LANDSNET

Reliability of Supply and Quality of Delivered Electricity

Performance Report 2016

LANDSNET- 17008

Contents

Summary

Landsnet defines 5 main key performance indexes, any one of them is linked to the promises Landsnet has given their stakeholders, which are customers, owners, the community and its employees, which are:

Index	Promise
Trust	In harmony with the community and environment
Minutes of not supplied energy	**Safe supply of electricity, quality and safety of the transmission system**
Demand of yield of the equity	High efficiency of funds – effective business
Work satisfaction	Good place to work
Rate of accidents (H value)	Good place to work

Landsnet's 2016 Performance Report addresses the promise to provide: "Guaranteed electricity, quality and safety of the transmission system into the future". It contains a summary of information from the transmission system. The report, moreover, takes account of Landsnet's duties according to Regulation No. 1048/2004 on the quality of electricity and security of supply, contains statistics for 2016 and compares these with statistics from the previous 10 years.

The number of registered grid disturbances decreased in 2016 as compared with the preceding year. The number of grid disturbances was 95 in 2015, compared with 72 in 2016, in 2014 there were 69. There was also decreased number of faults from 123[1] in 2015 to 85[2] in 2016. The number of registered grid disturbances in high-voltage power lines decreased significantly, as did the number of grid disturbances in substations, but not as much. The 10-year average number of grid disturbances is 62 per year. The weather has high influence on the number of grid disturbances, and the weather was milder in 2016 than the year 2015.

The number of registered grid disturbances decreased in 2016 as compared with the preceding year. The number of grid disturbances was 95 in 2015, compared with 72 in 2016, in 2014 there were 69. There was also a decreased number of faults from 158 in 2015 to 85 in 2016. The number of registered grid disturbances in high-voltage power lines decreased significantly, as did the number of grid disturbances in substations, but not as much. The 10-year average number of grid disturbances is 62 per year.

According to the Regulation on the quality of electricity and security of supply No. 1048/2004, electricity companies must measure the voltage characteristics in accordance with the ÍST EN 50160 standard. Landsnet is under obligation to take sample measurements from at least 6 load points in substations each year. At the 6 substations, where Landsnet took sample measurements in 2016, using precise quality measuring devices, the quality requirements were met in all substations.

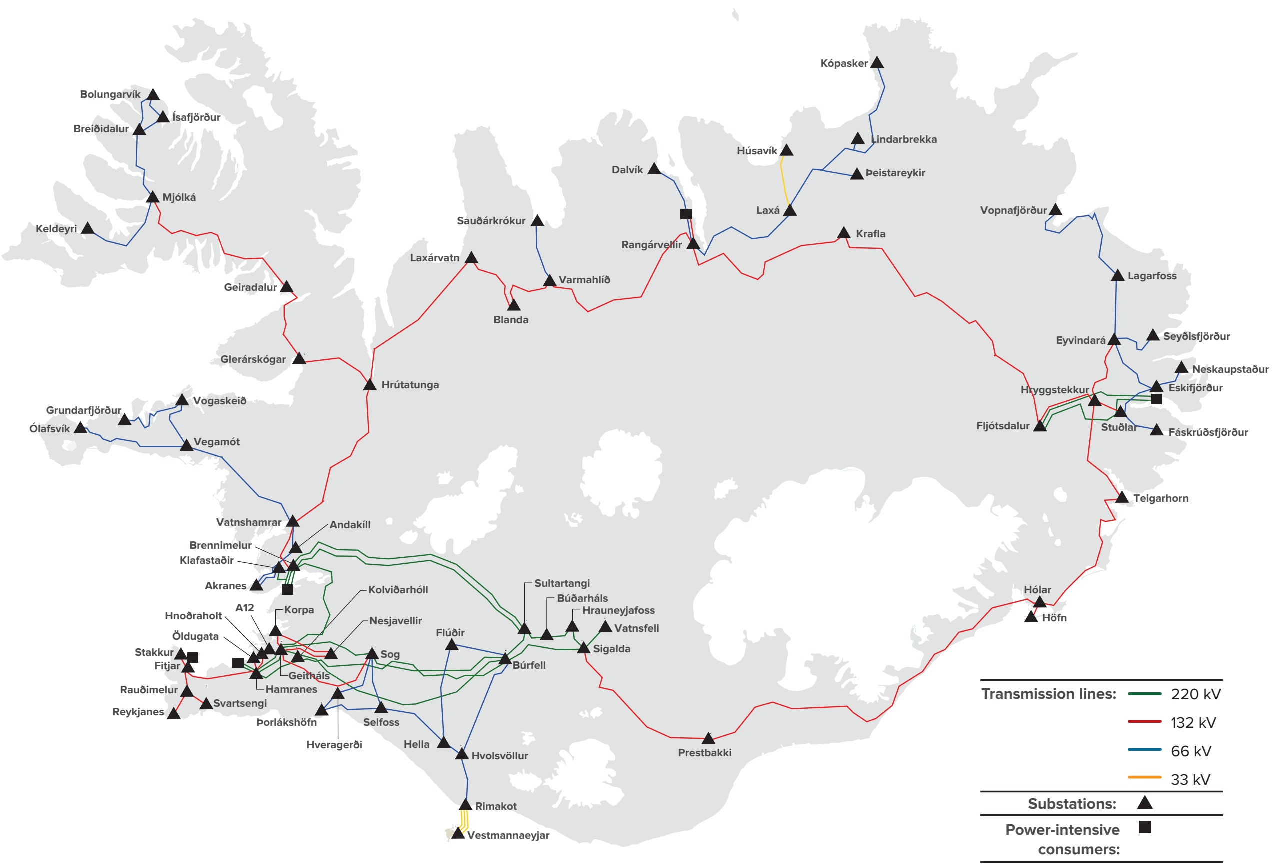
According to the same Regulation, delivery voltage must be within limits that are +/-10%. More stringent requirements are made to delivery voltage to power-intensive industries. Landsnet has defined these limits as being -9% and +5%. These limits, therefore, are taken into account when voltage quality in the 220kV system is assessed. The results from measurements in the energy management system, which are continuous throughout the year, show that values exceeded limits in some cases. These deviations can all be traced to lack of voltage due to malfunctions or maintenance of the delivery location in question.

Frequency in the electricity system was well within the tolerance margins defined in the Regulation, and was according to it 99.9962% of the time inside the limit given.

Landsnet's internal goals as regard to frequency quality state that in each month, 99.5% of frequency measurements must be within limits that are 50 Hz +/- 0.2 Hz, taking account of a 10-second average value. The frequency during eleven months of the year 2016 was within these limits, but the limit was not achieved in October. For the whole year, 99.66% of the frequency measurements where though within those limits.

1) This number was lowered from the number given in the Performance report 2015.
2) Five of these 85 faults were planned actions as defence of the system.

Landsnet's Transmission System 2016



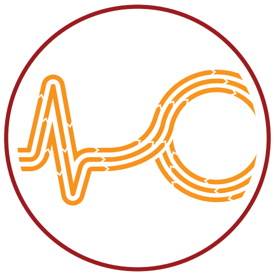
Key Figures

Goals for Security of Supply	2016	Target
Power Interruption Index (SRA)	0.39	Below 0.85
Average Outage Duration Index-Outage Minutes (SMS)	5.1	Below 50
System Minutes (KM)	No disturbance was longer than 10 system minutes, see page 14	No disturbance longer than 10 system minutes

Statistics from System Operation

Total feed-in to the transmission system

17,848 GWh



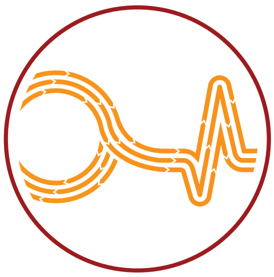
Highest average power of feed-in (hour value)

2,291 MW

Total load on the transmission system

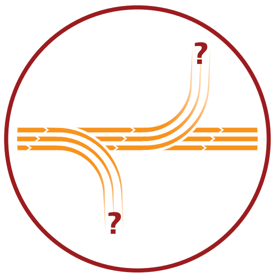
17,488 GWh

There of to curtailable load 437 GWh



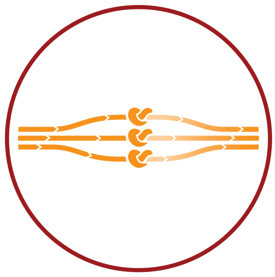
Highest average power of the load (hour value))

2,241 MW



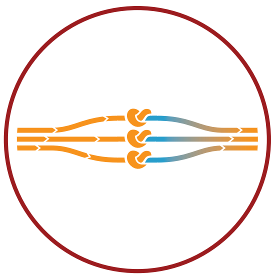
Transmission losses

360 GWh



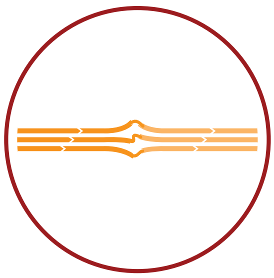
Number of grid disturbances

72



Number of grid disturbances leading to curtailment

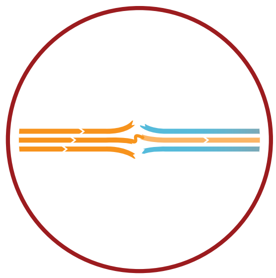
35



Number of faults

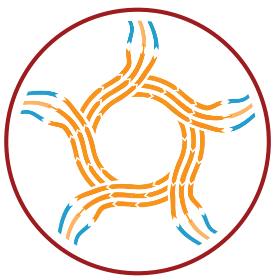
85

Five of these 85 faults were planned actions as defence of the system



Number of faults, leading to curtailment

37

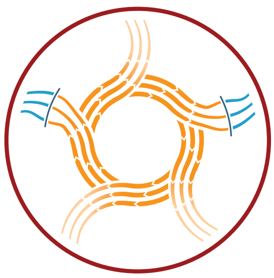


Total energy not supplied due to faults

170 MWh

Reserve fosil fuel generation due to faults

242 MWh



Total energy not supplied to users with curtailable curtailable load

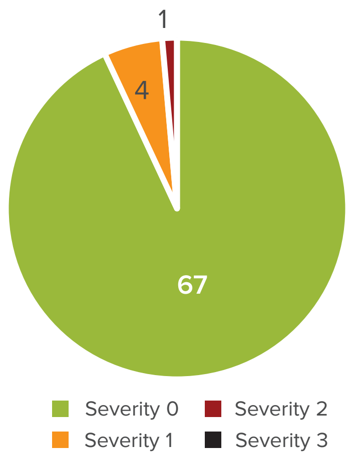
724 MWh

Security of Supply

A total of 72 disturbances were registered in 2016 with 85[3] faults, so more than one fault occurred in some of the disturbances. Energy not supplied in 2016 due to unplanned grid interruptions totalled 170[4] MWh or 5.1 outage minutes.

Energy not supplied to user of secondary energy is not included in the curtailment figures but this curtailment, which is according to supply contracts, has been increasing over the last few years and will be discussed in detail later in this chapter.

Number of Disturbances in Each Severity Class



Main disturbances in 2016:
The number of registered grid disturbances decreased by 23 between years, from 95 in the year 2015 to 72 in the year 2016. There was also a decreased number of faults from 123 in 2015 to 853 in 2016. The color indicates the severity of each incident according to Landsnet's classification[5] and the following were the main disturbances leading to curtailment:

- **4.2.2016** Severe weather with icing caused outage on Sigalda Line 4, between Sigalda and Prestbakki, and Prestbakki Line 1, between Hólar and Prestbakki. The Prestbakki Line was damaged in several locations, causing temporary power supply shortage from Prestbakki until the Sigalda Line was energized again. Energy not supplied to primary load was estimated 2 MWh.
- **15.2.2016** Mjólká Line 1, between Geiradalur and Mjólká, went out of operation for a short period. The West Fjords' smart grid immediately started the reserve power station in Bolungarvík. The line was back in operation the following day, after being repaired. Energy not supplied to primary load was estimated 0.6 MWh and to curtailable load around 247 MWh.
- **16.02.2016** Glerárskógar Line 1, between Hrútatunga and Glerárskógar, went out of operation in severe weather. The West Fjords' smart grid immediately started the reserve power station in Bolungarvík, and therefore the energy not supplied was not as much as would otherwise be expected. Energy not supplied to primary load was estimated 3 MWh and to curtailable load around 95 MWh.
- **19.02.2016** Tálknafjörður Line 1, between Mjólká and Keldeyri, went out of operation in severe weather. After several unsuccessful attempts to reenergize the line it was decided to wait until the storm had passed. The line was not damaged but energy not supplied to primary load was estimated 3 MWh and to curtailable load around 94 MWh.
- **23.2.2016** Sauðárkrókur Line 1, between Varmahlíð and Sauðárkrókur, went out of operation. After unsuccessful attempts to reenergize the line, it was found that a circuit breaker for transformer 1 in Sauðárkrókur had broken down. Energy not supplied to primary load was estimated 24 MWh and to curtailable load around 4 MWh.
- **10.03.2016** An outage occurred on the 132kV circuit breaker for transformer 1 in Öldugata in Hafnarfjörður. The outage was caused by a loose wire in the transformers differential current protection. Energy not supplied to primary load was estimated 3 MWh.
- **30.05.2016** Eyvindará Line 1, between Hryggstekkur and Eyvindará, went out of operation. The outage was caused by time mismatch in the lines' differential current protection clocks, the differential current protection was therefore disabled so the line could be reenergized. Energy not supplied to primary load was estimated 4 MWh and to curtailable load around 4 MWh.
- **03.06.2016** Mistakes were made in relation to a maintenance operation that caused all load from Þingvallastræti to Rangárvellir to fall out of service. Energy not supplied to primary load was estimated 2 MWh.
- **15.06.2016** A disturbance in a big users load system in the southwest caused power swings on the 132kV main system. The systems' protections caused a split in the system, dividing the system in two separate islands, south-west and north-east islands splitting at Blanda and Hólar. Energy not supplied to primary load was estimated 81 MWh and to curtailable load around 1 MWh.

