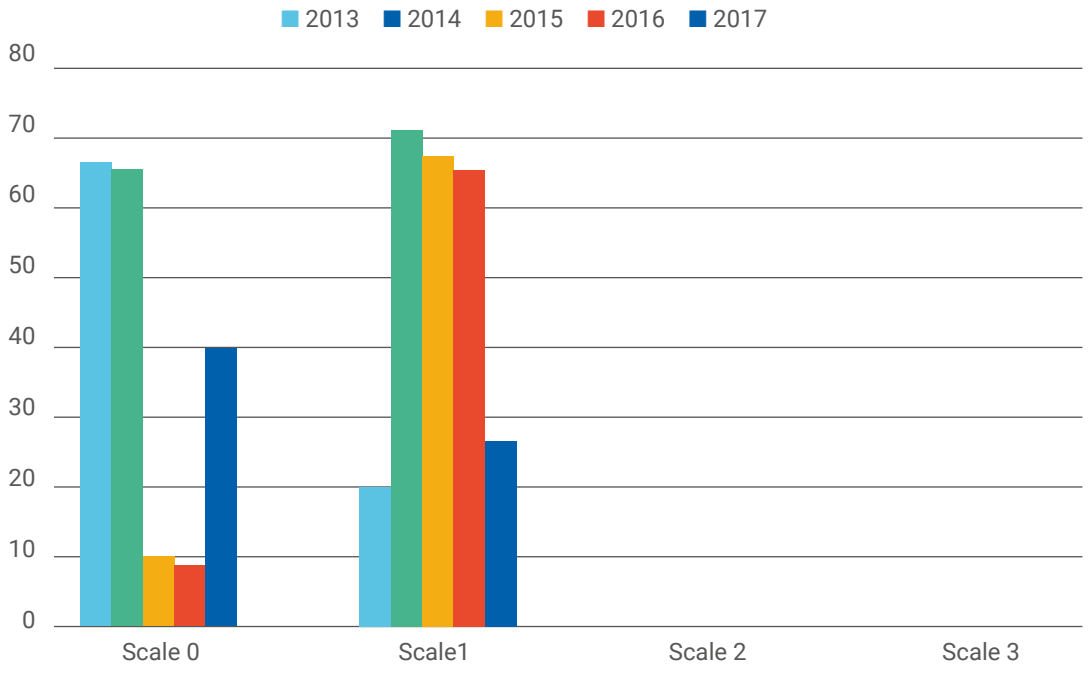
DURATION OF INCIDENTS BY DOMINATING CRITERIA

Figure 42. Duration of incidents by dominating criteria 2017



INCIDENTS BY SCALE 2013 - 2017

Figure 43. Incidents by scale 2014 - 2017

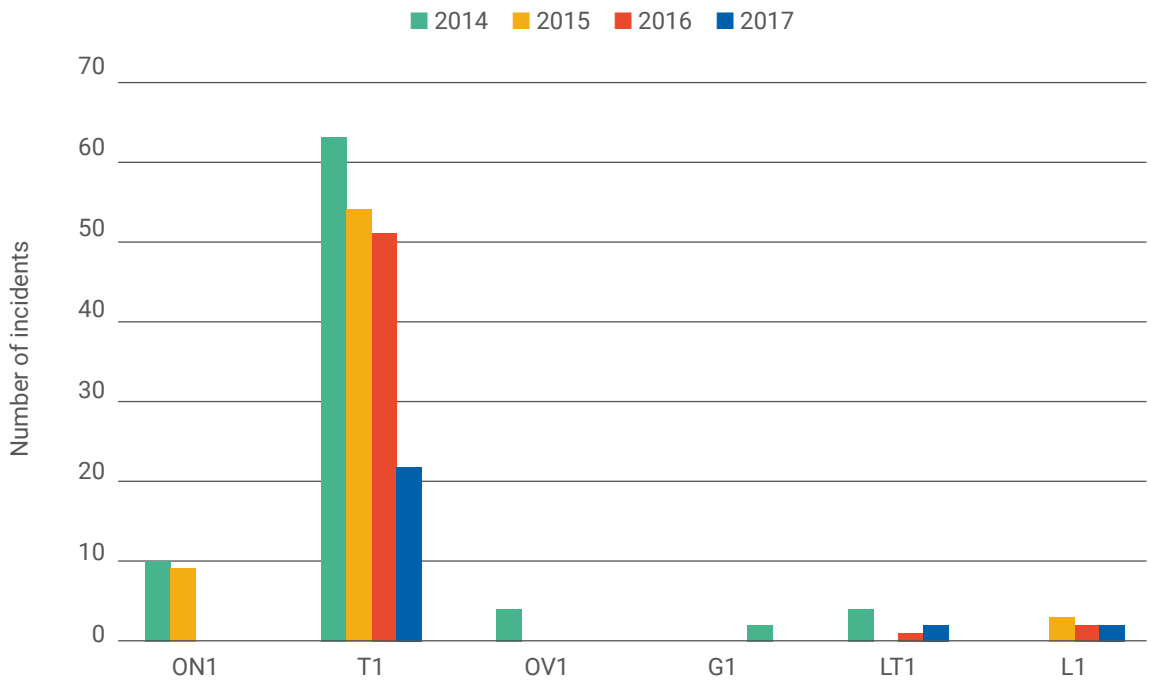


- Scale 0 incidents reported in 2017 increased due to decreases in scale 1 reporting.
- Scale 1 incidents reported in 2017 decreased due to no extreme weather.
- Scale 2 incidents reported in 2013 - 2017 – none.
- Scale 3 incidents reported in 2013 - 2017 – none.

The updates performed to the ICS Methodology influeneced the 2017 reporting for Nordic T0 and T1 incidents. Final tripping of one HVDC link was a T0 incident in 2013. For the 2014 – 2016 reports, it was considered to be a T1 incident. For 2017, some of the HVDC Incidents were scaled down to scale 0 due to low gravity and no impact on the power system. This will give a more correct representation of the year 2017.

SCALE 1 INCIDENTS

Figure 44. Scale 1 incidents by dominating criteria 2014 – 2017



- N-1 violation (ON1) - none in 2017.
- Incidents on transmission network elements (T1) - decreased compared to 2016.
- Violation of standards on voltage (OV1) - none in 2017.
- Loss of tools and facilities (LT1) - at approximately the same level as in 2016.
- Inidents on load (L1) - at approximately the same level as in 2016.

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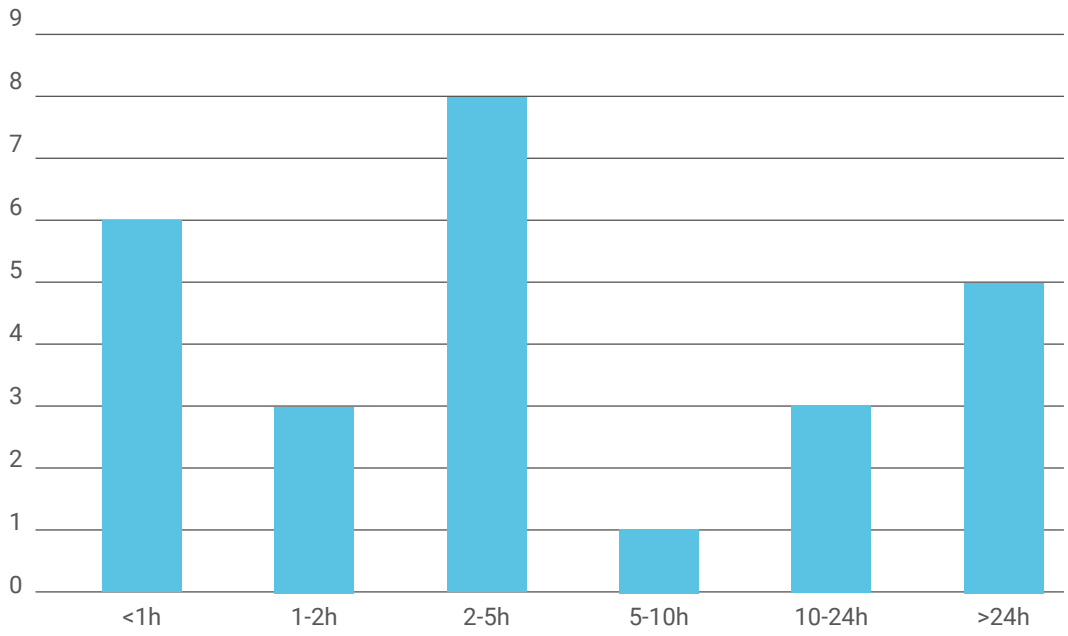
DURATION OF SCALE 1 INCIDENTS 2017

Figure 45. Duration of scale 1 incidents in 2017



Overall, 65 % of scale 1 incidents were of short duration, i.e., <5 h in length.

SCALE 2 INCIDENTS

There were no scale 2 incidents reported in the Nordic Area in 2013 - 2017.

SCALE 3 INCIDENTS

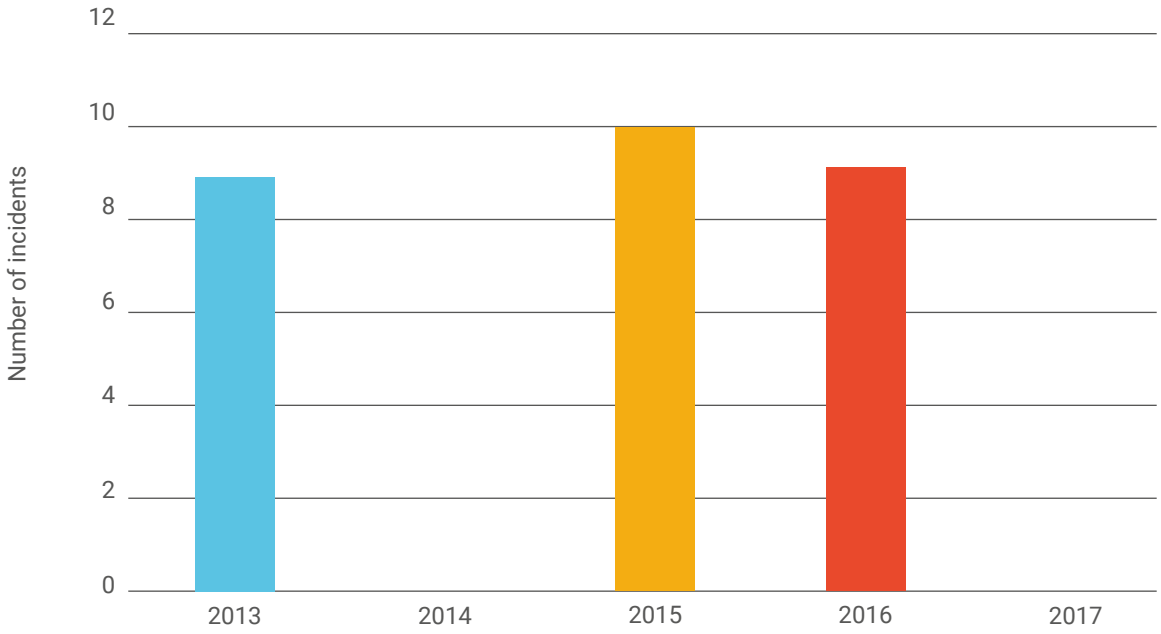
There were no scale 3 incidents reported in the Nordic Area in 2013 - 2017.

N-1 VIOLATIONS 2017

There were no N-1 incidents reported in the Nordic Area in 2017.

EVOLUTION OF N-1 INCIDENTS FROM 2013 – 2017

Figure 46. N-1 violations 2013 – 2017



ANALYSIS OF SIGNIFICANT CHANGES IN TRENDS 2017

In 2017, a total of 66 incidents were reported in the Nordic Area, which is a decrease from 2016, when 76 incidents were reported. The dominant incidents were incidents on transmission network elements (T0 and T1). The number of scale 0 and scale 1 incidents decreased in 2017. The number of incidents on transmission network elements decreased. 2017 was a year with no extreme conditions and a lot fewer and smaller consequences. For the other type of incidents, there were no significant changes in trends compared with previous years.