3) Five of these 85 faults were planned actions as defence of the system.
4) Curtailments of curtailable load are not included.
5) In appendix 2 the classification of severity explained.

- **19.06.2016** Blanda Line 1, between Laxárvatn and Blanda, went out of operation. The outage was caused by a tree which was too close to one of the phases and caused a phase to ground short circuit fault. This caused power swings in the system leading to load reductions with the big consumers. Energy not supplied to primary load was estimated 28 MWh and to curtailable load around 6 MWh.
- **10.07.2016** An outage occurred on Rimakot Line 1, between Hvolsvöllur and Rimakot, and Hella Line 2, between Hella and Hvolsvöllur. A dead raven was found near the end mast of Rimakot Line 1 at Hvolsvellur and was considered likely to have caused the outage, where the outage of Hella Line 1 was unavoidable as it was at the end mast of Rimakot Line 1. Energy not supplied to primary load was estimated 5 MWh and to curtailable load around 7 MWh.
- **12.11.2016** Ólafsvík Lie 1, between Vegamót and Ólafsvík, went out of operation. The outage was caused by a broken chain that caused a fire in a conductor and damaged a mast on the line. Energy not supplied to primary load was estimated 9 MWh and to curtailable load around 17 MWh.
- **15.11.2016** A lightning struck the Búrfell Line 3, between Búrfell and Hamranes, causing some load at big consumer and curtailable load to fall out of service. The lightning also caused some communication problems that lead to an outage on Breiðidalur Line 1, between Mjólká and Breiðidalur. This resulted in a temporary blackout in the north part of the West Fjords until the West Fjords' smart grid started the reserve power station in Bolungarvík. Energy not supplied to primary load was estimated 42 MWh and to curtailable load around 6 MWh.

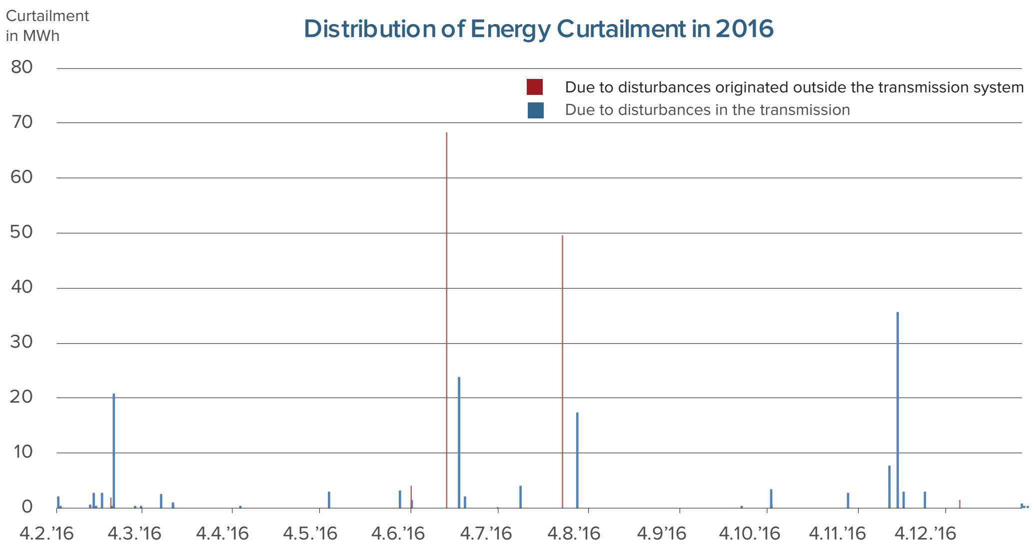


Figure 1.

In accordance with Regulation No. 1048/2004, on the quality of electricity and security of supply, Landsnet's security of delivery is assessed on the basis of the following indexes. Landsnet is under obligation to establish goals for itself as regards the first three:

1) Power Interruption Index (SRA)
2) Average Outage Duration Index-Outage Minutes (SMS)
3) System Minutes (KM)
4) Power Energy Curtailment Index (SSO)
5) Power Supply Average Curtailment per Disturbance (SMA)
6) Index of Reliability (AS)

These indexes have been calculated for 2016 and are discussed below. Moreover, a comparison will be made with the past 10 years. The calculations of the indexes include all grid disturbances in the transmission system.

The origin of the grid disturbances is indicated in the following figures, showing whether they are in Landsnet's system or originate in the systems of other utilities that have an effect on Landsnet's system. These may involve grid disturbances in the systems of energy producers and energy users.

Power Interruption Index (SRA)

The Power Interruption Index for 2016 is 0.39. Landsnet's goal of 0.85 was achieved in 2016. Figure 2 shows the transmission system's Power Interruption Index over the past 10 years.

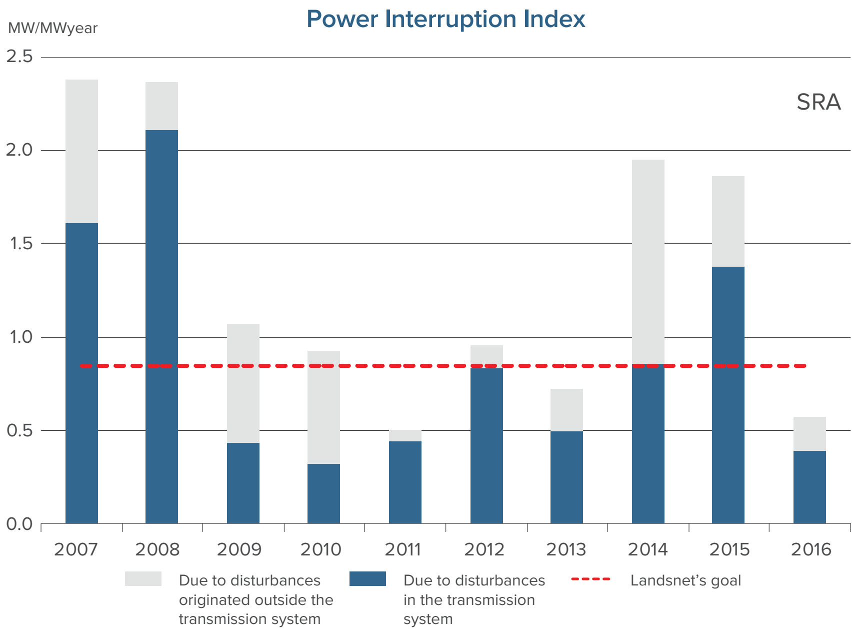


Figure 2.

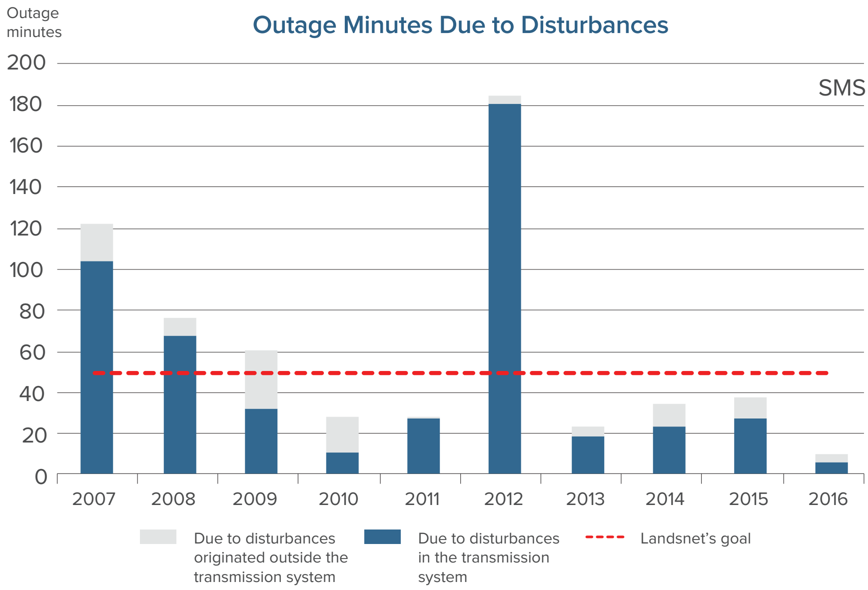


Figure 3.

Average Outage Duration Index - Outage Minutes (SMS)

Outage minutes have hitherto been one of the main indicators of the transmission system's security of supply. Over the past few years, Landsnet's goal has been to ensure that outage minutes do not exceed 50 minutes per year. Outage minutes in 2016 were 5.1 minutes and the goal therefore achieved as this is the lowest value over the last decade, as can be seen in Figure 3. Unsupplied energy from the transmission system caused by disturbances in other systems, such as generation systems, distribution systems or by major users, are not included in the main results for the transmission system. Nevertheless, a proportion of these curtailments are shown separately in the figures. Energy not supplied to curtailable load is not included in these system minutes, but the result for curtailable load is shown in a separate chapter of this report.

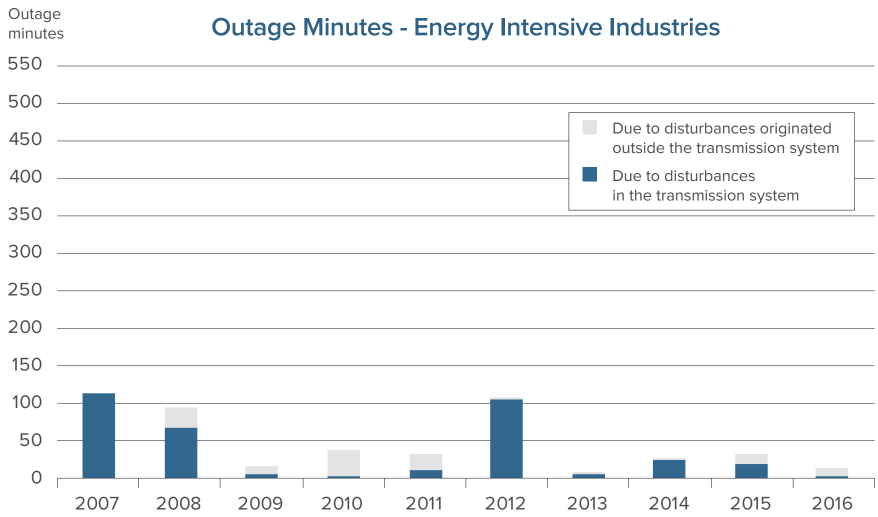


Figure 4.

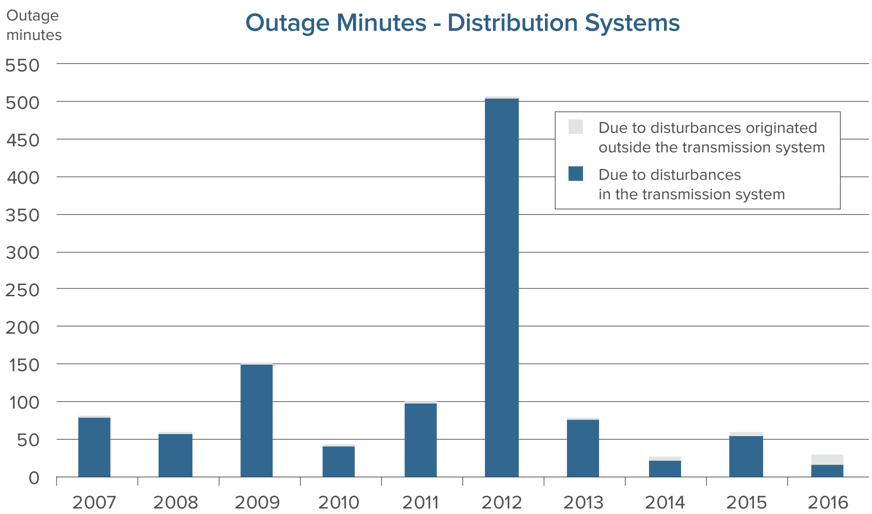


Figure 5.

Figures 4 and 5 show outage minutes calculated for power-intensive industries on the one hand and distribution systems on the other. As the figures show, outages to power-intensive industries due to disturbances in the transmission system were few in 2009 to 2011. They increased in 2012 and decreased again in 2013 and have been few since then. Outage minutes calculated for delivery to distribution utilities have decreased significantly from the year 2012. Figure 6 shows the division of outage minutes according to the causes of disturbances.

Figure 7a shows how many curtailment cases are within determined time limits. The first column shows the number of curtailment instances lasting between 0-3 minutes, the next column shows the number of curtailment instances lasting between 3-30 minutes, etc. The comparison with the 10-year period is shown in Fig. 7b.

Tables 1 and 2 show the curtailment and calculated duration of outages for customers owing to grid disturbances in Landsnet's transmission system in 2016. The outage time is calculated from the ratio of unsupplied energy and energy sales to each customer over the year. The year 2015 is shown for comparison.

Customer, primary energy	**2016**						**2015**					
	No. of events		**Unsupplied energy**		**Outage duration**		**No. of events**		**Unsupplied energy**		**Outage duration**	
	LN syst.	Other syst.	LN syst.	Othe syst.	LN syst.	Total	LN syst.	Other syst.	LN syst.	Othe syst.	LN syst.	Total
	(No.)	*(No.)*	*[MWh]*	*[MWh]*	*[d hh:mm]*	*[d hh:mm]*	*(No.)*	*(No.)*	*[MWh]*	*[MWh]*	*[d hh:mm]*	*[d hh:mm]*
Power-intensive industries, total	9	3	14.133	80.583	0 00:05	0 00:08	27	4	705.2	116.5	0 00:25	0 00:30
HS Veitur, primary energy	2	0	7.319	0	0 00:06	0 00:06	9	5	72.5	68.4	0 01:14	0 02:25
Norðurorka, primary energy	2	0	1.682	0	0 00:07	0 00:07	4	0	34.1	0.0	0 03:06	0 03:06
Orkubú Vestfjarða, primary energy	36	0	14.969	0	0 00:59	0 00:59	46	2	67.1	10.4	0 05:42	0 06:35
Orkuv. Reykjavíkur, primary energy	1	0	3.397	0	0 00:01	0 00:01	2	0	6.1	0.0	0 00:02	0 00:02
RARIK, primary energy	0	0	73.588	0	0 00:32	0 00:32	78	6	176.2	4.9	0 01:50	0 01:53
Rafv. Reyðarfjarðar, primary energy	0	0	0	0	0 00:00	0 00:00	0	0	0.0	0.0	0 00:00	0 00:00

Table 1: Interruptions affecting individual customers due to grid disturbances, primary load.

Customer, secondary energy	**2016**						**2015**					
	No. of events		**Unsupplied energy**		**Outage duration**		**No. of events**		**Unsupplied energy**		**Outage duration**	
	LN syst.	Other syst.	LN syst.	Othe syst.	LN syst.	Total	LN syst.	Other syst.	LN syst.	Othe syst.	LN syst.	Total
	(No.)	*(No.)*	*[MWh]*	*[MWh]*	*[d hh:mm]*	*[d hh:mm]*	*(No.)*	*(No.)*	*[MWh]*	*[MWh]*	*[d hh:mm]*	*[d hh:mm]*
HS Veitur	3	0	7.519	0	0 00:34	0 00:34	8	4	0.0	0.0	0 00:00	0 00:00
Norðurorka	1	0	0.071	0	0 00:02	0 00:02	2	1	0.0	0.0	0 00:00	0 00:00
Orkubú Vestfjarða	49	0	682.159	0	2 10:15	2 10:15	78	3	0.0	0.0	0 00:00	0 00:00
Orkuveita Reykjavíkur	0	0	0	0	0 00:00	0 00:00	0	2	0.0	0.0	0 00:00	0 00:00
RARIK	0	1	35.09	0.827	0 01:40	0 01:42	42	10	0.0	0.0	0 00:00	0 00:00

Table 2: Interruptions affecting individual customers due to grid disturbances, curtailable load.

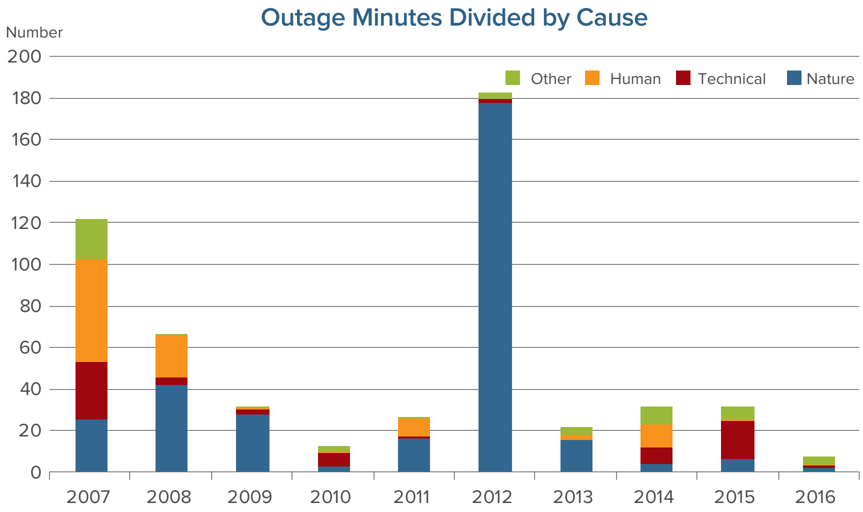


Figure 6.

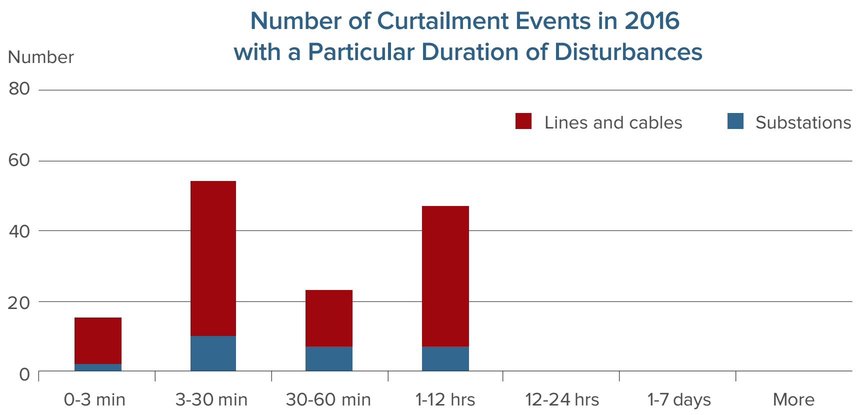


Figure 7a.

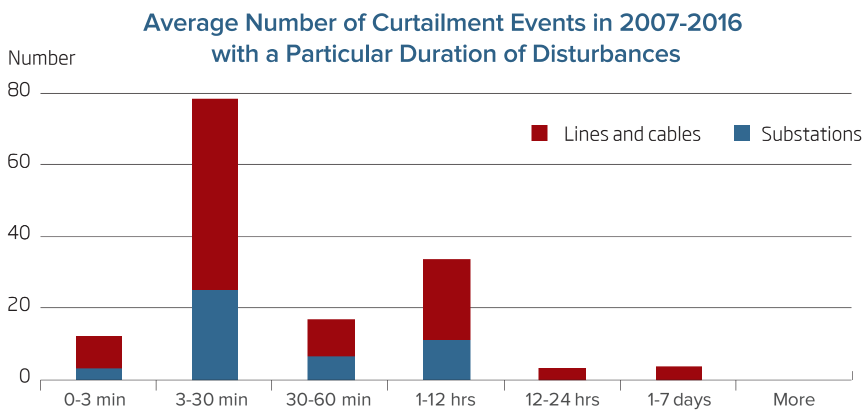


Figure 7b.

System Minutes (KM)

The System Minutes Index shows how serious each case is. The severity of each case is categorised as follows:

Category 0, instances are < 1 min

Category 1, instances are ≥ 1 and < 10 min

Category 2, instances are ≥ 10 and <100 min

Category 3, instances are ≥ 100 and <1000 min

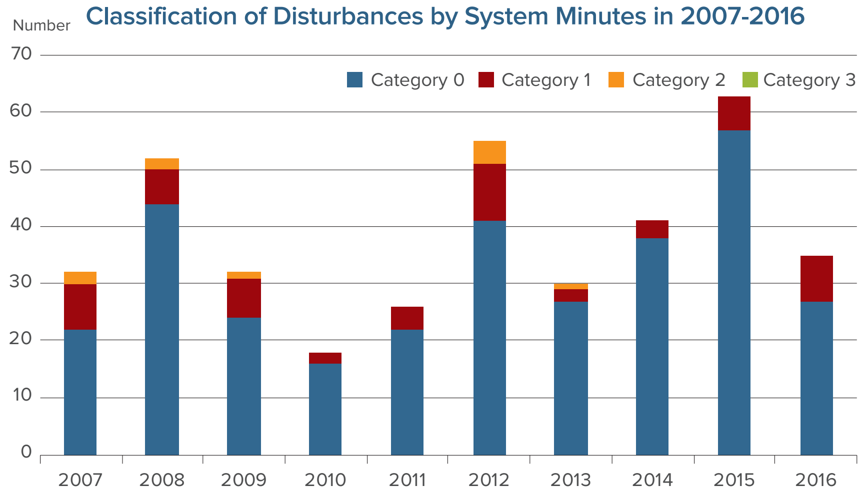


Figure 8.

Landsnet's goal is to ensure that no grid disturbance lasts more than 10 system minutes. This goal has been achieved in the years 2014-2016. Figure 8 shows the division of system minutes into the above categories over the past 10 years.

Figures 9-11 show the indexes that the National Energy Authority (is. Orkustofnun) has decided that Landsnet must measure. No requirements, however, are made for specific goals for these indexes.

Power Energy Curtailment Index (SSO)

The Power Energy Curtailment Index measures curtailed energy delivery, which is the ratio of energy curtailment if the power had been unchanged during the entire curtailment period and the total power in the system.

Power Supply Average Curtailment per Disturbance (SMA)

The Power Supply Average Curtailment per Disturbance Index measures the average curtailment of load, which is an indicator of the average curtailment in each disturbance.

Index of Reliability (AS)

The Index of Reliability shows the reliability of the system as a proportion of the number of curtailed hours during the year.

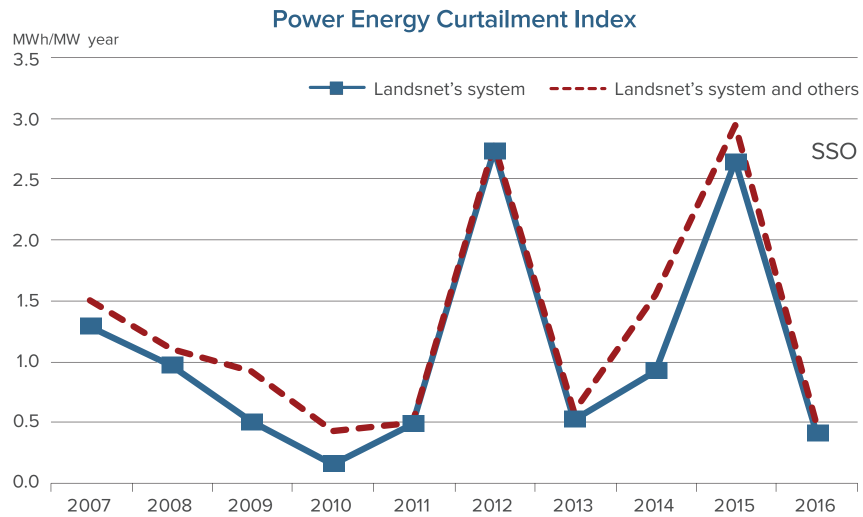


Figure 9.

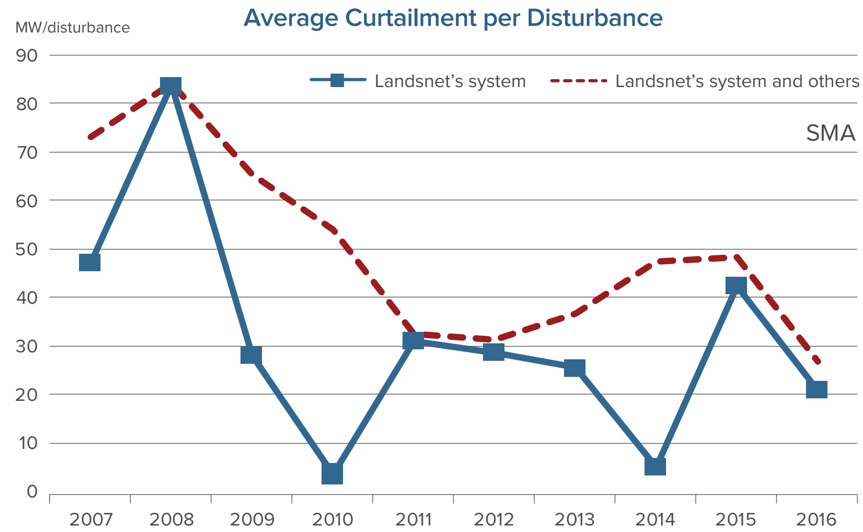


Figure 10.

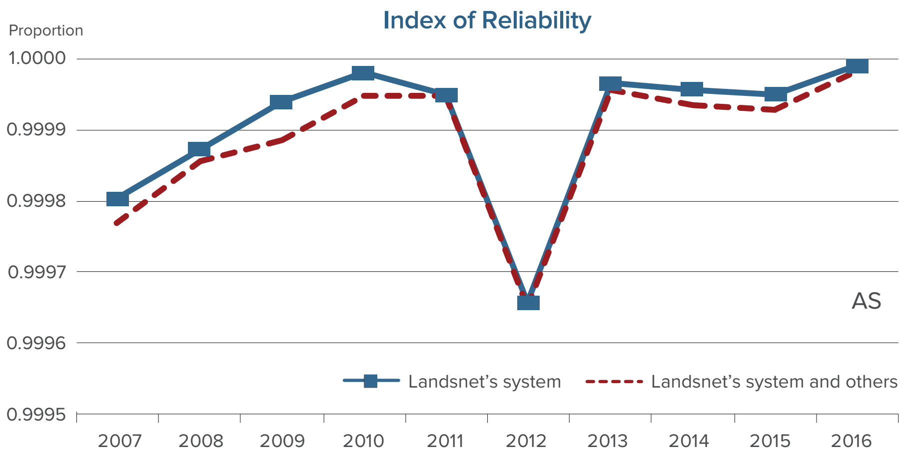


Figure 11.

Energy Curtailment to Customers with Curtailable Load

Landsnet has agreements with several customers that allow curtailment of the customers' load in case of troubles in the operation of the transmission system, according to grid code B5 article 5.1. This load is called curtailable load.

With increased load on the transmission system the curtailments of curtailable load has increased significantly in the last few years. These curtailments are either based on a request from Landsnet's control centre or done automatically with circuit breakers. In recent years, Landsnet has set up automatic tripping of curtailable load to increase operational security and to get a better utilization of the transmission system. Curtailments of curtailable load has increased by 98% in the years 2013-2015 but decreased in the year 2016, due to both good weather and less demand from these users.

The estimated curtailment of curtailable load in the year 2016 is 724 MWh. This curtailment corresponds to 22 system minutes and if the agreement on curtailable load did not exist the system minutes of the transmission system would have increased by the same amount in 2016.

Figure 12 shows the amount of curtailment of curtailable load over the last 4 years, as a result of disturbances in the transmission system.

Energy Produced by Backup Power Stations

In areas where the transmission or distribution system is weak, utilities have installed backup power plants to secure supply to end users. Landsnet has access to these power stations and they are used to feed primary load in disturbances and during system maintenance.