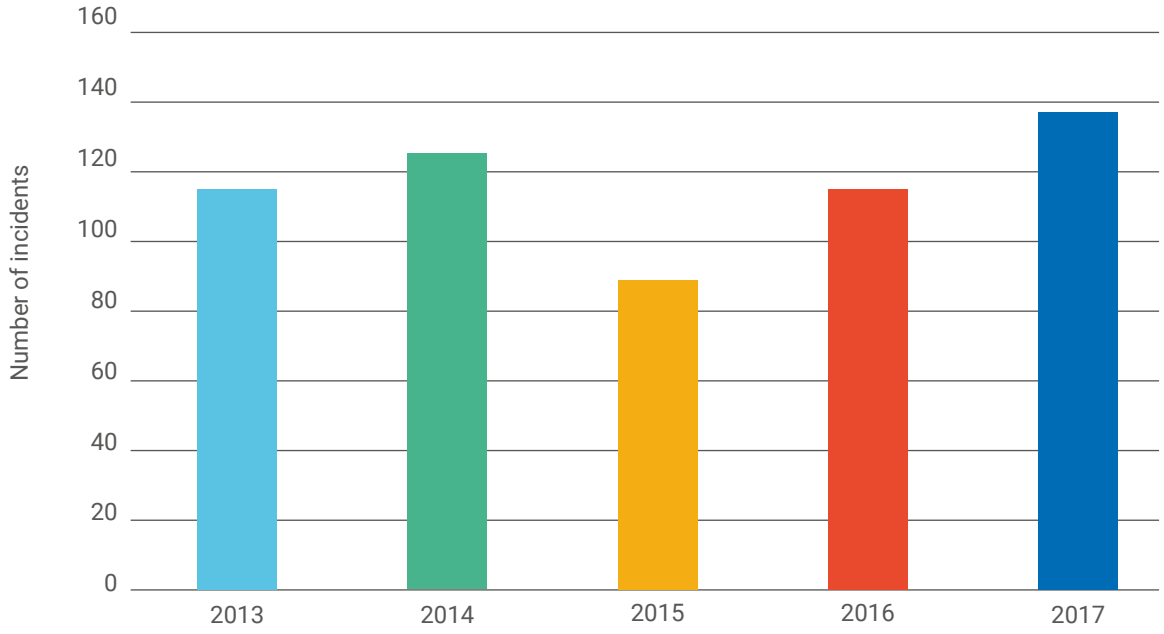
There were 24 scale 1 incidents recorded in the Nordic synchronous area. The majority of the incidents were classified as incidents on transmission network elements (T1), and 86 % of these incidents were on HVDC links. Two incidents involved loss of tools and facilities (LT1), and two were incidents involving load (L1). During 2017, there were no extreme weather conditions and no big capacity bottlenecks influencing the the Nordic synchronous area. Some of the HVDC Incidents were scaled down from scale 1 to scale 0 due to very low gravity and/or no impact on the power system. This was done by some of the TSOs to obtain a more correct representation of the incidents.

INCIDENTS IN GREAT BRITAIN

REPORTED INCIDENTS 2013 - 2017

National Grid Electricity System Operator of Great Britain (GB) recorded 138 incidents in 2017 in comparison with 112 incidents in 2016, 88 incidents in 2015, 125 incidents in 2014 and 115 incidents in 2013.

Figure 47. Reported Incidents 2013-2017



The high number of incidents in 2014 was due to a combination of 109 scale 0 and 16 scale 1 incidents. By comparison, in 2017, there were 126 scale 0 and 12 scale 1 incidents. However, Figure 47 suggests that there is no upward trend between 2013 to 2017. In fact, it can be seen that, from 2015 onwards, the incident numbers have gradually increased.

INCIDENTS BY DOMINATING CRITERIA

National Grid Electricity System Operator of Great Britain reported 138 incidents in total in 2017, out of which 126 incidents were of scale 0 and 12 incidents were of scale 1.

Table 10. Number of incidents reported in Great Britain Area in 2017

Dominant criteria	Count
Incidents on transmission system elements (T0)	124
Incidents on power generating facilities (G0)	2
Disturbances on transmission system elements (T1)	10
Loss of tools and facilities (LT1)	2
Total	138

Disturbances on transmission System Elements (T0 and T1) made up the largest part of the reported incidents. In addition, there were only two incidents reported under the Loss of Power Generating Facilities (G0) and two incidents under the Loss of Tools and Facilities (LT1).

Figure 48. Monthly distribution of incidents by dominating criteria – 2017

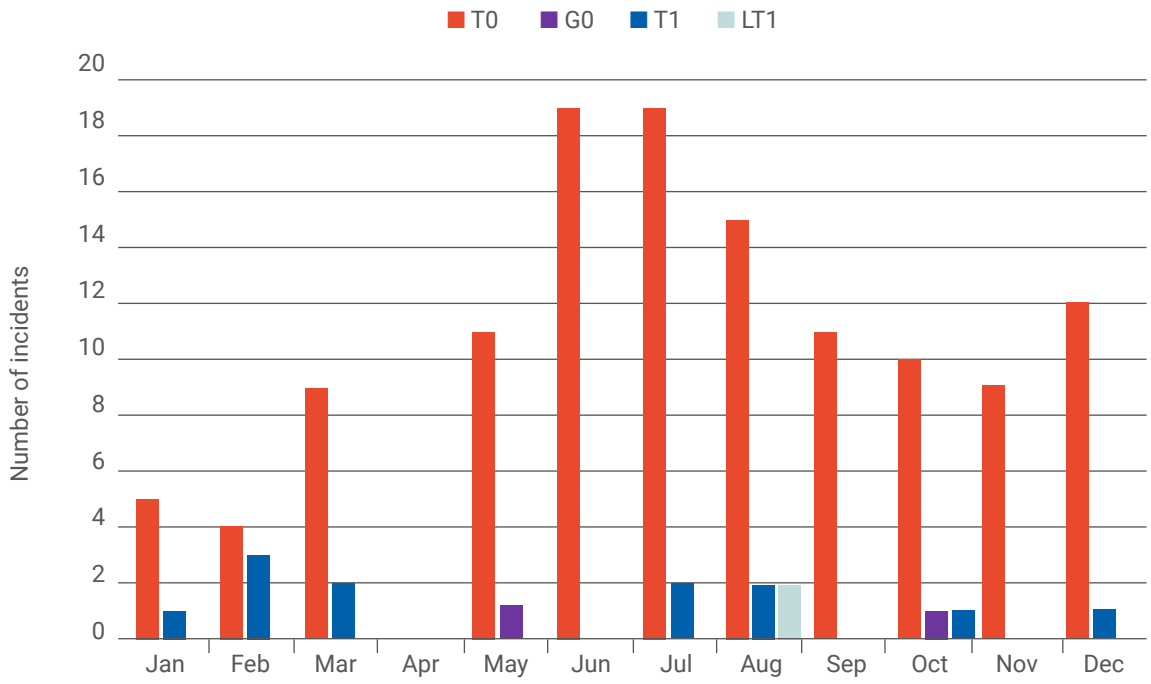
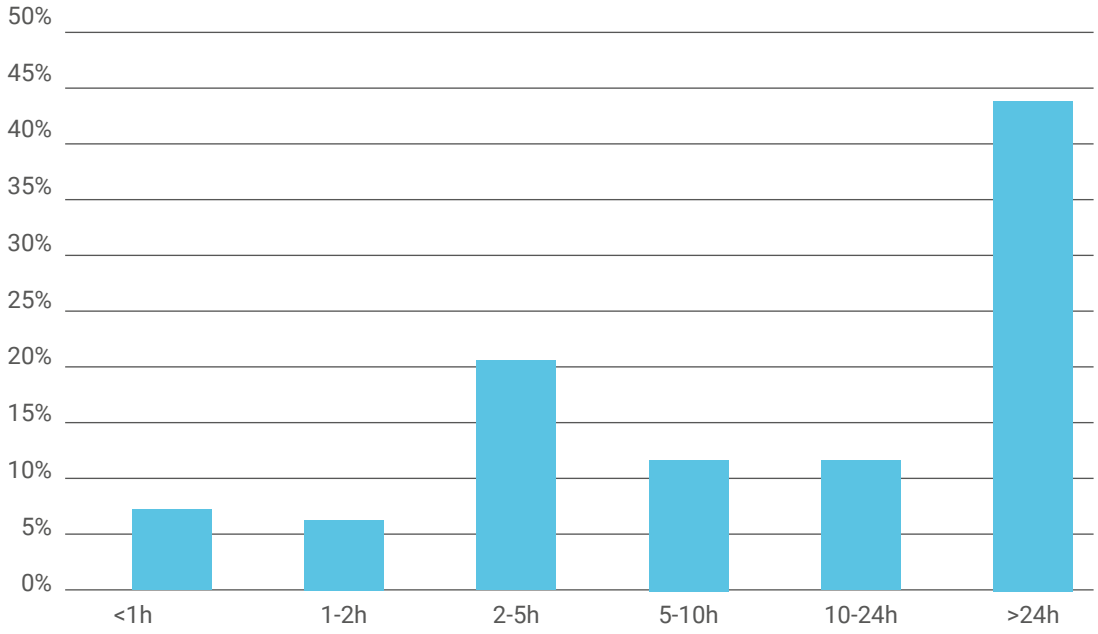


Figure 48 indicates that a higher number of reported incidents occured during the summer. The maximum number of 19 incidents appeared in both June and July.

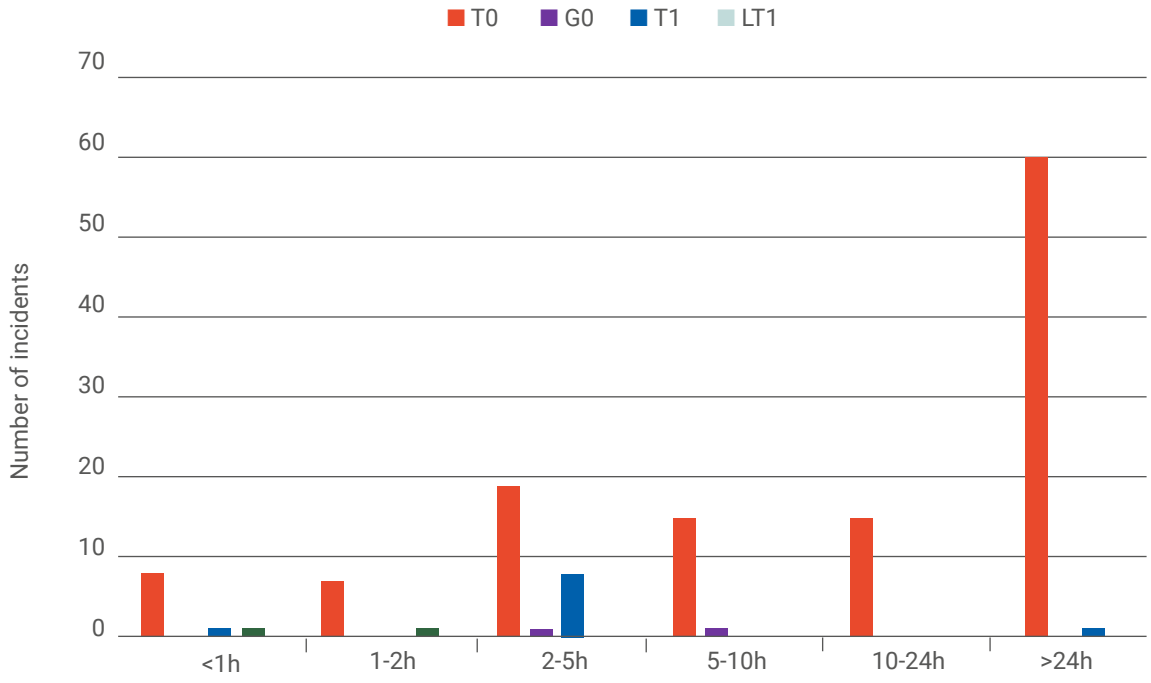
Figure 49. Duration of incidents



Overall, 33 % of the reported incidents were of short duration, i.e., <5 h in length.

In addition, 44.2 % 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.