Since it can take some time to start up these power generators, there will usually be some curtailment of primary load in disturbances although reserve generators are available. In the West Fjords, Landsnet has set up a new backup power station that starts automatically within 90 seconds.

Electricity generation by these backup power stations due to transmission disturbances decreased significally in 2016 compared to the three years before when it increased by 96%. Electricity generation by these backup power stations amounted to 242 MWh in the year 2016. If Landsnet did not have access to these backup power stations, the system minutes of primary load would have been 12 minutes in year 2016, instead of 5, a total increase of 7.3 minutes.

Figure 13 shows the electricity generation by backup power stations because of disturbances in the transmission system.

Summary of Supply from the Transmission Net

With the increased load in the transmission system, the generation by backup power stations has increased significantly as well as the curtailments of curtailable load. There are many examples of how smart grid solutions and rapid response of the Landsnet control centre have been able to minimize or prevent curtailments of primary loads. Landsnet's targets of delivery in 2016 were achieved.

In Table 2 and Figure 14 electricity generation of reserve power stations and load curtailments are shown in system minutes. This showcases the influence of these two factors on the transmission system security of supply. It also shows what the result would be if there were no access to backup power or if there were no curtailable power. The system minutes would be 34 minutes instead of the 5 minutes measured for the year 2016.

	MWh	SMS in min.
Curtailment of primary load	169.5	5.1
Generation in other backup power stations	242.4	7.3
Curtailment of curtailable load	724.0	21.8
Total	1,135.9	34.2

Table 3: Curtailment of primary and secondary load and power produced in backup station in the year 2016, mesuerd in energy and in system minutes.

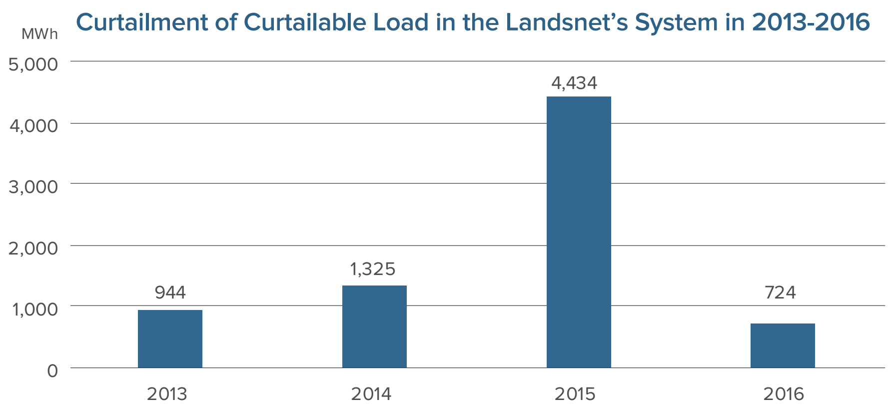


Figure 12.

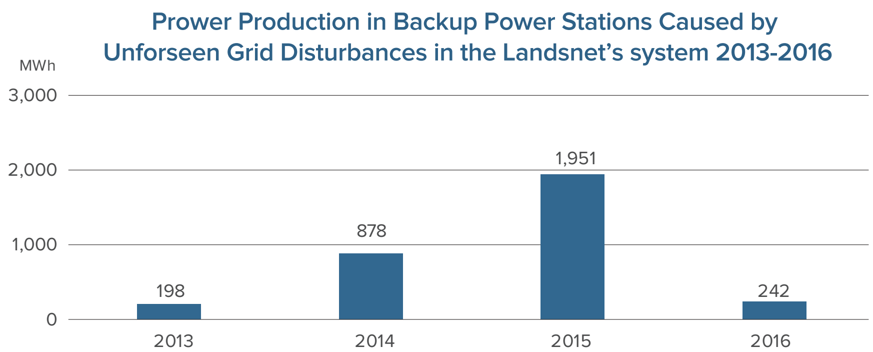


Figure 13.

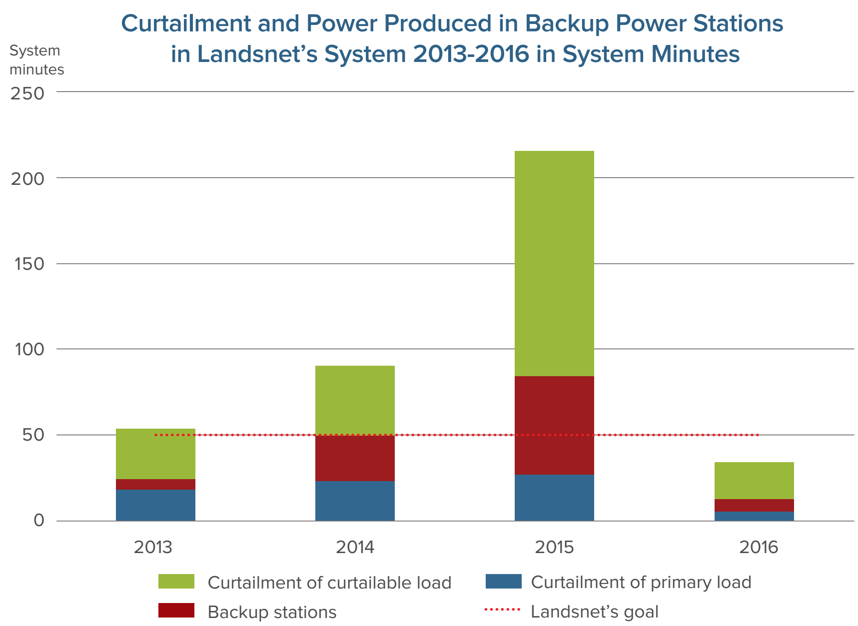


Figure 14.

System Minutes by Regions

Our security of supply to general consumers varies between regions. The security is highest in the Southwest where power outages are not common, or an average of 7 minutes per year in the last 5 years. The West Fjords have the lowest security of supply and power outages there were on average 1,800 minutes per year over the past 5 years. Second lowest is the West with 600 minutes on average per year over the past 5 years. Figures 15 and 16 show that the outage minutes vary widely by region and years, as one big outage may distort the picture substantially.

Countrywide outage minutes for general priority consumers are greater than power outages minutes of general consumers as well as large-scale consumers, as shown in Figure 16.

Figures 17-24 show outage minutes for distribution consumers in each region over the last 5 years. The year 2012 was a difficult operational year with many large disruptions throughout the country, as can be seen clearly in these figures. Another point of interest is that outage minutes in the West Fjords have decreased over the past 3 years, thanks to the smart grid functionality and backup generators located in Bolungarvík.

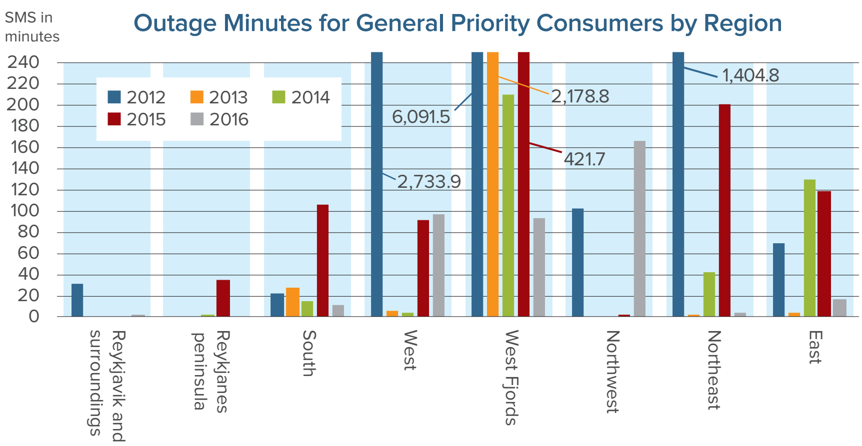


Figure 15.

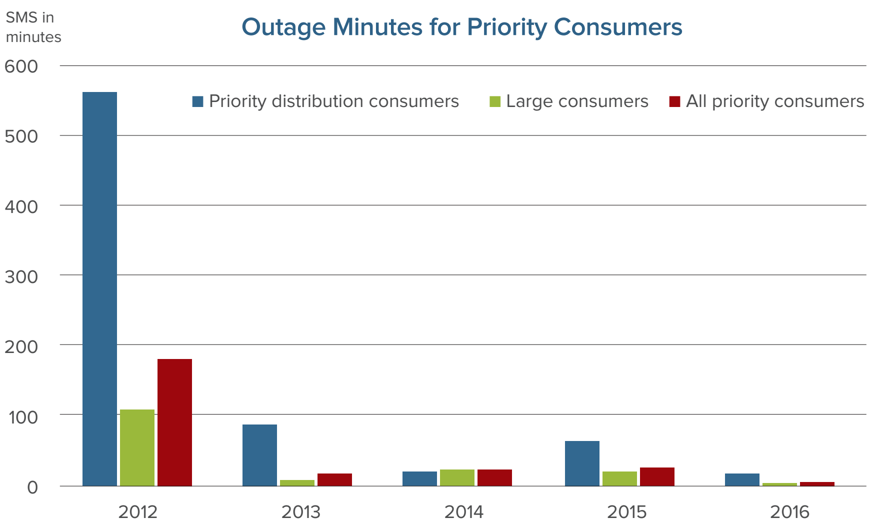


Figure 16.

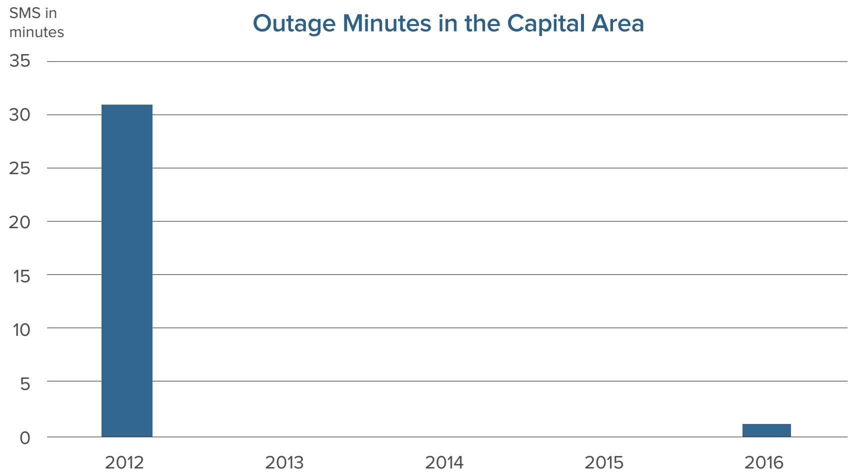


Figure 17.

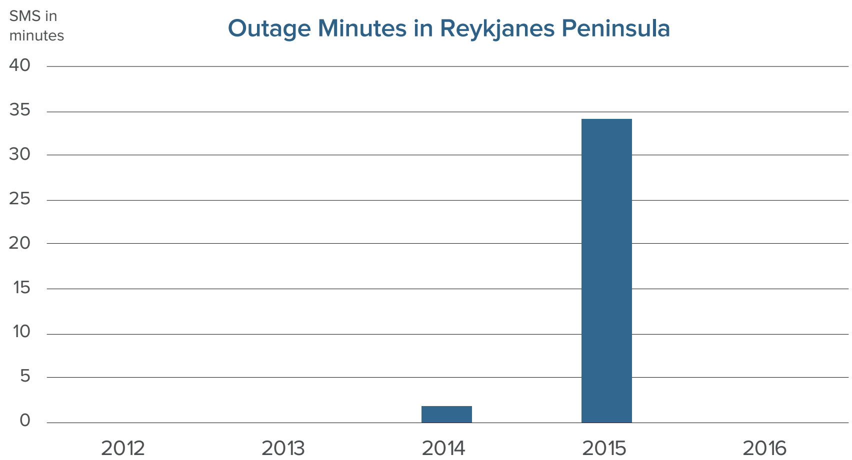


Figure 18.

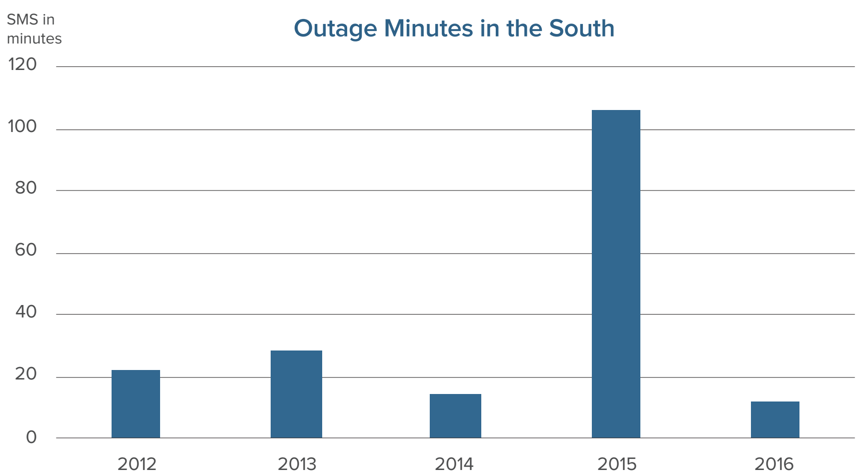


Figure 19.

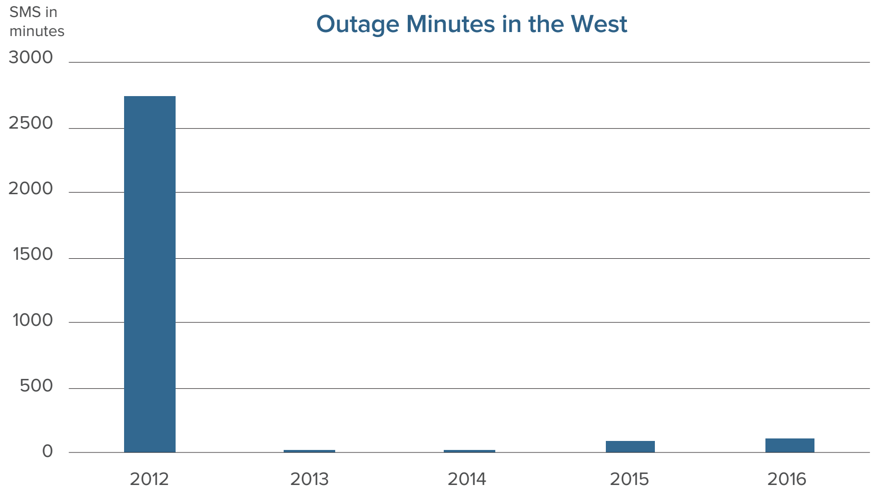


Figure 20.

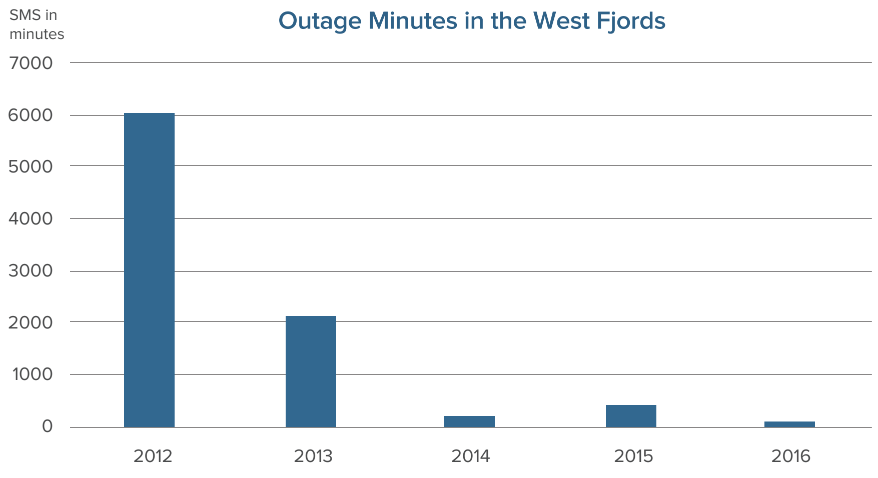


Figure 21.

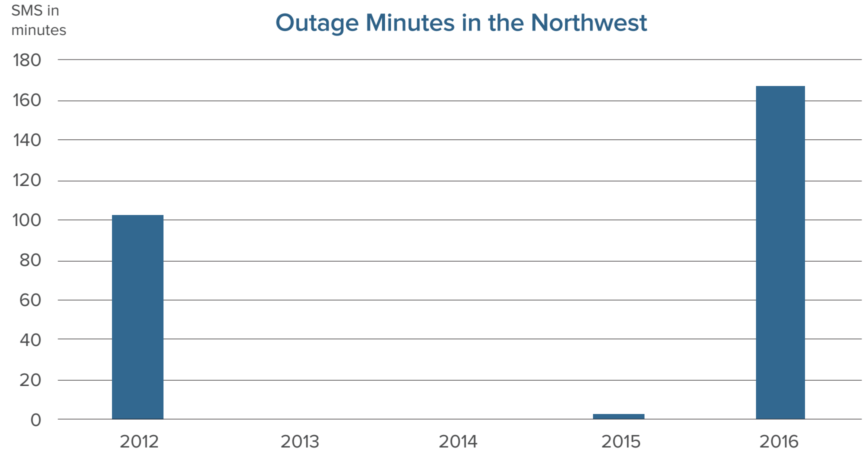


Figure 22.

This section has been removed due to errors in the calculation of macroeconomic costs, based on information and data from the Start Group (a workgroup focusing on operational disturbances: www.truflun.is).

A review is currently underway.


ABB

Grid Disturbances

A grid disturbance is an unexpected event that can cause automatic or manual disconnection of a unit in the transmission system or in the event of a failed reconnection after a malfunction. Each grid disturbance may therefore involve more than one fault. This means that the number of faults will always be equal to or greater than the number of grid disturbances. On registering grid disturbances each fault is classified, e.g. according to type, unit that caused the failure and the cause.

There were fewer grid disturbances in 2016 than in the preceding year, or a total of 72 disturbances that involved 85[7] faults. The average number of grid disturbances over the last 10 years, for the same size of transmission system, is 67, involving 81 faults.

Figure 26 shows the number of grid disturbances in the transmission system over the past 10 years. The figure shows the division of cases according to the location of the disturbance, i.e. in substations, on lines/cables or whether system disturbances are involved. Figure 27 shows the division of grid disturbances by cause.

System disturbance is defined as follows:

A forced outage which result from system effects or conditions and is not caused by an event directly associated with the component or unit being reported. If, e.g., voltage fluctuations or deviations in frequency cause units to disconnect from operation or if users are disconnected for such reasons, then the event is a system disturbance. However, a non-selective tripping at the customer for these reasons are not considered system malfunctions.

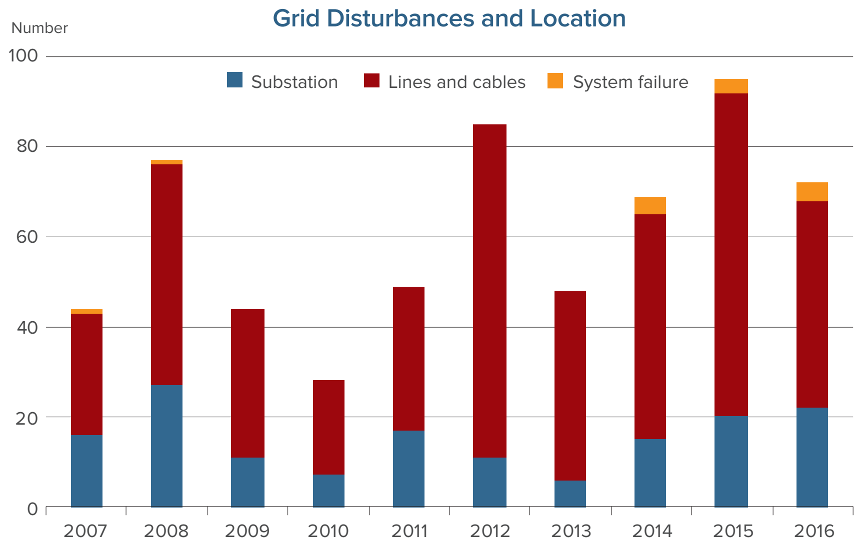


Figure 26.

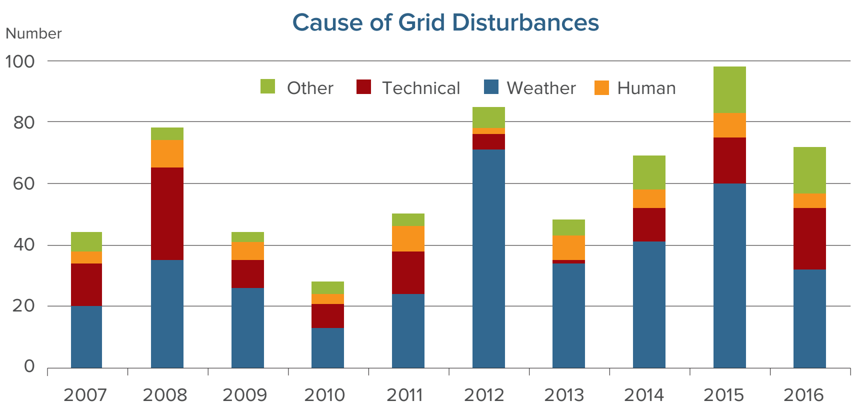


Figure 27.

7) Five of these 85 faults were planned actions as defence of the system

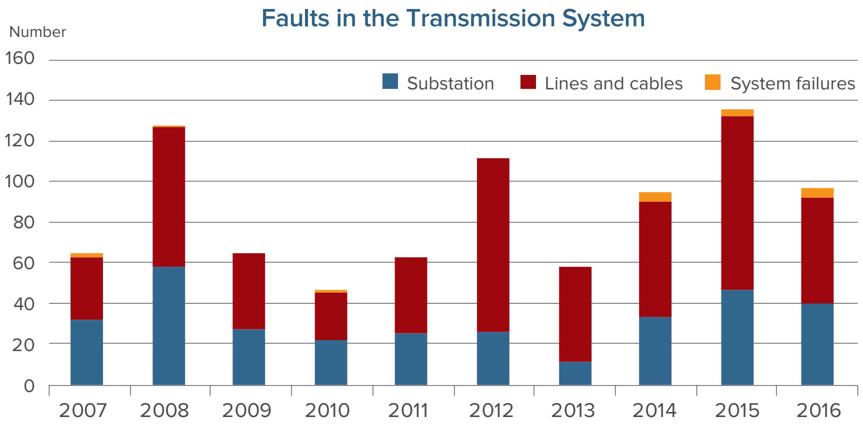


Figure 28.

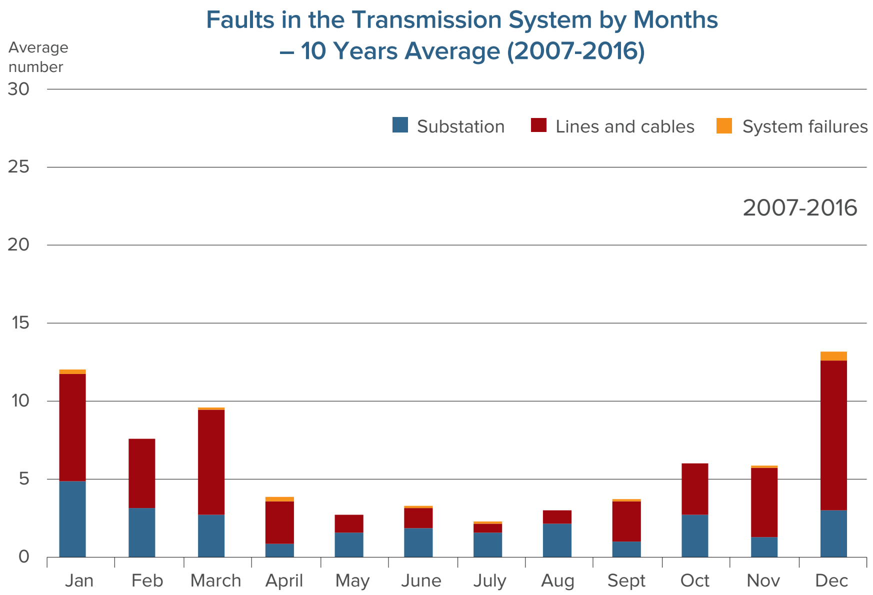


Figure 29.

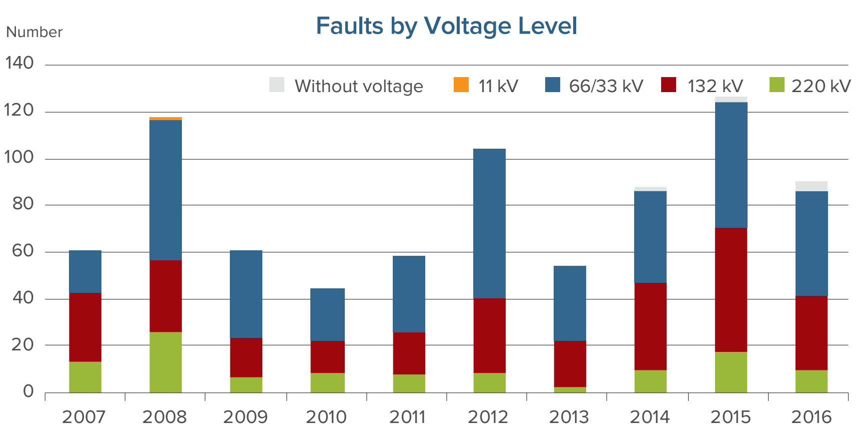


Figure 30.

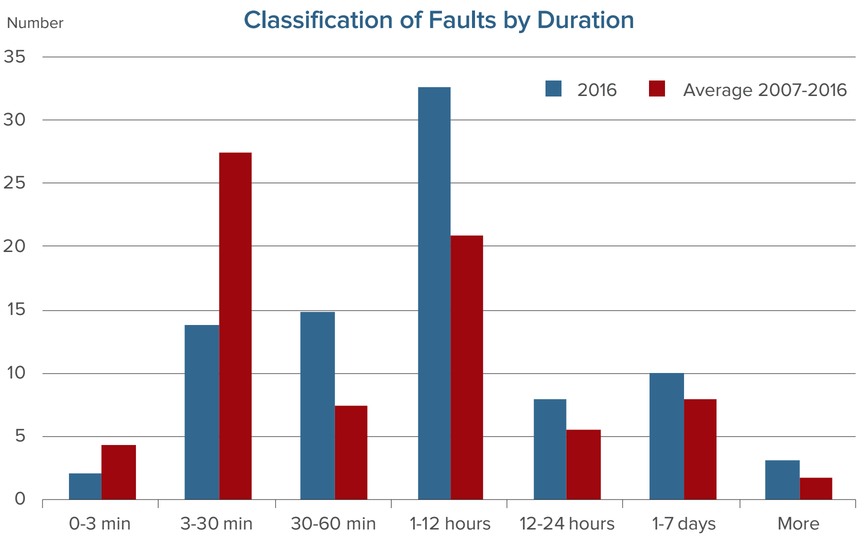


Figure 31.

Number of Faults

Unexpected faults in the year 2016 were 85[8] but were 123[9] the year before. The following figures show the number of faults for the last 10 years, and their comparison in different categories.