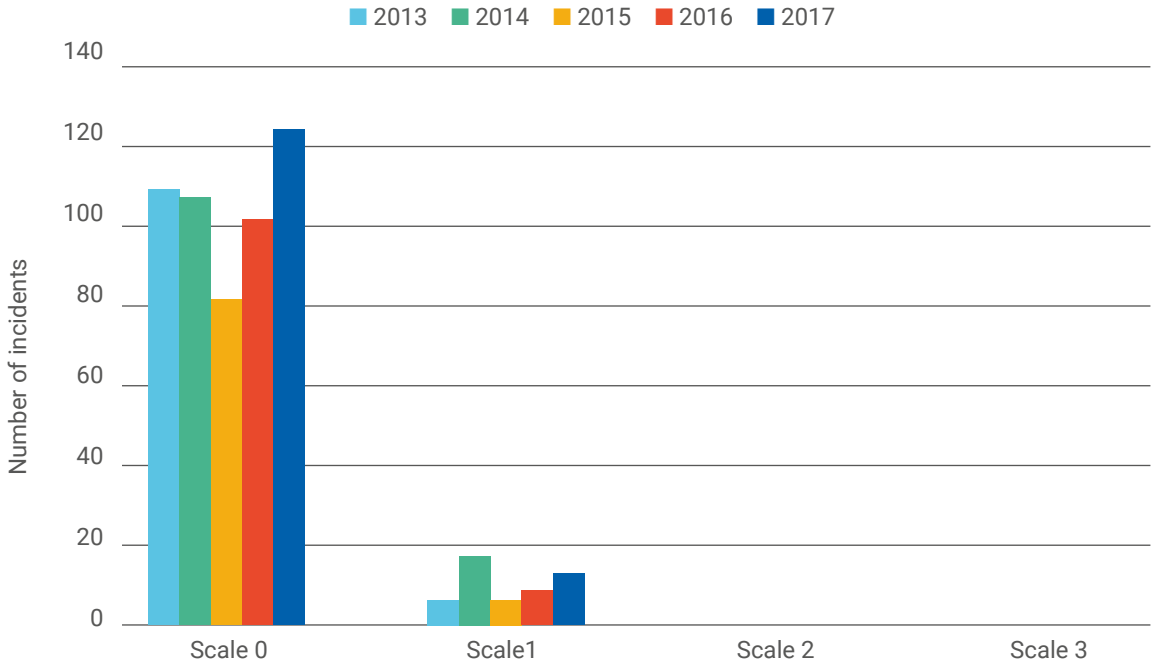
Figure 50. Duration of incidents by dominating criteria 2017



Most of the scale 1 incidents (T1 & LT1) had relatively short durations. There were 10 instances in which an HVDC interconnector tripped, and most were subsequently returned to service within 5 hours.

INCIDENTS BY SCALE 2013 - 2017

Figure 51. Incidents by scale 2013-2017

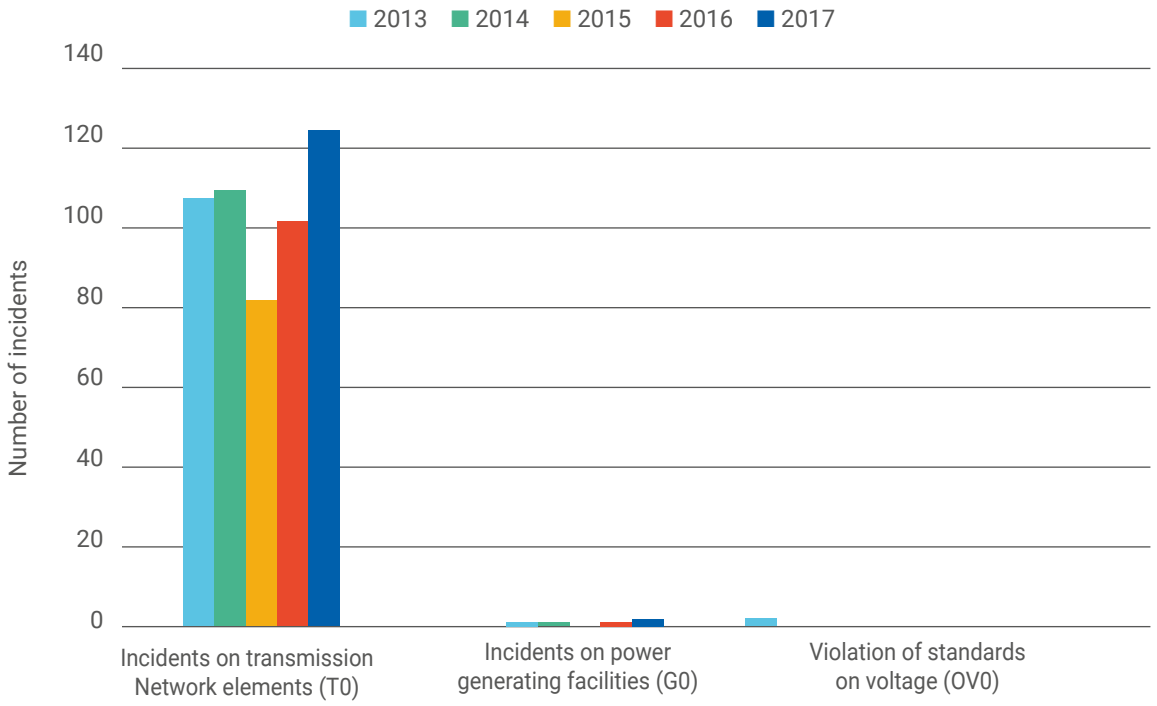


The number of scale 0 incidents reported in 2017 was higher than that reported in 2016; also, the total number of incidents reported was considerably higher than the totals reported in 2013, 2014 and 2015.
The number of scale 1 incidents reported in 2017 increased in comparison with previous years.
There were no scale 2 and scale 3 incidents reported from 2013 to 2017.

SCALE 0 INCIDENTS

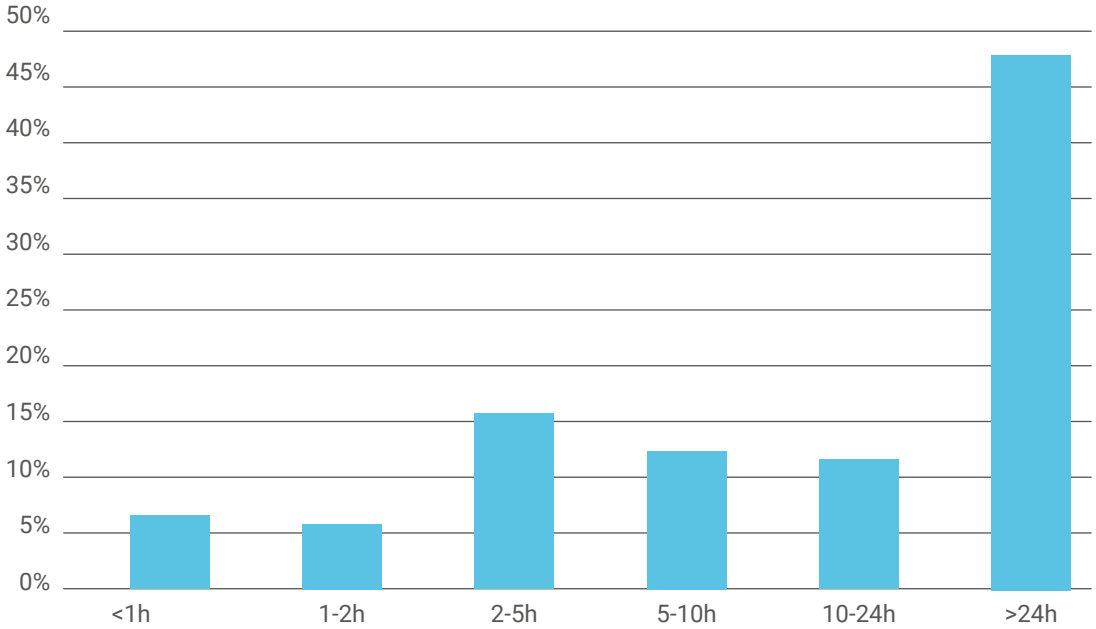
There were a total of 126 scale 0 incidents recorded in Great Britain in 2017 in comparison with 102 in 2016, 82 in 2015, 109 in 2014 and 110 in 2013.

Figure 52. Scale 0 incidents by dominating criteria 2013 – 2017



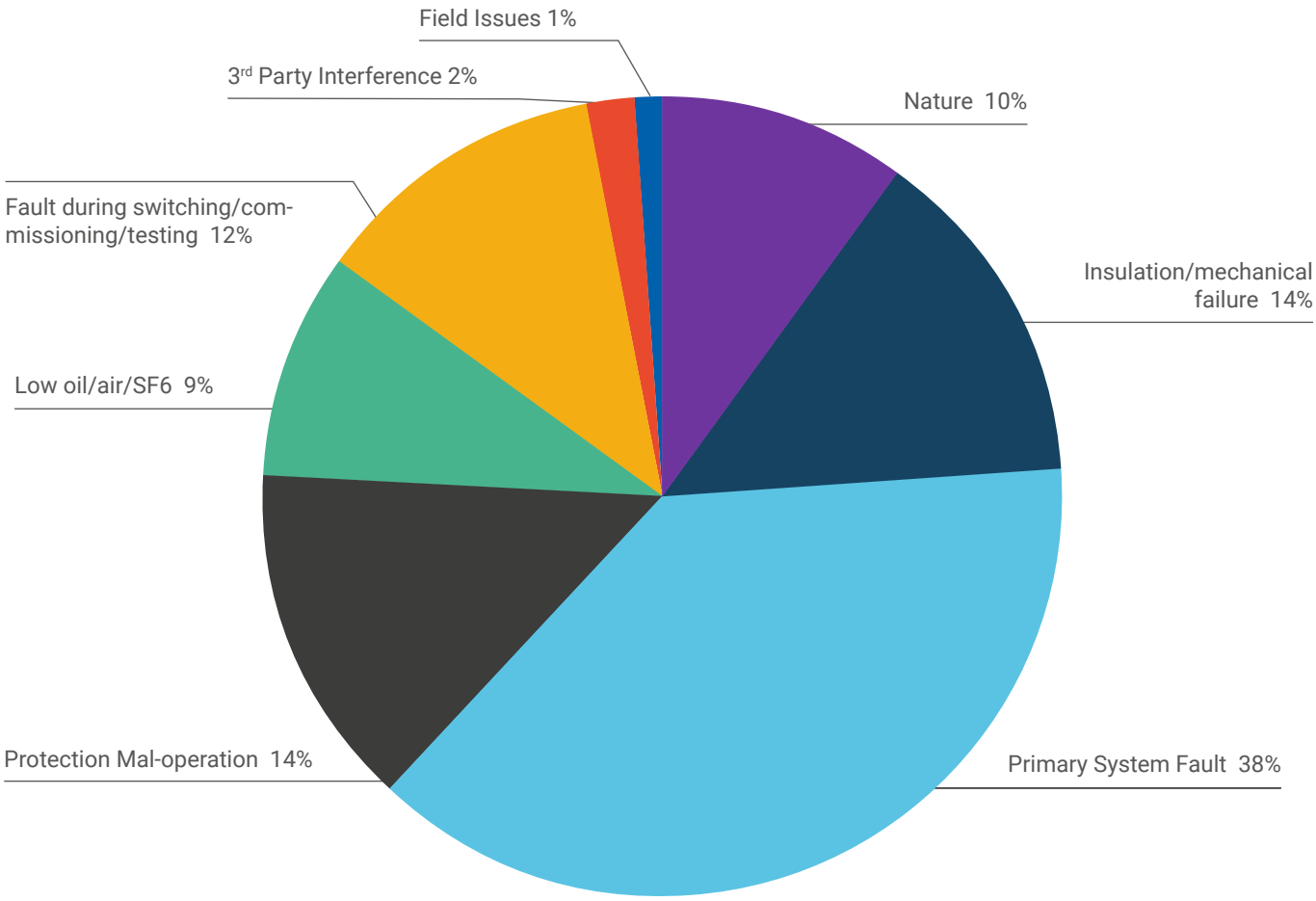
National Grid Electricity System Operator of Great Britain experienced 126 scale 0 incidents in 2017, out of which 124 incidents resulted in a final tripping of Transmission System Elements (T0) and only 2 incidents were associated with unexpected disconnections from the grid of power generating facilities (G0). All of these incidents were secured following the application of curative remedial actions within appropriate timescales. The two G0 incidents were caused by a generator gas supply issue and power supply issue on the DSO network. Both incidents tripped the Combined-Cycle Gas Turbine (CCGT) units and hence disconnected 1320 MW from the grid in each incident.

Figure 53. Duration of scale 0 incidents in 2017



Overall, 28 % of the reported scale 0 incidents were of short duration, i.e., <5 h in length.

Figure 54. Immediate causes of T0 Incidents

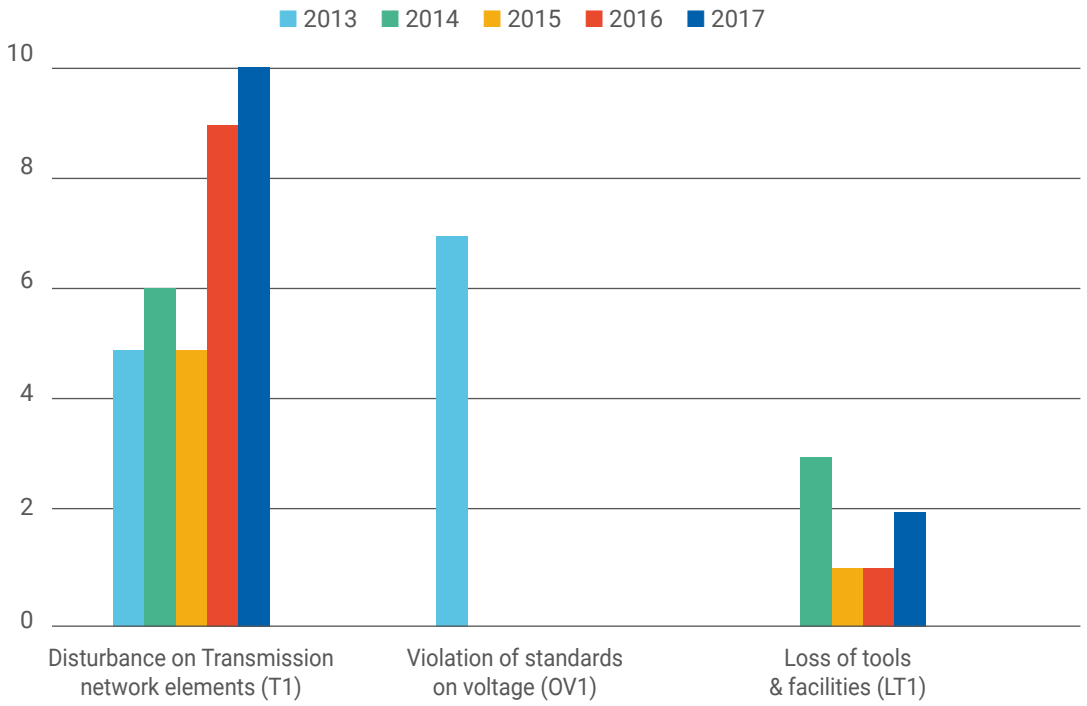


More than one third of the T0 incidents in 2017 were caused by primary system faults that resulted in the automatic operation of circuit breakers following the detection of a primary system fault current. The system remained secure following all of the incidents.

SCALE 1 INCIDENTS

Great Britain recorded 12 incidents of scale 1 in comparison with 10 in 2016, 6 in 2015, 16 in 2014 and 5 in 2013.

Figure 55. Scale 1 incidents by dominating criteria 2013 – 2017

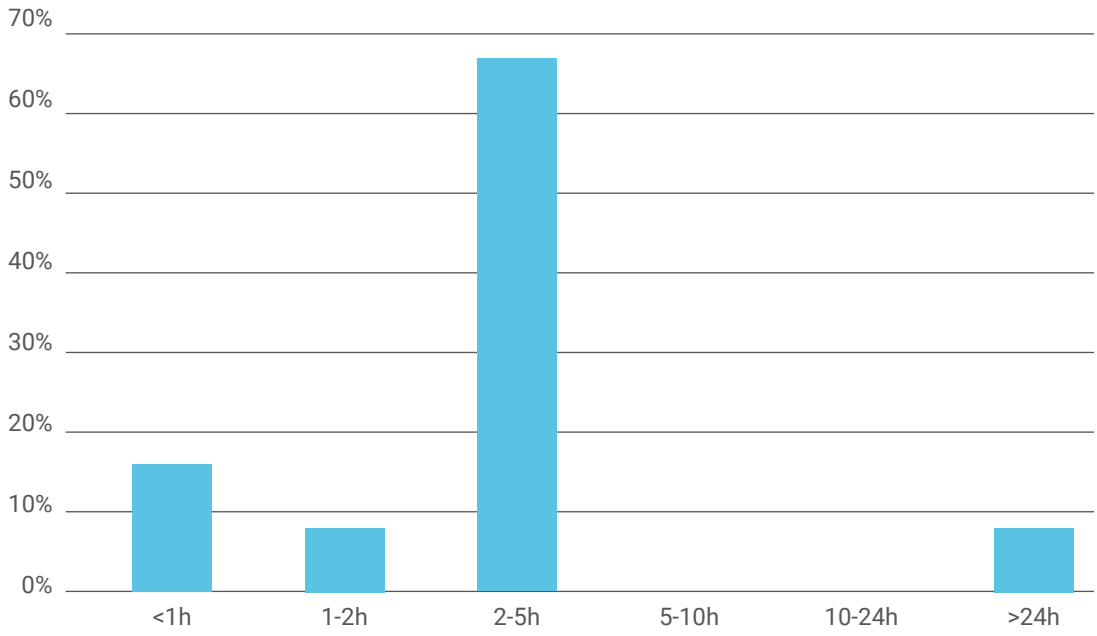


National Grid Electricity System Operator of Great Britain experienced 10 Scale 1 incidents associated with the final tripping of Transmission network elements (T1). All of these incidents led to the reduction in the cross-border exchange capacity of the HVDC interconnectors between Great Britain and France (IFA) or Great Britain and Northern Ireland (Moyle).

There were two occasions during which the Moyle HVDC interconnector tripped as a result of a disturbance in the Great Britain synchronous area. The remaining 8 incidents reported as T1 were associated with the trip of the IFA HVDC interconnector; these incidents were consequences of problems associated with the HVDC converter station on the Great Britain end of the interconnector.

Only two scale 1 incidents were recorded in Great Britain under the Loss of Tools (LT1) criteria,i.e., when the SCADA system was lost from South Scotland for 30 minutes, and the Integrated Energy Management System Power Network Analyser (iEMS PNA) system was lost for 75 minutes.

Figure 56. Duration of scale 1 incidents in 2017



Overall, 92 % of the reported scale 1 incidents were of short duration, i.e., <5 h in length.

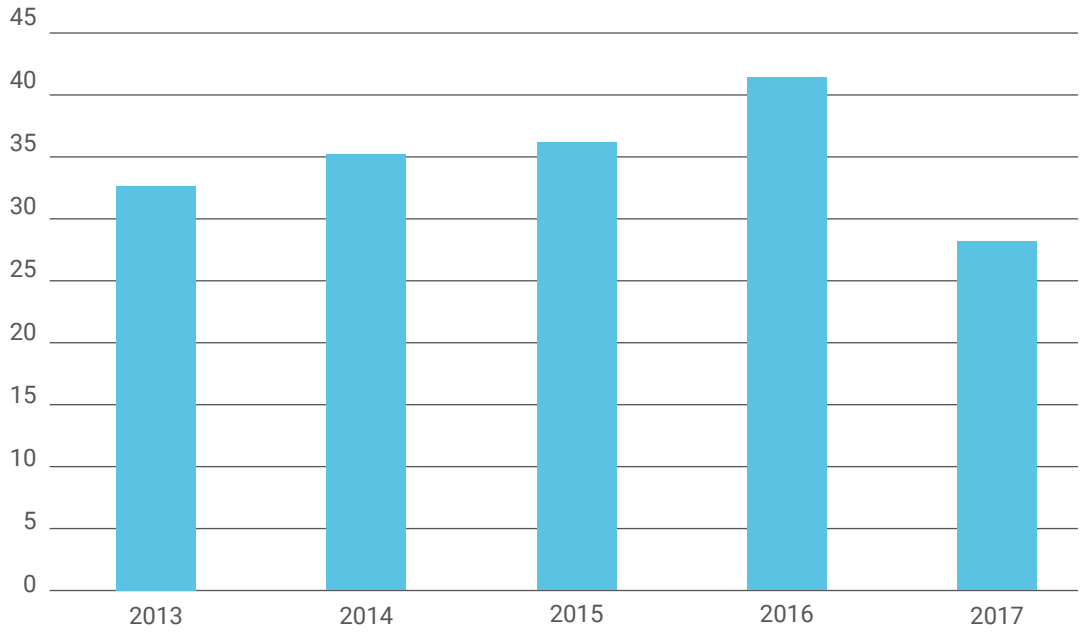
ANALYSIS OF SIGNIFICANT CHANGES IN TRENDS 2017

In 2017, a total of 138 incidents were reported in the Great Britain synchnorous area, an increase compared to the 112 reported incidents in 2016, although there was no «upward trend» compared to the previous 4 years. The dominant incidents were incidents on transmission System Elements (T0 and T1). The number of scale 0 and scale 1 incidents in 2017 increased in comparison to the numbers for 2016. There were no scale 2 or scale 3 incidents, which remained unchanged in 2017. For the other type of incidents, there were no significant changes in trends in comparison to previous years.

INCIDENTS IN BALTIC AREA

REPORTED INCIDENTS 2013 - 2017

Figure 57. Reported incidents 2013 – 2017



INCIDENTS BY DOMINATING CRITERIA 2017

Baltic TSOs reported 28 incidents in 2017. There were 17 scale 0 incidents and 11 scale 1 incidents. No incidents of scale 2 or scale 3 were reported.

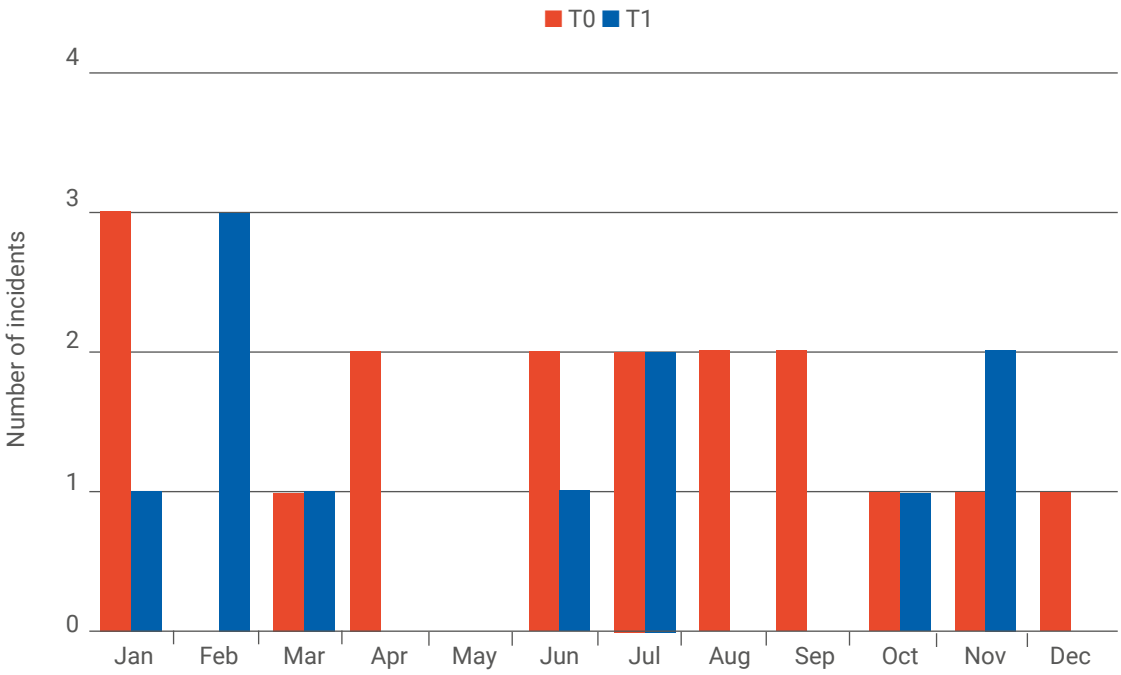
Table 11. Number of incidents reported according to dominating criteria 2017

Dominant criteria	Count
Incidents on transmission network elements (T0)	17
Incidents on transmission network elements (T1)	11
Total	28

Of the incidents on transmission network elements (T1), 10 happened on HVDC connections.