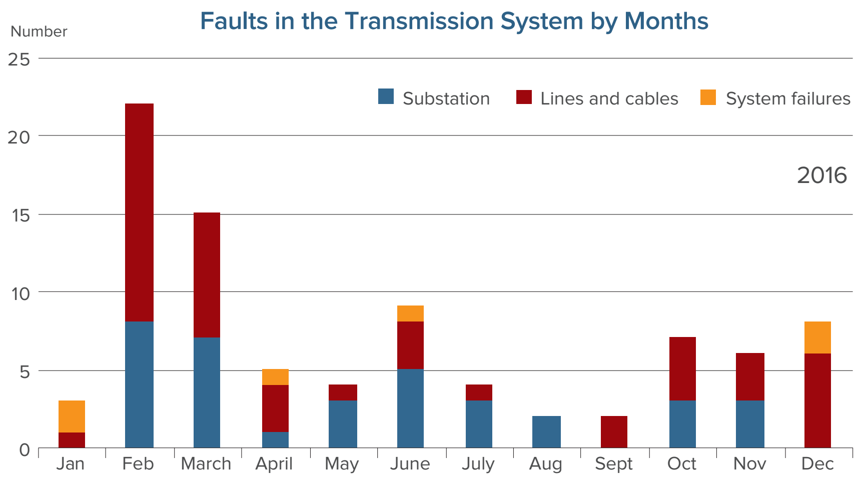


Figure 32.

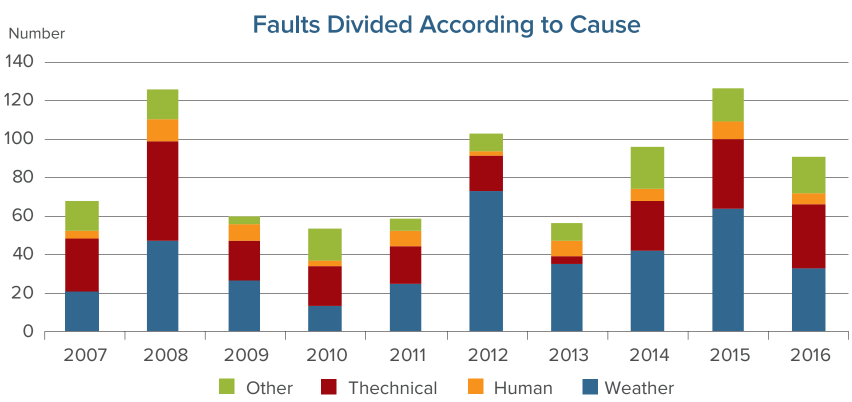


Figure 33.

8) Five of these 85 faults were planned actions as defence of the system.
9) This number has been corrected from an earlier error in the 2015 Performance Report.

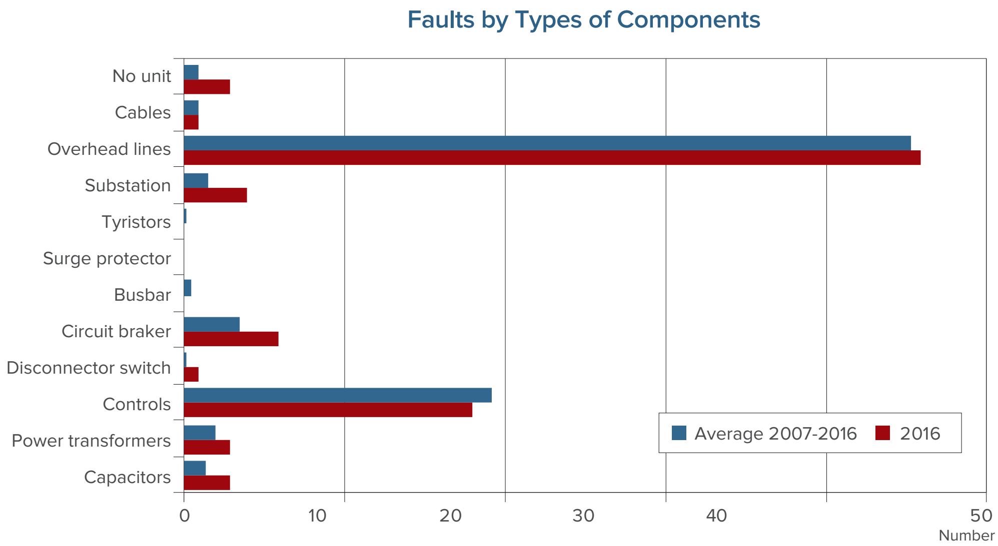


Figure 34.

Faults in Substations

There were 35 unexpected faults in substations in 2016. They are divided between stations as shown by Figure 36. The 10-year average is also shown for comparison. Figure 35 shows the causes of faults in substations, as compared with the 10-year average.

Included in the number of faults are also registered failures where control- and auxiliary- equipment is functioning as was expected. Five such failures are included in the number for 2016; one fault is recorded at Blanda when a busbar splitting was enabled, three when Breiðdalslína 1 was taken out due to a disturbance in the West Fjords, and one was registered at Fljótsdalur when Kárahnjúkar and Reyðarál were isolated from the system.

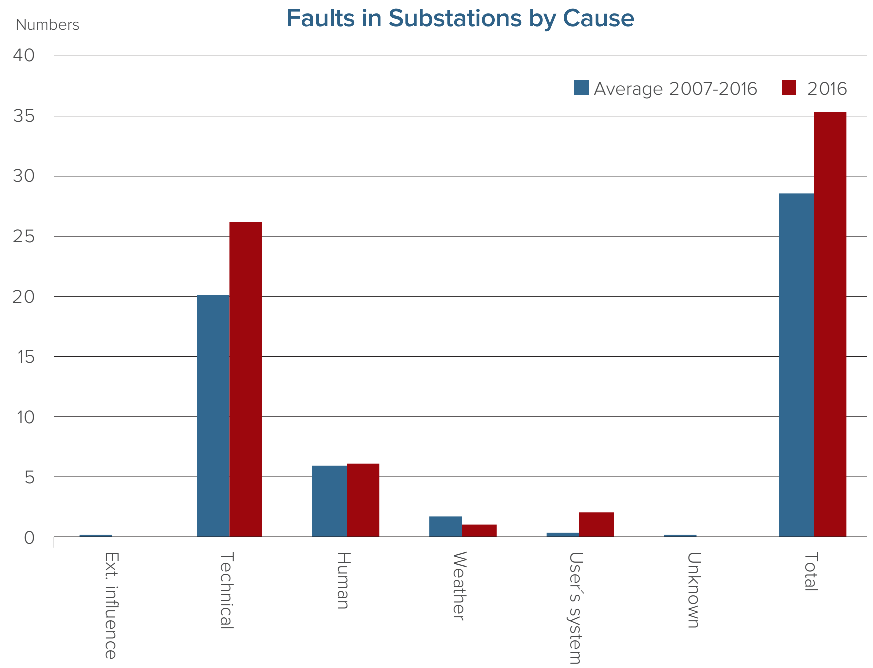


Figure 35.

Division of Faults by Substations

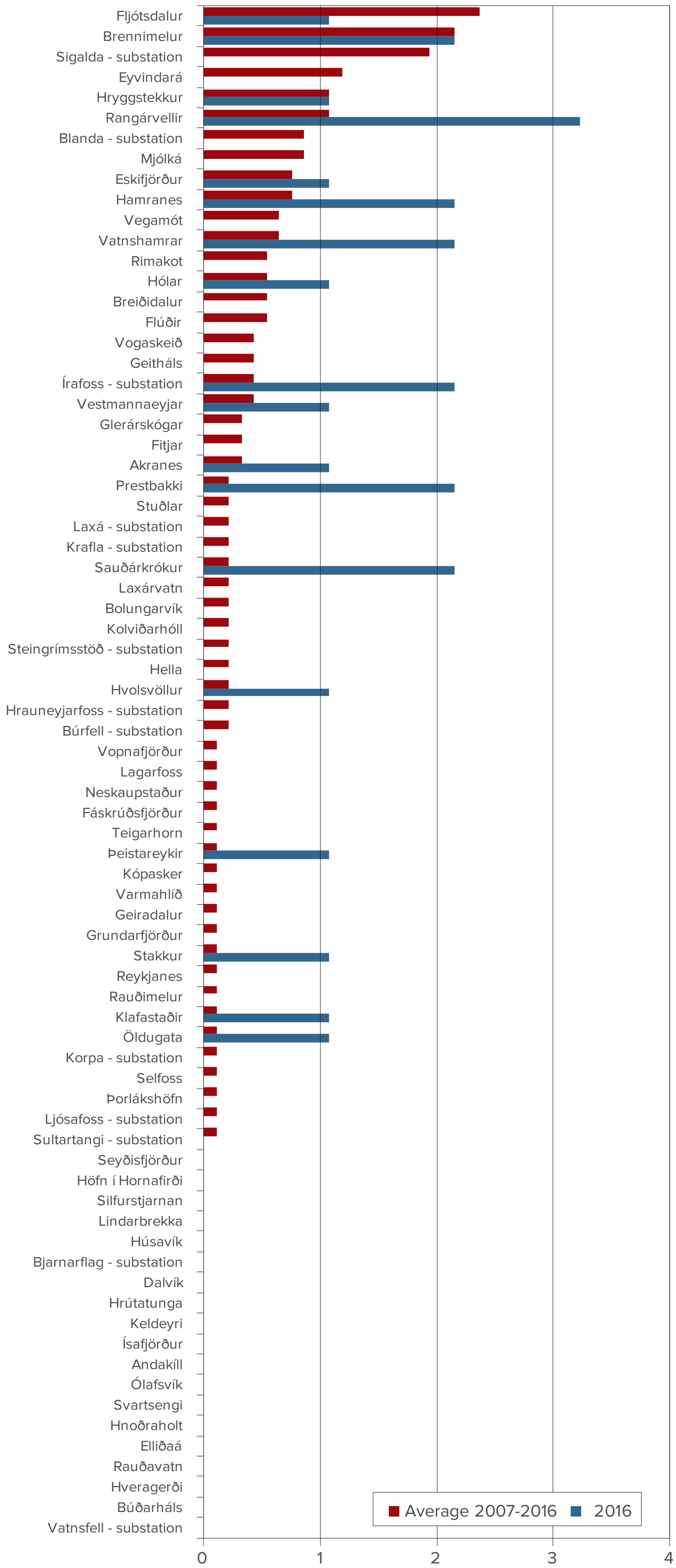


Figure 36.

Faults in Lines and Cables

There were 46 unexpected faults in overhead lines and cables in 2016. The corresponding number for 2015 is 110. These faults are divided between operating voltage as shown in Figure 37. Figure 38 shows the cause of line faults in 2016, with the 10-year average shown for comparison. Figures 39 to 41 show the average number of faults per year for every 100 km over the past 10 years.

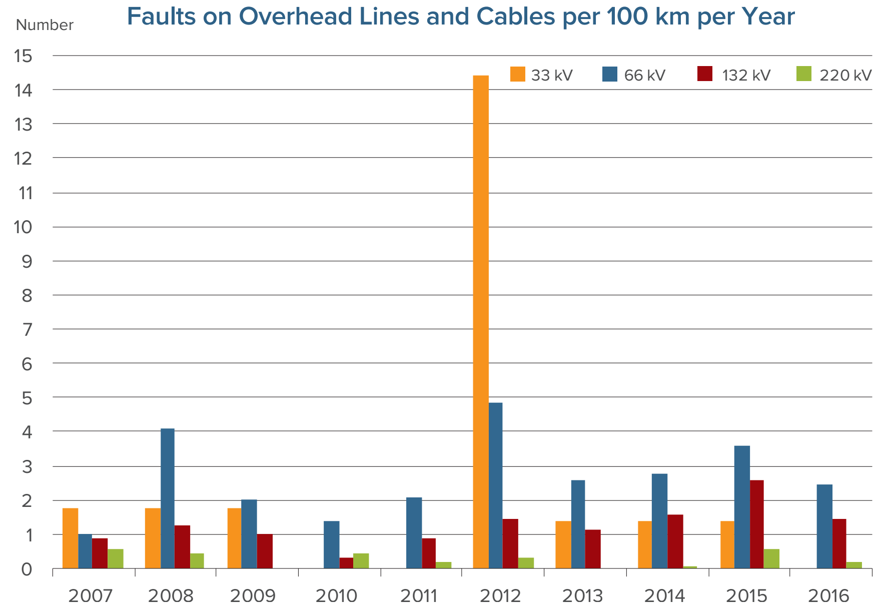


Figure 37.

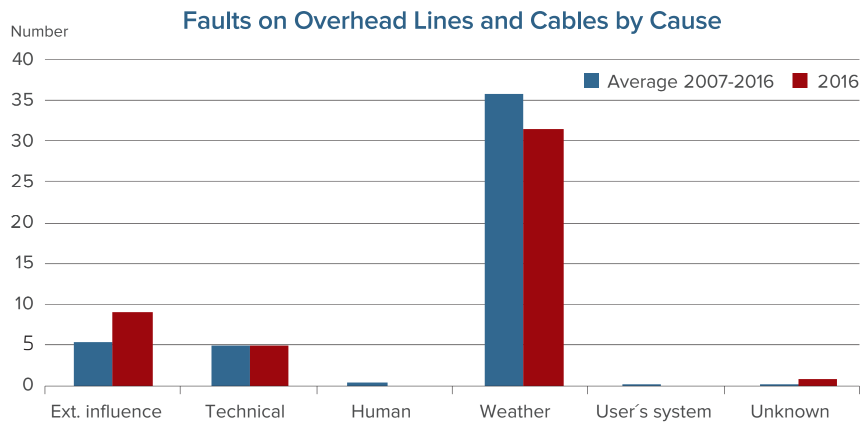


Figure 38.