MONTHLY DISTRIBUTION OF INCIDENTS BY DOMINATING CRITERIA

Figure 58. Monthly distribution of incidents by dominating criteria – 2017

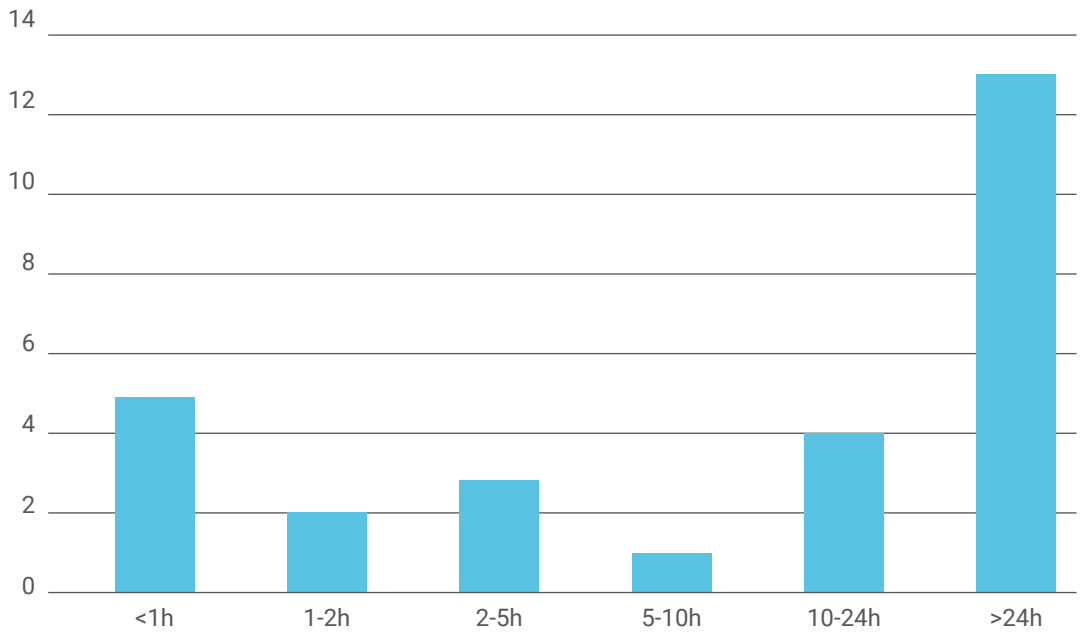


Legend of criteria

- T0 Incidents on transmission network elements
- T1 Incidents on transmission network elements

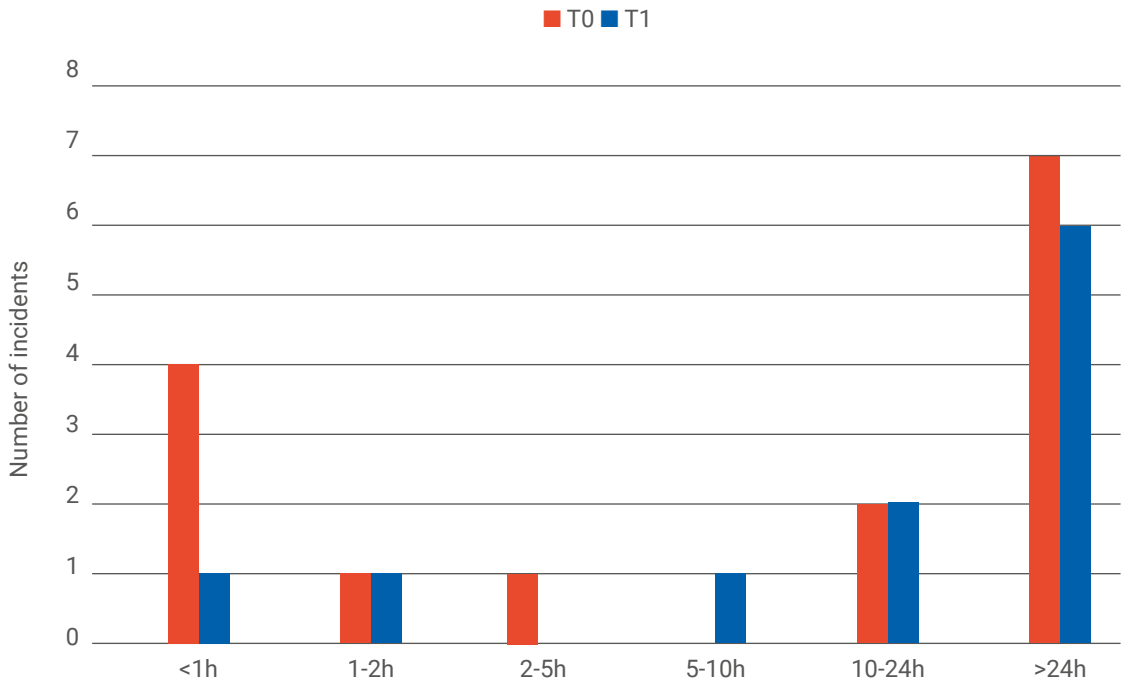
DURATION OF INCIDENTS 2017

Figure 59. Duration of incidents 2017



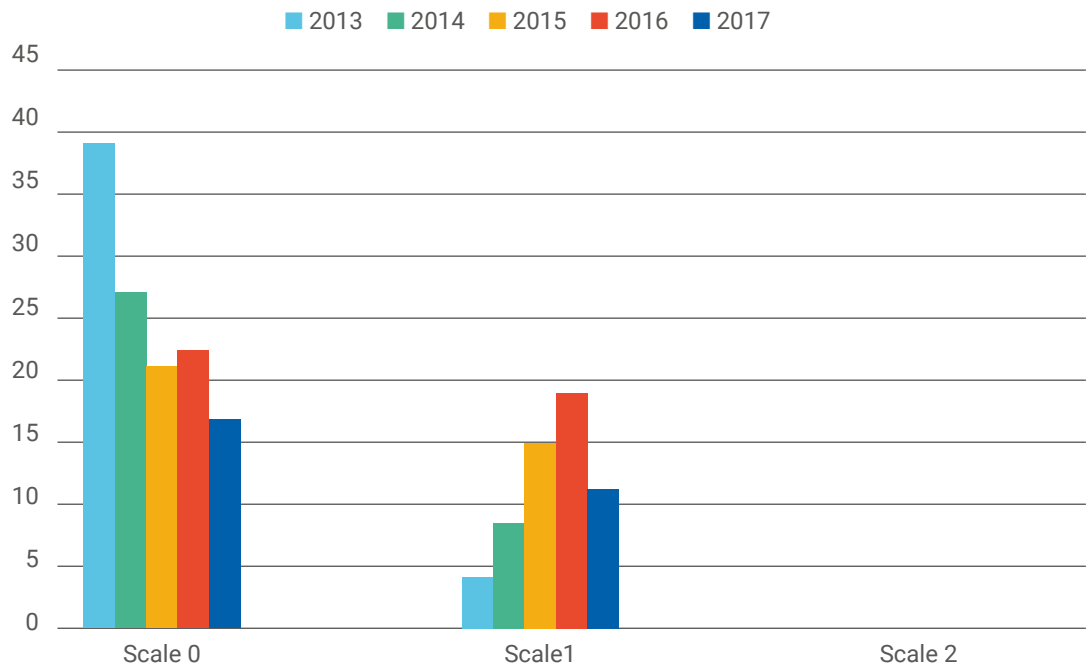
DURATION OF INCIDENTS BY DOMINATING CRITERIA

Figure 60. Duration of incidents by dominating criteria 2017



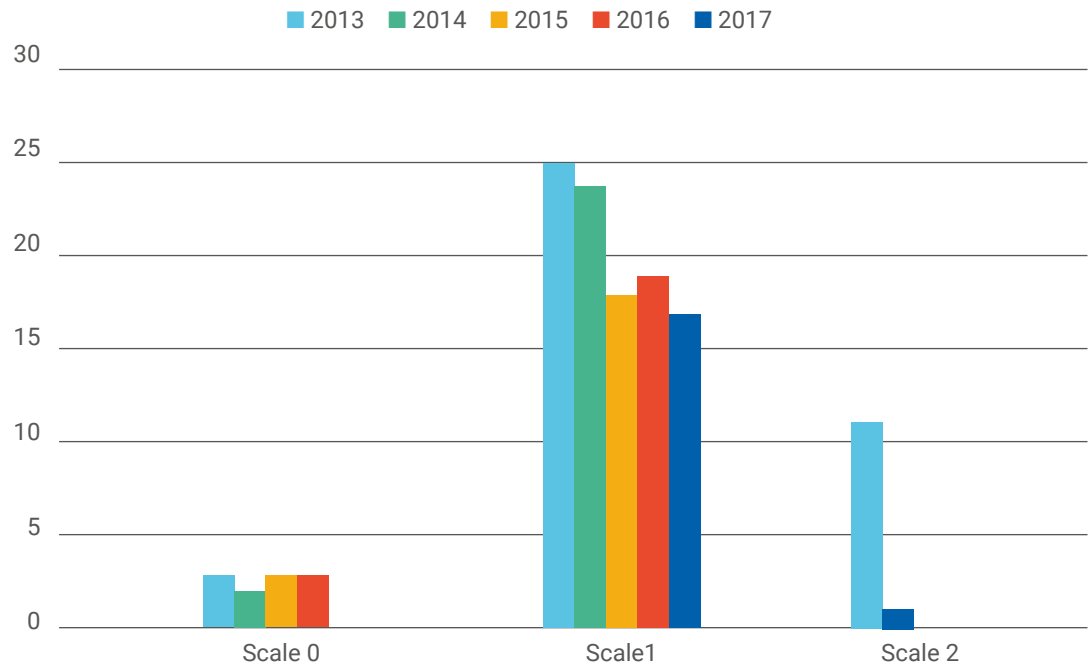
INCIDENTS BY SCALE 2013 – 2017

Figure 61. Number of incidents by scale 2013 - 2017



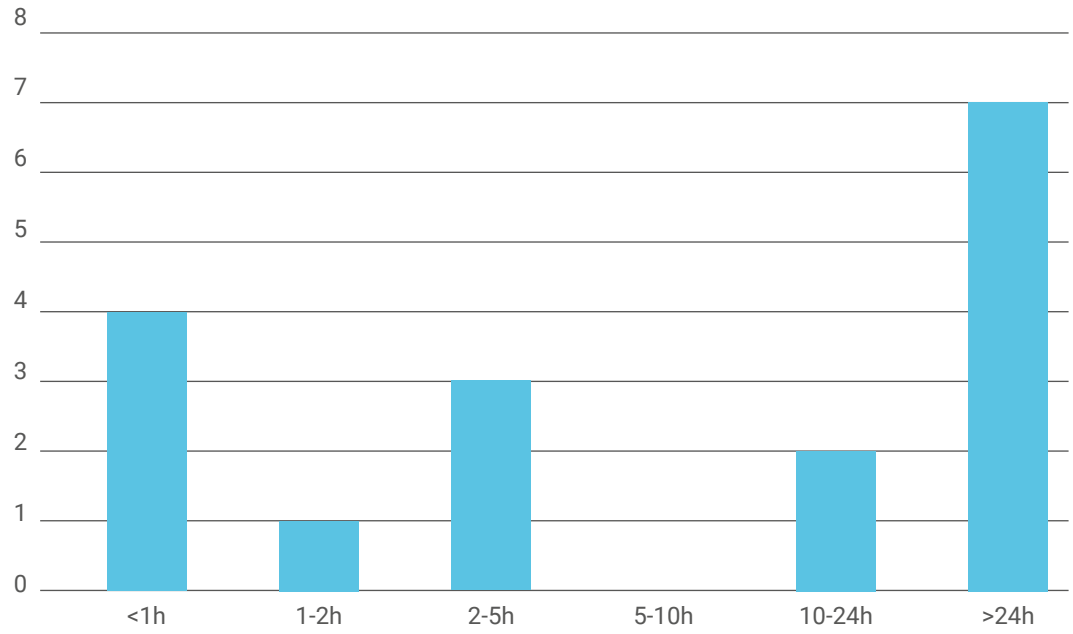
SCALE 0 INCIDENTS

Figure 62. Scale 0 incidents by dominating criteria 2013 – 2017



Loss of load (L0) incidents in 2013 and 2014 are reported due to differences in the previous methodology.

Figure 63. Duration of scale 0 incidents in 2017



SCALE 1 INCIDENTS

Figure 64. Scale 1 incidents by dominating criteria 2013 – 2017

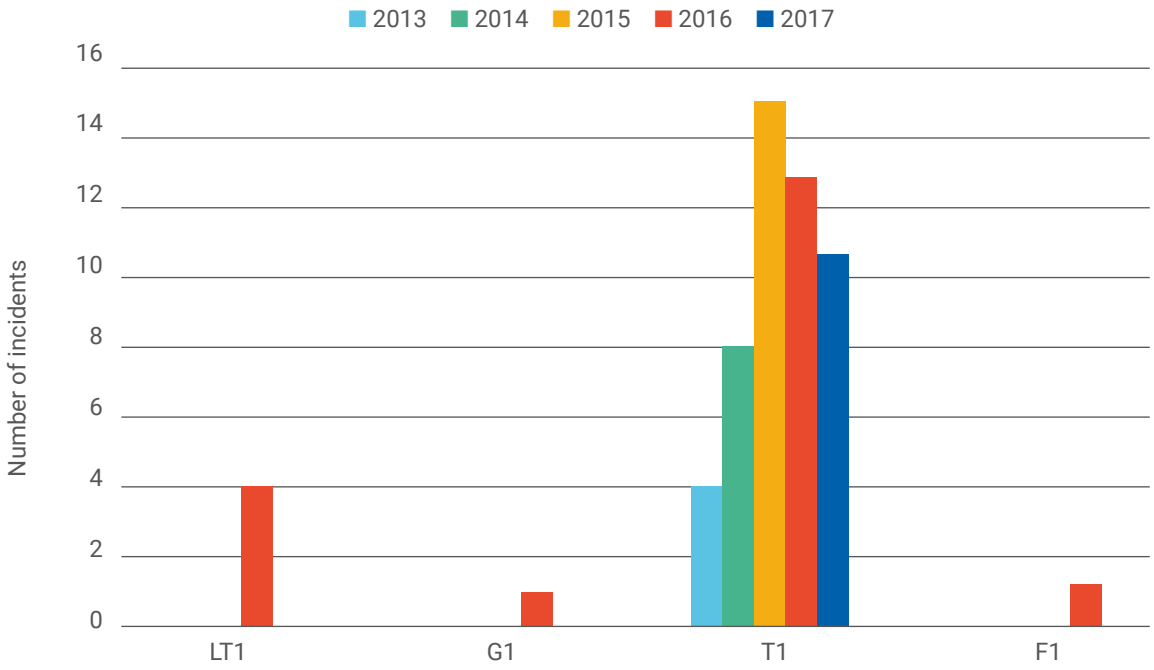
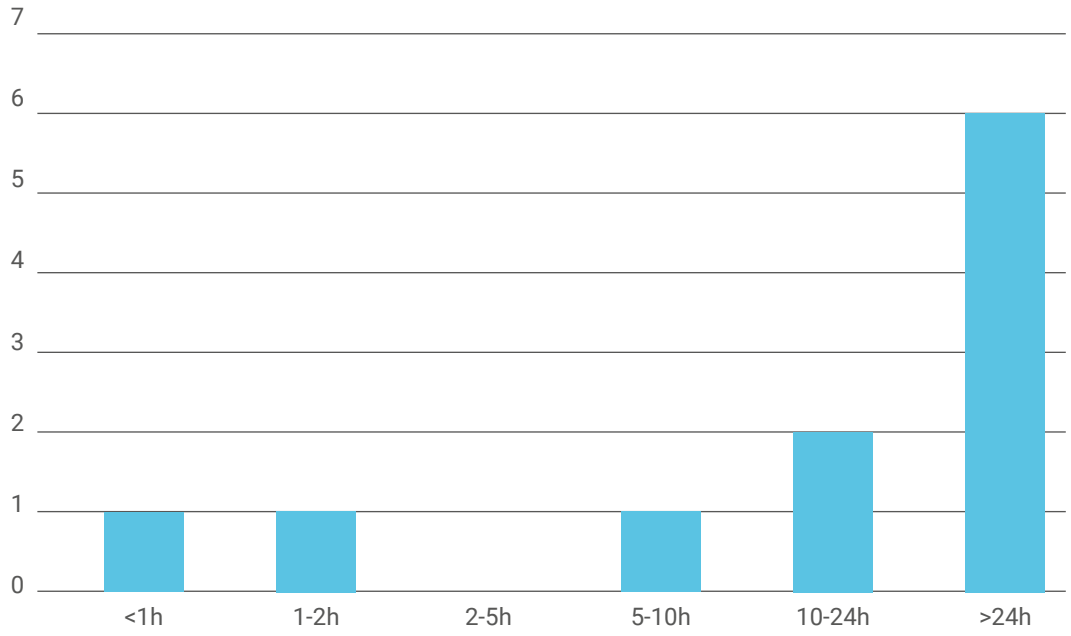


Figure 65. Duration of scale 1 incidents in 2017



SCALE 2 INCIDENTS

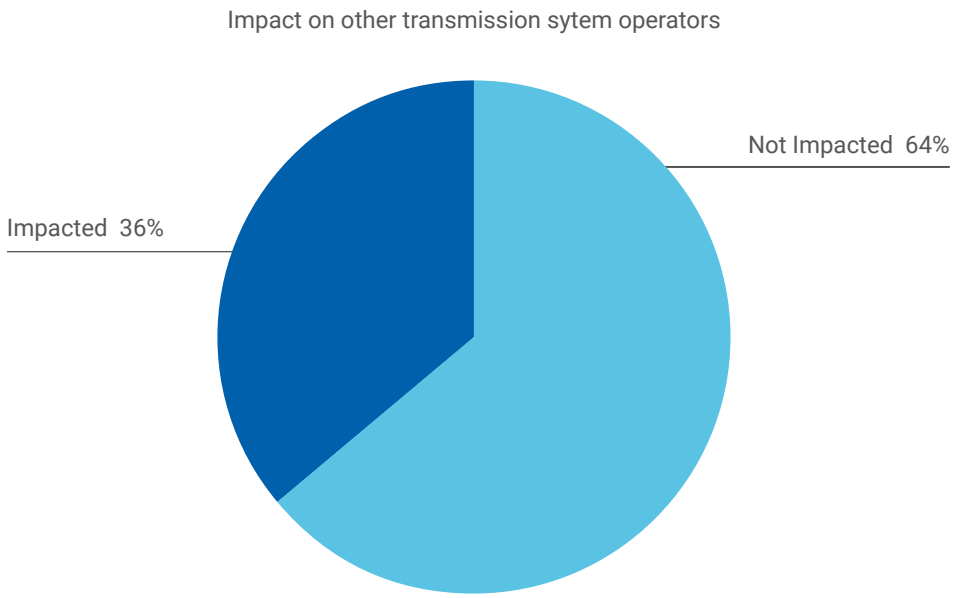
There were no scale 2 incidents reported in the Baltic Synchronous Area in 2013 - 2017.

SCALE 3 INCIDENTS

There were no scale 3 incidents reported in the Baltic Synchronous Area in 2013 - 2017.

IMPACT ON OTHER TRANSMISSION SYSTEM OPERATORS

Figure 66. Impact on other transmission system operators in 2017



N-1 VIOLATIONS

There were no N-1 incidents reported in the Baltic Synchronous Area in 2013 - 2017.

ANALYSIS OF SIGNIFICANT CHANGES IN TRENDS 2017

In the time period 2013 – 2017, the Baltic Synchronous Area TSOs reported almost similar numbers of incidents each year. Differences between dominating categories are connected to changes in methodology and the development of Baltic TSOs (HVDC equipment).

INCIDENTS IN IRELAND

INCIDENTS BY DOMINATING CRITERIA

In 2017, there were 35 incidents reported for the synchronous area of Ireland; 27 of scale 0 and 8 of scale 1. There were no recorded scale 2 or scale 3 incidents in 2017.

Overall, 89 % of scale 0 incidents were at power generating facilities. The remaining 11 % of scale 0 incidents involved transmission network elements.

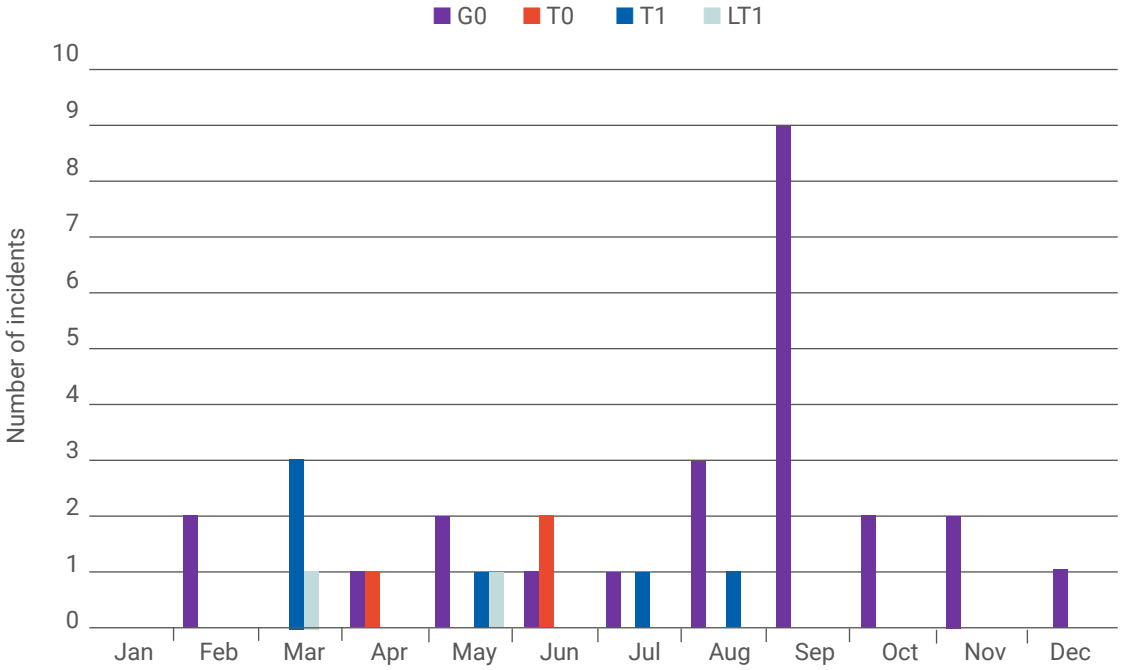
There were 6 scale 1 incidents on transmission network elements due to trippings of HVDC interconnectors; four trippings of the Moyle interconnector and two trippings of the East-West Interconnector. There were two incidents of loss of tools and facilities. In the first incident, the energy management system (EMS) display was available without control for approximately one hour. In the second incident, there was a six-hour period with intermittent loss of contingency analysis, and the EMS display was not showing the correct system status.

Table 12. Number of incidents by dominating criteria - Ireland

Dominant criteria	Count
Incidents on power generating facilities (G0)	24
Incidents on transmission network elements (T0)	3
Incidents on transmission network elements (T1)	6
Loss of tools and facilities (LT1)	2
Total	35

Nine of the 24 incidents at generating facilities (G0) occurred in September. Four of those incidents were due to unexpected output reduction by a generator. On one occasion, a second generator tripped in response to an unexpected output reduction. The maximum frequency deviation time duration resulting from the incidents at generating facilities lasted seven minutes. An incident leading to frequency degradation (F0) requires a minimum frequency deviation time of 10 minutes for the synchronous area of Ireland.