Average Number of Faults per Year on 220 kV Lines per 100 km (2007-2016)

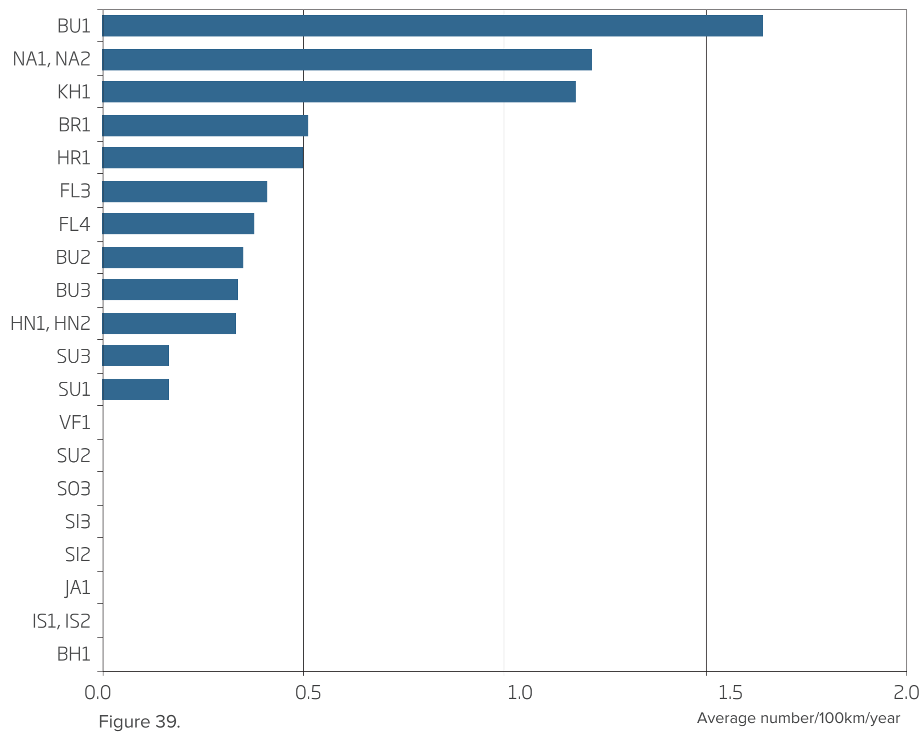


Figure 39.

Average Number of Faults per Year on 132 kV Lines per 100 km (2007-2016)

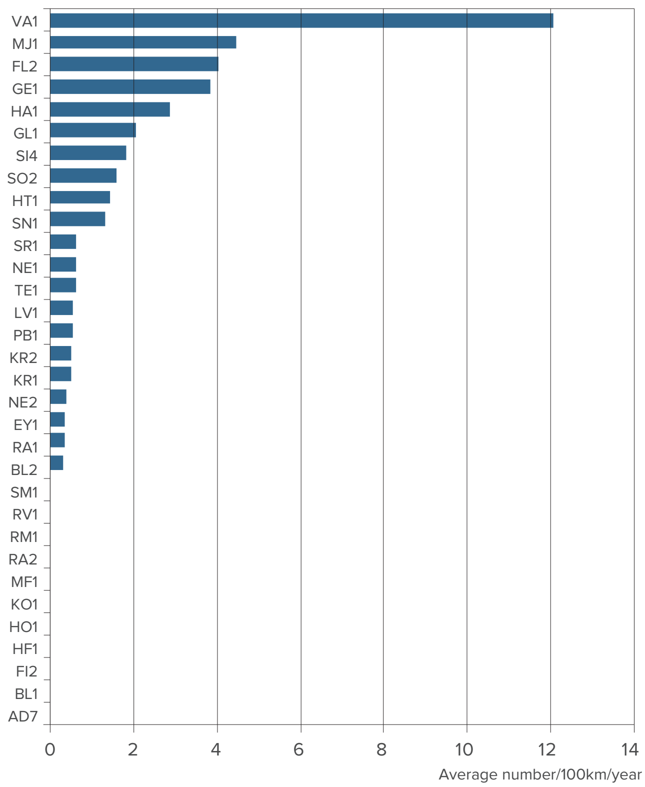


Figure 40.

Average Number of Faults per Year on 66 kV Lines per 100 km (2007-2016)

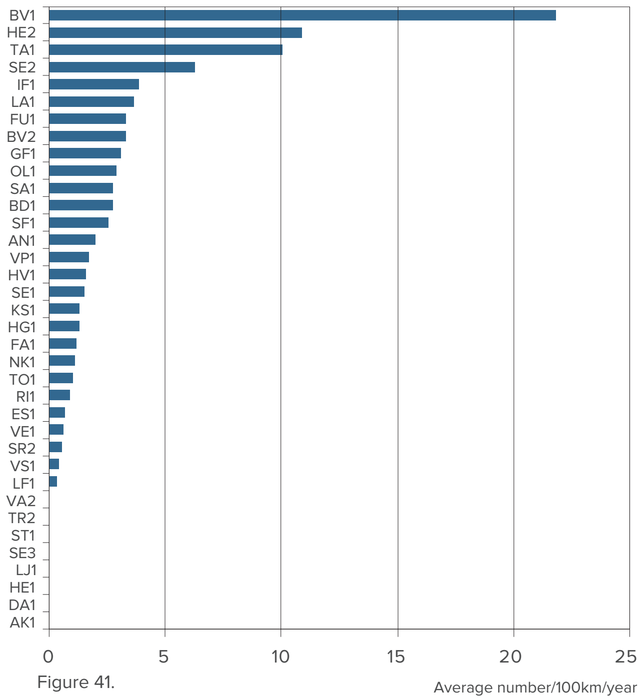


Figure 41.


Islandia
165 MVA
Q01
F11
F12
F13
F14
Q02
F21
F22
F61
F62
F63
F64
F65
F66
F67
F68
F69
F70
S31
S33
S32
S34
S52
X03
S71
S72
S75
S77

Voltage and Frequency Quality

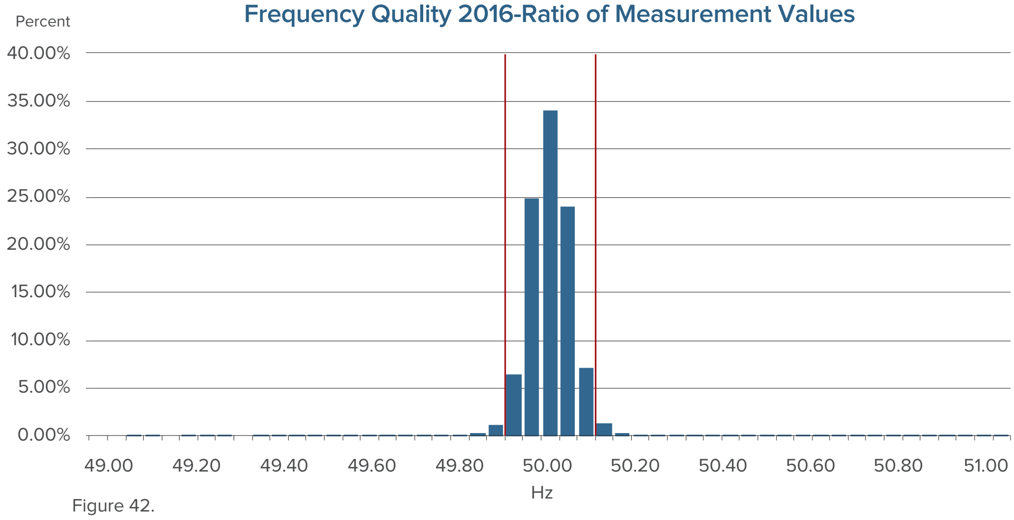


Figure 42.

Frequency

According to the regulation on the quality of electricity and security of supply, the following requirements on frequency in the electrical system apply:

System frequency shall be 50 Hz. Under normal operating conditions, the average operating frequency measured over 10 seconds must be within the following limits:

50 Hz ± 1% (ie. 49.5-50.5 Hz) 99.5 % of the time.

50 Hz +4 / -6% (ie. 47-52 Hz) 100% of the time.

The total time where frequency exceeded the 1% limit in 2016 is as follows:

>50.5 Hz = 13.5 minutes (0.00295% of the time)

<49.5 Hz = 3.7 minutes (0.0008% of the time).

According to this, the frequency was within limits 99.9962% of the time, thereby meeting the requirements.

In addition, Landsnet has set itself internal goals regarding frequency quality:

The goal is to ensure that 99.5% of measurement values are within limits that are 50 Hz +/- 0.2 Hz in every month. A 10-second average value is used. In 2016, frequencies were within these limits for 11 months of the year, but not in October. Still, the yearly was within the limits, or 99.66%.

Voltage

According to the Regulation on the quality of electricity and security of supply No. 1048/2004, electricity companies must measure voltage characteristics in accordance with the ÍST EN 50160 standard. Landsnet is under obligation to take sample measurements from at least 6 delivery stations each year. Special sample measurements were taken in 2016, using precise quality measuring instruments, at the following delivery points:

Eyvindará, 66 kV
Hrútatunga, 132 kV
Neskaupstaður, 66 kV
Rangárvellir, 66 kV
Stakkur, 132 kV
Vatnshamrar, 66 kV

Measurements were taken continuously for at least one week at each location. Quality requirements were met at all points. Figures 43-50 show the voltage values for delivery points in the transmission system. An examination was made of the distribution of 5-minute values in all cases. The measurements are taken from the energy management system.

According to the Regulation, delivery voltage must be within defined limits, which are ±10%. More stringent requirements are made to delivery voltage for power-intensive industries. In such cases, the limits of delivery voltage have been defined as +5% / -9%. These limits, therefore, are taken into account when the 220kV system is assessed. Results show that the delivery voltage was within the range everywhere except in the West Fjords, specifically in Bolungarvík and Ísafjörður. The voltage level in these places exceeded the lower limits which can be traced back to disturbances or maintenance of substations.

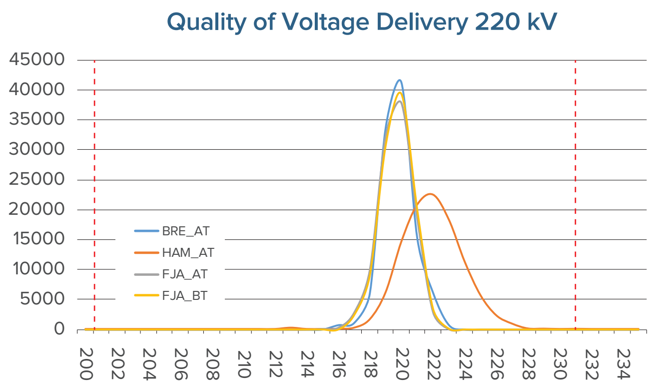


Figure 43.

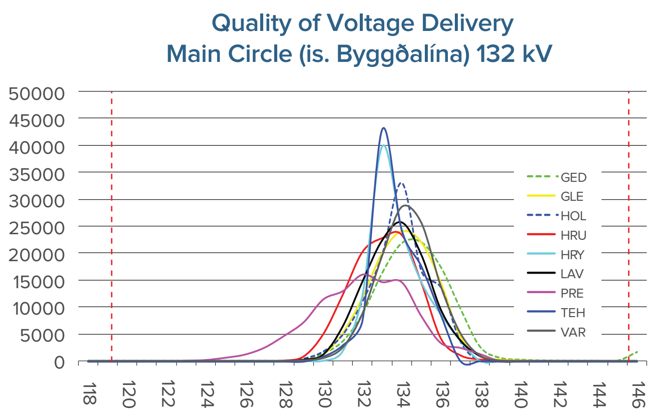


Figure 44.

Quality of Voltage Delivery
Southwest 132 kV

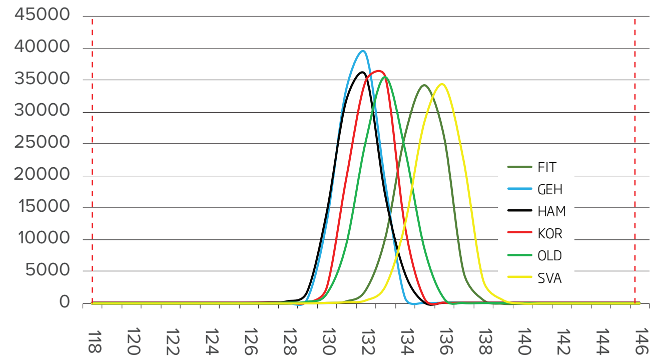


Figure 45.

Quality of Voltage Delivery
West 66 kV

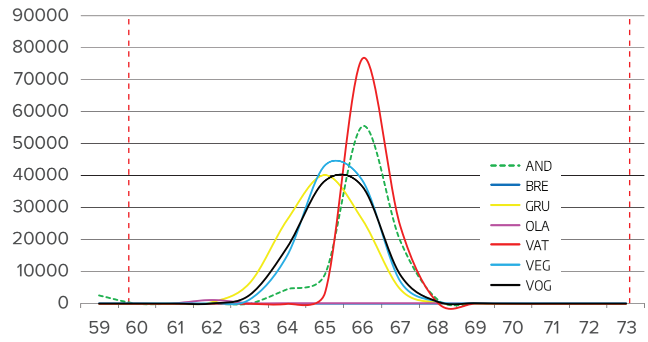


Figure 46.

Quality of Voltage Delivery
The West Fjords 66 kV

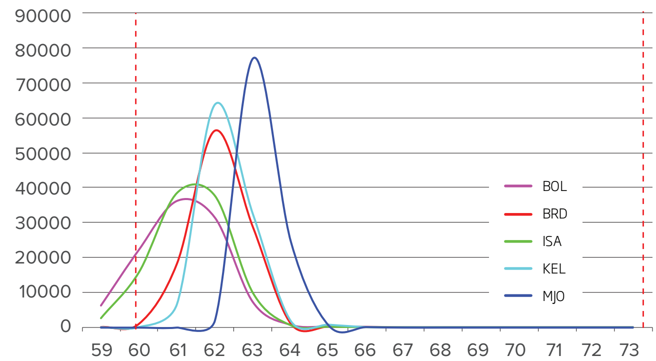


Figure 47.