Figure 67. Number of incidents by month and dominating criteria – Ireland



DURATION OF INCIDENTS

Twelve incidents lasted longer than 24 hours. Eight of those were Incidents on power generating facilities and 4 invovled transmission network elements.

Figure 68. Duration of all incidents – Ireland

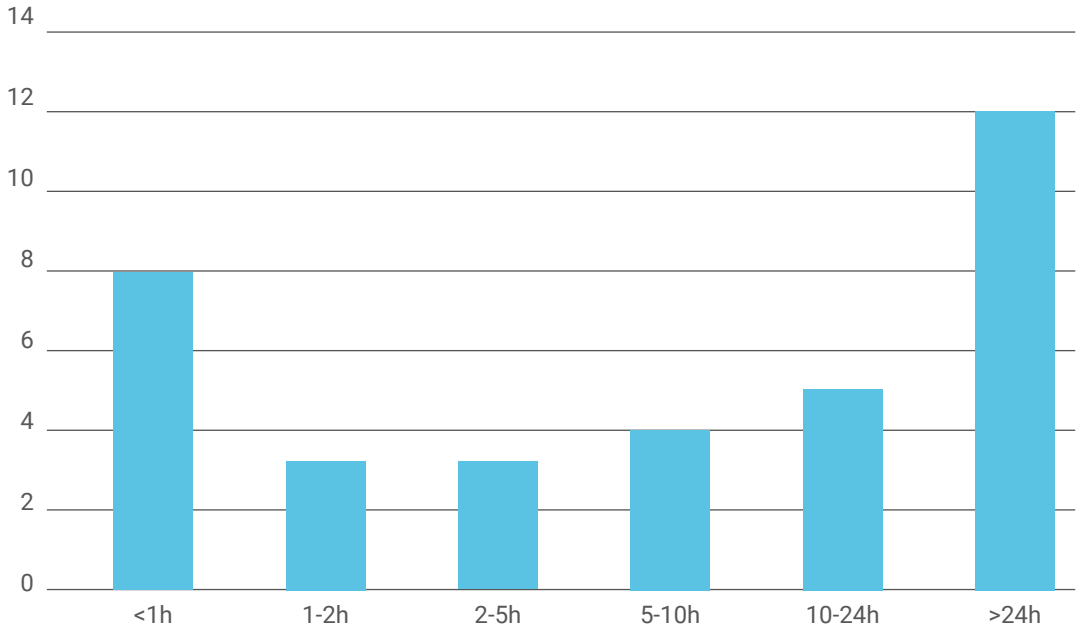


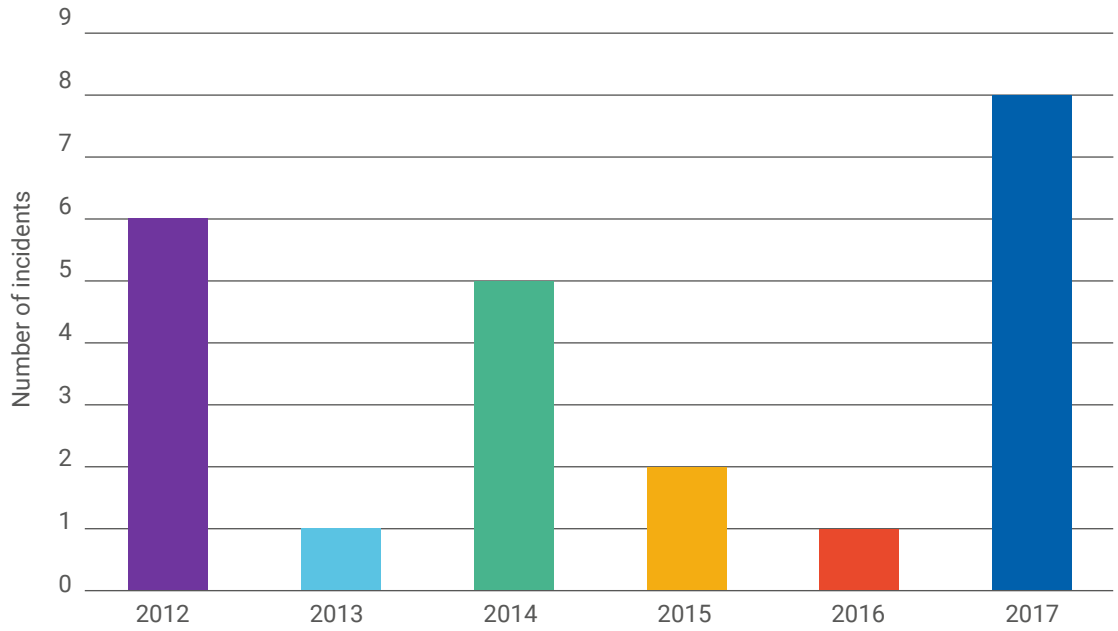
Table 13. Duration of incidents by dominating criterion - Ireland

Dominating Criterion	<1 h	1-2 h	2-5 h	5-10 h	10-24 h	>24 h	Total
G0	6	2	2	2	4	8	24
T0	1				1	1	3
T1	1		1	1		3	6
LT1		1		1			2
Total	8	3	3	4	5	12	35

ANALYSIS OF SIGNIFICANT CHANGES IN TRENDS

There were 8 recorded scale 1 incidents in Ireland in 2017, an increase from 1 in 2016, and the largest number of scale 1 incidents since data collection began in 2012. Six incidents involved the tripping of HVDC interconnectors between Ireland and Great Britain. Such incidents are reported as scale 1 due to the reduction in transfer capacity between the synchronous areas.

Figure 69. Scale 1 incidents by year - Ireland



INCIDENTS IN ISOLATED SYSTEMS

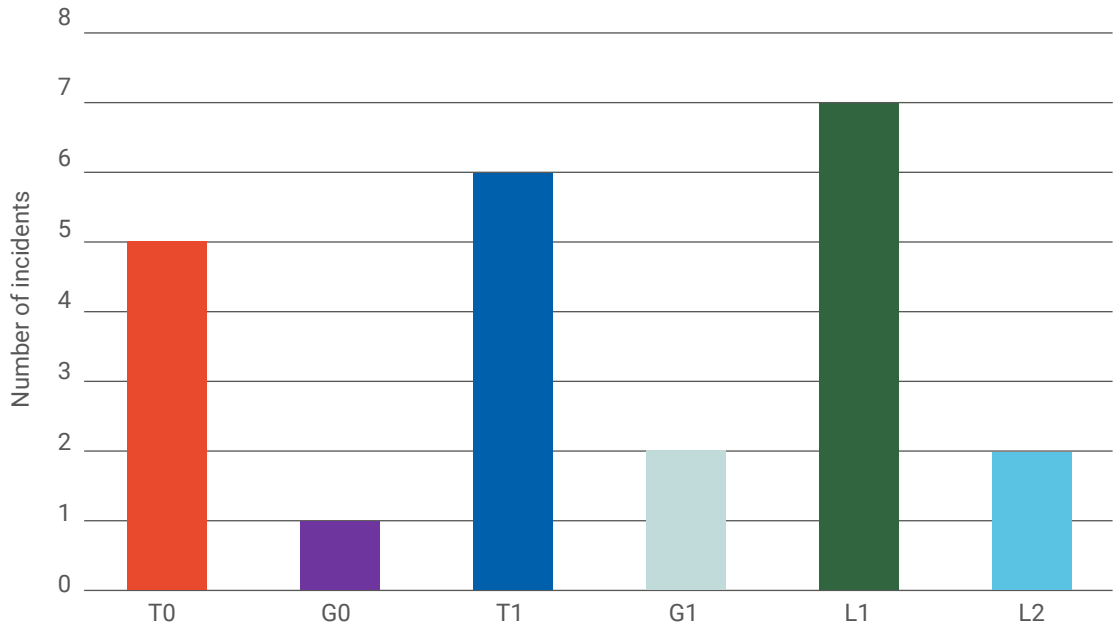
INCIDENTS BY DOMINATING CRITERIA

In total, 23 incidents were recorded in 2017 by TSOs in the Isolated Systems synchronous area (Cyprus and Iceland). In terms of scale 0 and 1 incidents, the primary reasons given were transmission network elements (T0 and T1, respectively). There were also 2 cases of scale 2 incidents on load.

Table 14. Number of incidents reported for 2017 in Isolated Systems

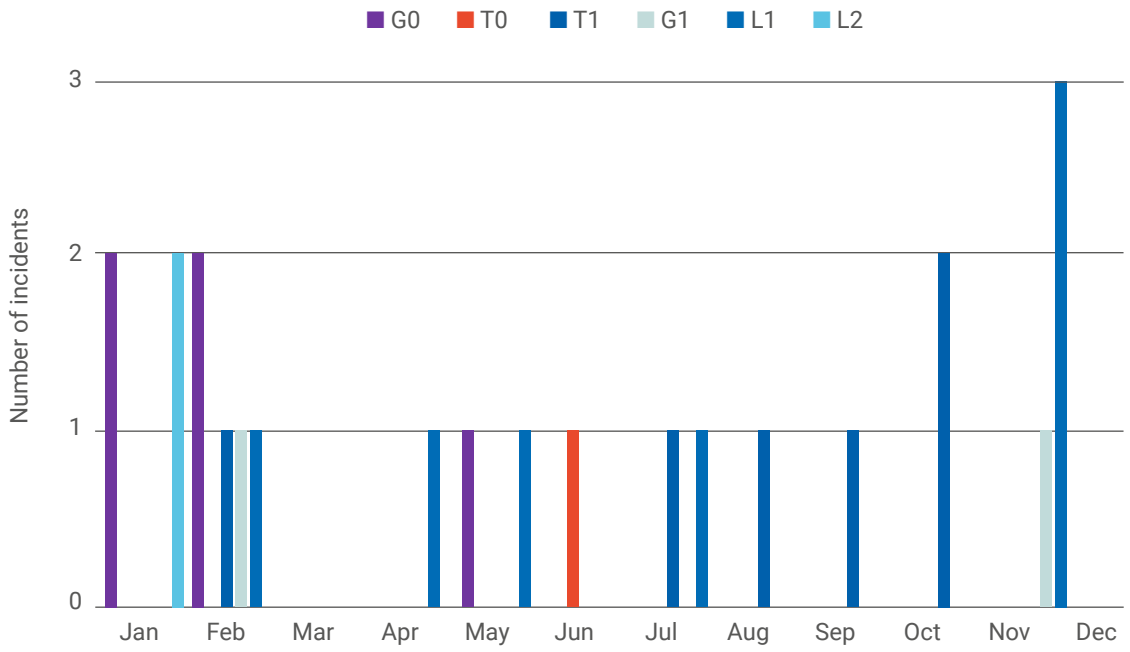
Dominant criteria	Count
Incidents on transmission network elements (T0)	5
Incidents on power generating facilities (G0)	1
Incidents on transmission network elements (T1)	6
Incidents on power generating facilities (G1)	2
Incidents on load (L1)	7
Incidents on load (L2)	2
Total	23

Figure 70. Incidents by dominating criteria



Regarding the number of incidents per month and dominating criteria, the majority of incidents occurred in February with 5 cases, followed by January and November with 4 incidents for each month.

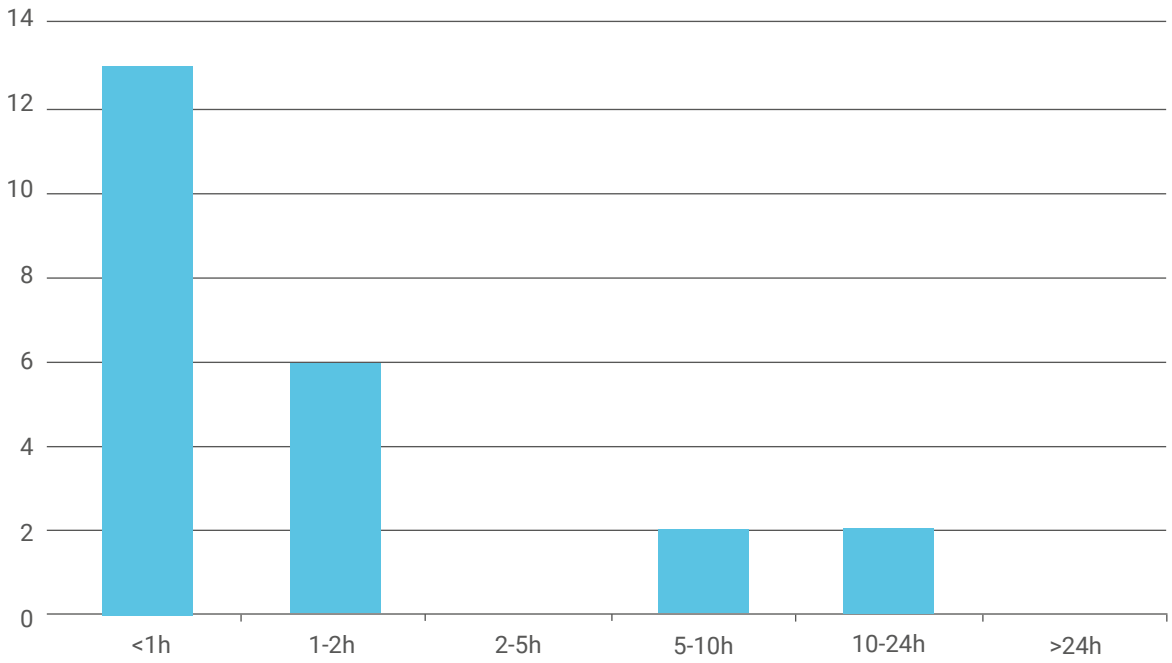
Figure 71. Monthly distribution of incidents by dominating criterion – 2017

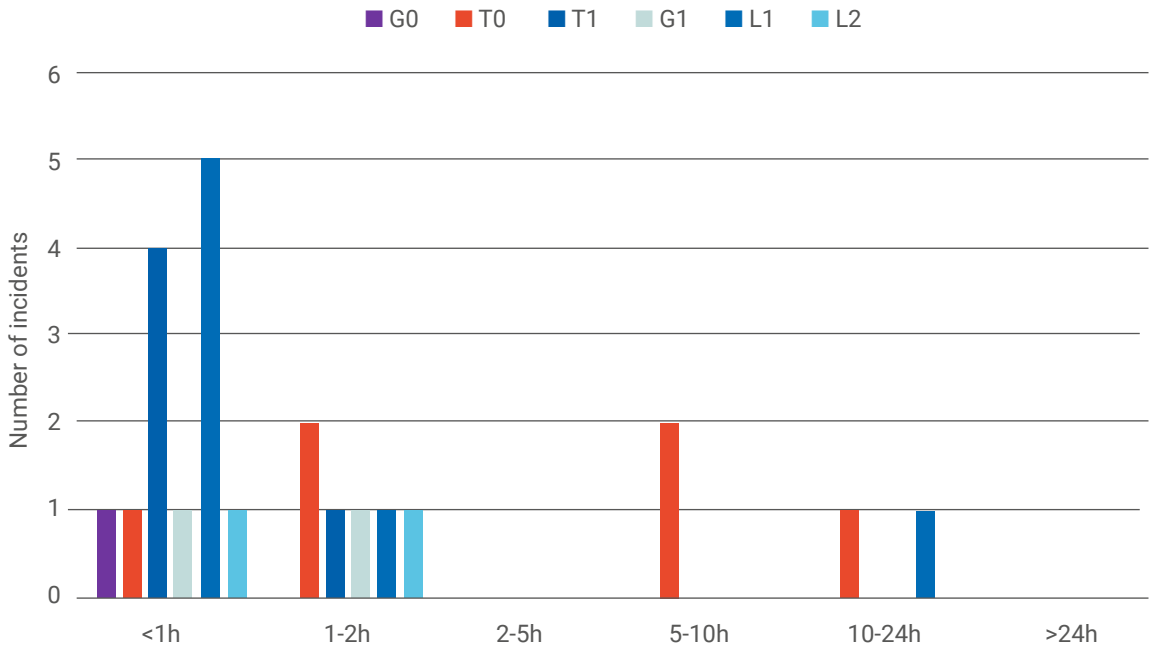


DURATION OF INCIDENTS

In Isolated Systems, 13 incidents lasted less than 1 hour (56 %), followed by 6 incidents (26 %) with durations between 1 and 2 hours. Five of the incidents with durations of less than 1 hour were incidents involving load (L1), and four incidents involved transmission network elements (T1).

Figure 72. Duration of incidents 2017





INCIDENTS BY SCALE 2014 - 2017

The incidents in Isolated Systems are reported starting from 2014. Compared to previous years, from 2015 until 2017, there was a continuous increase in the number of incidents affecting Isolated Systems (of, respectively, 54 and 35 %), mainly due to scale 1 incidents.

Figure 74. Incidents by scale 2014 – 2017

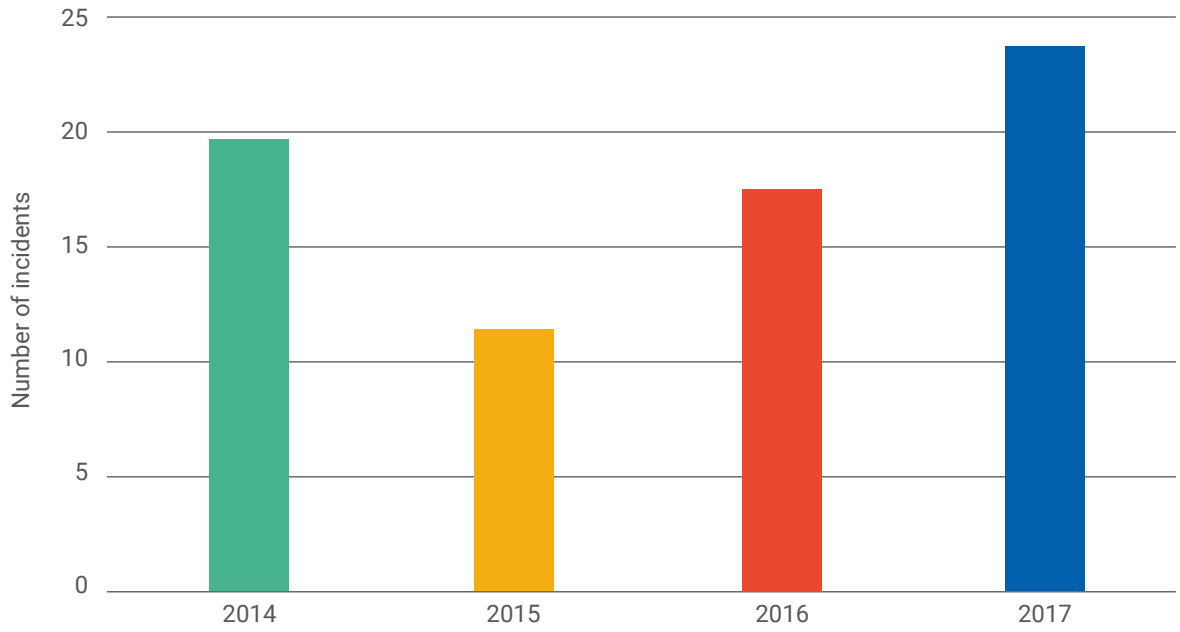
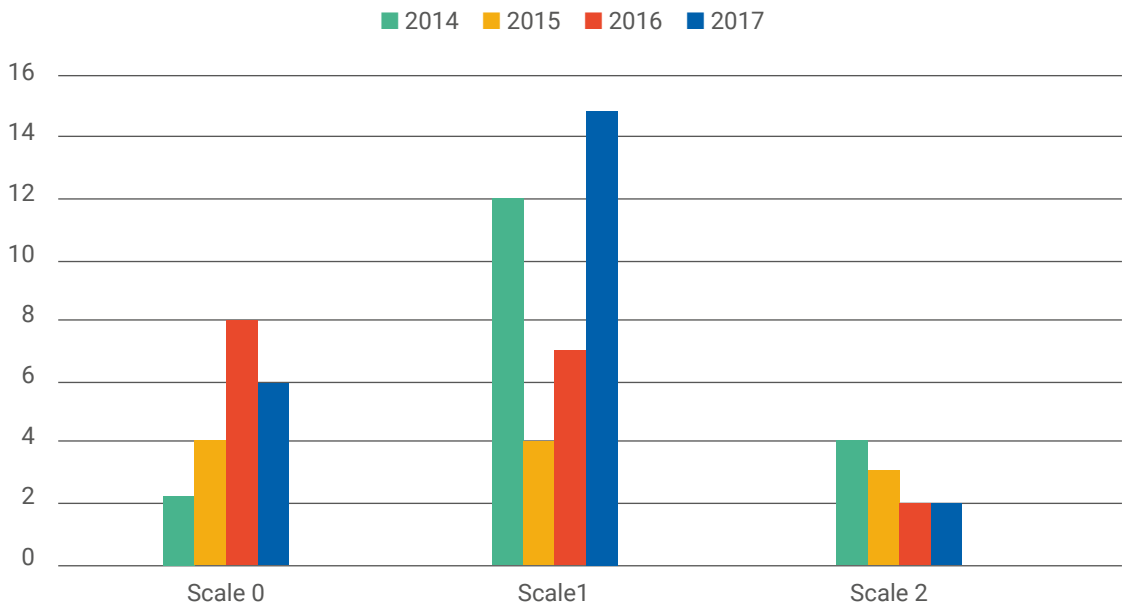


Figure 75. Incidents by scale 2014 - 2017



ANALYSIS OF SIGNIFICANT INCIDENTS

In 2017, 2 scale 2 incidents occurred in Isolated Systems. Both were incidents involving load. The first was associated with tripping during maintenance work on all power units in a power plant, with the loss of 690 MW in generation and consequent loss of load of approximately 614 MW. Following the event, a system split occurred.

The second incident, due to a transmission line fault, caused a frequency deviation of 990 mHz for five minutes, loss of generation of 229 MW and load disconnection of 96 MW.

CONCLUSIONS

For the 2017 annual report on the incident classification scale, data was received from all ENTSO-E full members. A total of **1072 incidents** were reported, which represents an increase of about 13 % over 2016.

The number of scale 0 incidents increased over 2016 by 11 %. For all of the **680 reported scale 0 incidents**, systems remained in normal states (based on the system design criteria) during and after the incident.

The **390 scale 1 incidents reported** represent an increase of 15 % compared to last year.

A full 65 % of the scale 1 incidents were incidents on transmission network elements, which are mostly connections (AC and DC) between TSOs. A total of 66 incidents of scale 1 were N-1 violations, a decrease of 25 % compared to 2016. The remaining 69 incidents include violations of standards on voltage (5 %), loss of tools and facilities (6 %), incidents involving load (2 %) and lack of reserve (3 %).

There were **2 incident reported of scale 2**, which occurred in the isolated systems and concerned incidents involving load.

All of these results and trends are derived from the available data reported by the TSOs. Nevertheless, it is too early to conclude that any general trends have emerged, because the numbers are more or less at the level of 2016. Within some categories, there are still some doubts as to whether the TSOs have acquired a harmonized understanding of ICS reporting. The level of explicity seems to be the highest in Continental Europe. Independent of further improvements in reporting, the general conclusion is that during 2017, TSOs demonstrated a high level of coordination and awareness to ensure and maintain remarkable standards of security of supply all over Europe.

REFERENCES

1) ENTSO-E – Incident Classification Scale Methodology, 8 May 2014, https://www.entsoe.eu/Documents/SOC%20documents/Incident_Classification_Scale/2014_ICS_Methodology.pdf

2) Commission Regulation (EU) (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation, http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1510809921386&uri=CELEX:32017R1485

3) ENTSO-E Statistical Factsheet, https://www.entsoe.eu/publications/statistics-and-data/#statistical-factsheet

4) ENTSO-E statistical data, https://www.entsoe.eu/data/power-stats/

5) ENTSO-E – Incident Classification Scale Methodology, 31 January 2013, https://www.entsoe.eu/Documents/SOC%20documents/Incident_Classification_Scale/2013_ICS_Methodology.pdf

CONTACT

ENTSO-E AISBL
Avenue de Cortenbergh 100
1000 Brussels – Belgium

www.entsoe.eu
@ENTSO_E

Tel +32 2 741 09 50
info@entsoe.eu