Quality of Voltage Delivery
North 66 kV

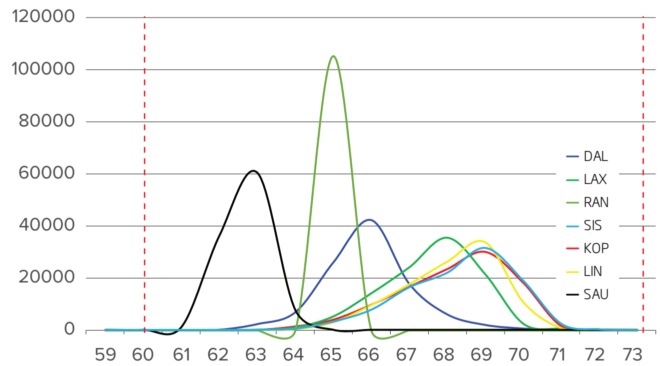


Figure 48.

Quality of Voltage Delivery
East 66 kV

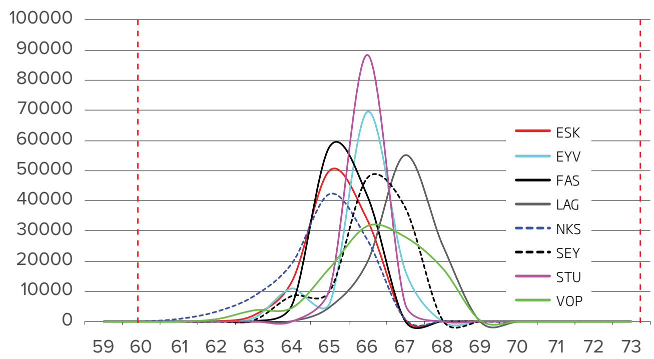


Figure 49.

Quality of Voltage Delivery
South 66 kV

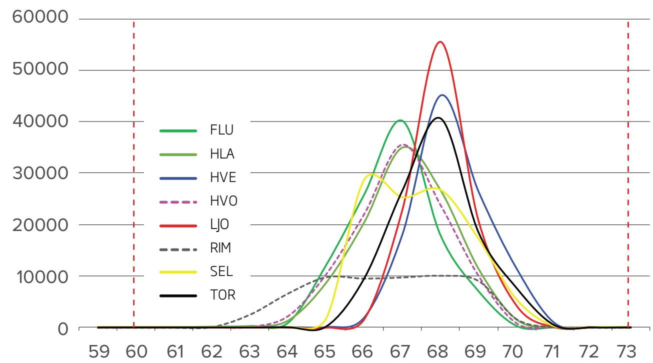


Figure 50.


Lífið er of stutt
fyrir vont kaffi
Ko

About Landsnet

We are a responsible and cutting-edge service company with a strong team of professionals and a high level of community awareness. We aim to be at the global forefront in our industry.

Role

Our role is to ensure cost-efficient development and operation of the grid and a secure and uninterrupted electricity supply, an essential requirement for any modern society. Our role also includes maintaining a balance between electricity supply and demand at all times in the electricity system.

Future vision

At the core of our future vision is an “electrified future” in keeping with society’s needs and expectations. Modern societies increasingly rely on a secure supply of electricity and we are committed to ensuring both a secure supply of electricity in the future and maintaining a balance between generation and consumption.

We will work to form as broad a consensus as possible on the way ahead, with due consideration for societal needs at any given time and treat the natural environment responsibly. At the same time we place priority on fostering a healthy electricity market environment and efficient use of financial resources.

Policy

Our corporate policy is based on the company’s role and future vision and aims to ensure that we perform our duties with care and diligence and in the best possible harmony with society and the environment. The policy sets out a promise to society to ensure a secure electricity supply, a high-quality grid, a high level of operational security in the future, harmony with society and the environment, efficient operations, informed debate and strategic management and organisation.

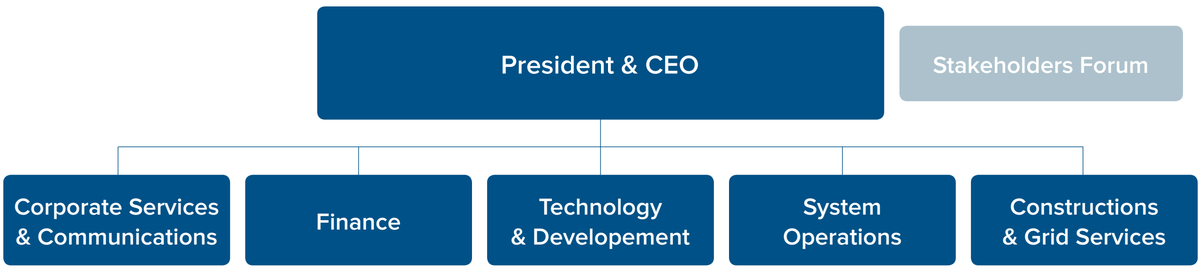
The promises are:

- A secure electricity supply – a high-quality, secure grid for the future
- In harmony with society and the environment
- Prudent use of funds – effective operations
- A clear image
- Strategic management and organisation
- A good workplace

Values

Our values – responsibility, co-operation and respect – reflect our role and vision and guide all our activities, both in customer and inter-employee relations. Our values provide the foundation for the corporate culture we strive for, including the views and behaviours of our staff, and are designed to inspire professionalism and support effective decision-making.

Organisation´s Chart



Landsnet´s High-Voltage Transmisson Lines and Cables in 2016

Voltage [kV]	Line	KKS code	First year in service	Connected substations	Length [km]	Of which undergr. [km]
220	**Brennimelur Line 1**	BR1	1977 / 2006	**Geitháls-Brennimelur**	58.6	
	Búðarháls Line 1	BH1	2014	**Búðarháls-HR1 (Langalda)**	5.6	
	Búrfell Line 1	BU1	1969	**Búrfell-Írafoss**	60.8	
	Búrfell Line 2	BU2	1973	**Búrfell-Kolviðarhóll**	86	
	Búrfell Line 3 (partly built for 400 kV)	BU3	1992/1998	**Búrfell-Hamranes**	119.07	0.07
	Fljótsdalur Line 3 (built for 400 kV)	FL3	2007	**Fljótsdalur-Reyðarfjörður**	49	
	Fljótsdalur Line 4 (built for 400 kV)	FL4	2007	**Fljótsdalur-Reyðarfjörður**	53	
	Hamranes Line 1	HN1	1969	**Geitháls-Hamranes**	15.1	
	Hamranes Line 2	HN2	1969	**Geitháls-Hamranes**	15.1	
	Hrauneyjafoss Line 1	HR1	1982	**Hrauneyjafoss-Sultartangi**	19.5	
	Ísal Line 1	IS1	1969	**Hamranes-Ísal**	2.4	
	Ísal Line 2	IS2	1969	**Hamranes-Ísal**	2.4	
	Járnblendi Line 1	JA1	1978	**Brennimelur-Járnblendivk**	4.5	
	Kolviðarhóll Line 1	KH1	1973	**Kolviðarhóll-Geitháls**	17.3	
	Norðurál Line 1	NA1	1998	**Brennimelur-Norðurál**	4.2	
	Norðurál Line 2	NA2	1998	**Brennimelur-Norðurál**	4	
	Sigalda Line 2	SI2	1982	**Sigalda-Hrauneyjafoss**	8.6	
	Sigalda Line 3	SI3	1975/2015	**Sigalda-Búrfell**	36.8	
	Sog Line 3	SO3	1969	**Írafoss-Geitháls**	35.8	
	Sultartangi Line 1	SU1	1982	**Sultartangi-Brennimelur**	121.6	
	Sultartangi Line 2	SU2	1999	**Sultartangi-Búrfell**	12.5	
	Sultartangi Line 3 (built for 400 kV)	SU3	2006	**Sultartangi-Brennimelur**	119	
	Vatnsfell Line 1	VF1	2001	**Vatnsfell-Sigalda**	5.8	
				Total 220 kV	**856.67**	**0.07**
132	**Blanda Line 1**	BL1	1977/1991	**Blanda-Laxárvatn**	32.7	
	Blanda Line 2	BL2	1977/1991	**Blanda-Varmahlíð**	32.4	
	Eyvindará Line 1	EY1	1977	**Hryggstekkur-Eyvindará**	27.5	
	Fitjar Line 1	MF1	1991	**Rauðimelur-Fitjar**	6.8	
	Fitjar Line 2	FI2	2015	**Fitjar-Stakkur**	8.5	8.5
	Fljótsdalur Line 2	FL2	1978	**Fljótsdalur-Hryggstekkur**	25	7
	Geiradalur Line 1	GE1	1980	**Glerárskógar-Geiradalur**	46.7	
	Glerárskógar Line 1	GL1	1983	**Hrútatunga-Glerárskógar**	33.5	
	Hafnarfjörður Line 1	HF1	1989	**Hamranes-Öldugata**	4	4
	Höfn Line 1	HA1	1987/2014	**Hólar-Höfn**	8	8
	Hnoðraholt Line 1	AD7	1990	**Hamranes-Hnoðraholt**	9.7	2
	Hólar Line 1	HO1	1981	**Teigarhorn-Hólar**	75.1	
	Hrútatunga Line 1	HT1	1976	**Vatnshamrar-Hrútatunga**	77.1	
	Korpa Line 1	KO1	1974	**Geitháls-Korpa**	6	0.3
	Krafla Line 1	KR1	1977	**Krafla-Rangárvellir**	82.1	
	Krafla Line 2	KR2	1978	**Krafla-Fljótsdalur**	123.2	0.1
	Laxárvatn Line 1	LV1	1976	**Hrútatunga-Laxárvatn**	72.7	
	Mjólká Line 1	MJ1	1981	**Geiradalur-Mjólká**	80.8	
	Nesjavellir Line 1	NE1	1998	**Nesjavellir-Korpa**	32	16
	Nesjavellir Line 2	NE2	2010	**Nesjavellir-Geitháls**	25	25
	Prestbakki Line 1	PB1	1984	**Hólar-Prestbakki**	171.4	
	Rangárvellir Line 1	RA1	1974	**Rangárvellir-Varmahlíð**	87.5	
	Rangárvellir Line 2	RA2	2009	**Rangárvellir-Krossanes**	4.4	4.4
	Rauðimelur Line 1	RM1	2006	**Reykjanes-Rauðimelur**	15	
	Rauðavatn Line 1	RV1	1953	**Geitháls-A12**	3	1
	Sigalda Line 4	SI4	1984	**Sigalda-Prestbakki**	78.1	
	Sog Line 2	SO2	1953	**Írafoss-Geitháls**	44.4	
	Stuðlar Line 1	SR1	2005	**Hryggstekkur-Stuðlar**	16	16
	Suðurnes Line 1	SN1	1991	**Hamranes-Fitjar**	30.7	0.1

Voltage [kV]	Line	KKS code	First year in service	Connected substations	Length [km]	Of which undergr. [km]
	Svartsengi Line 1	SM1	1991	**Svartsengi-Rauðimelur**	4.9	
	Teigarhorn Line 1	TE1	1981	**Hryggstekkur-Teigarhorn**	49.7	
	Vatnshamrar Line 1	VA1	1977	**Vatnshamrar-Brennimelur**	20.2	
				Total 132 kV	**1334.1**	**92.3**
66	**Akranes Line 1**	AK1	1996	**Brennimelur-Akranes**	18.5	18.5
	Andakíll Line 1	AN1	1966	**Andakílsvirkjun-Akranes**	34.85	1.3
	Bolungarvík Line 1	BV1	1979/2014	**Breiðidalur-Bolungarvík**	17.1	1
	Bolungarvík Line 2	BV2	2010/2014	**Ísafjörður-Bolungarvík**	15.3	15.3
	Breiðidalur Line 1	BD1	1975	**Mjólká-Breiðidalur**	36.4	0.8
	Dalvík Line 1	DA1	1982	**Rangárvellir-Dalvík**	39	0.1
	Eskifjörður Line 1	ES1	2001	**Eyvindará-Eskifjörður**	29.1	0.3
	Fáskrúðsfjörður Line 1	FA1	1989	**Stuðlar-Fáskrúðsfjörður**	16.8	
	Flúðir Line 1	FU1	1978	**Búrfell-Flúðir**	27.4	0.6
	Grundarfjörður Line 1	GF1	1985	**Vogaskeið-Grundarfjörður**	35.4	
	Hella Line 1	HE1	1995	**Flúðir-Hella**	34.4	1.7
	Hella Line 2	HE2	2015	**Hella-Hvolsvöllur**	13	13
	Hveragerði Line 1	HG1	1982	**Ljósafoss-Hveragerði**	15.4	0.1
	Hvolsvöllur Line 1	HV1	1972	**Búrfell-Hvolsvöllur**	45.1	0.25
	Ísafjörður Line 1	IF1	1959/2014	**Breiðidalur-Ísafjörður**	13	3
	Kópasker Line 1	KS1	1983	**Laxá-Kópasker**	83.3	0.1
	Lagarfoss Line 1	LF1	1971	**Lagarfoss-Eyvindará**	28	6
	Laxá Line 1	LA1	1953	**Laxá-Rangárvellir**	58.4	0.7
	Ljósafoss Line 1	LJ1	2002	**Ljósafoss-Írafoss**	0.6	0.6
	Neskaupstaður Line 1	NK1	1985	**Eskifjörður-Neskaupstaður**	18.2	1.9
	Ólafsvík Line 1	OL1	1978	**Vegamót-Ólafsvík**	48.8	
	Rimakot Line 1	RI1	1988	**Hvolsvöllur-Rimakot**	22.2	0.1
	Sauðárkrókur Line 1	SA1	1974	**Varmahlíð-Sauðárkrókur**	21.8	
	Selfoss Line 1	SE1	1981	**Ljósafoss-Selfoss**	20.3	2.7
	Selfoss Line 2	SE2	1947	**Selfoss-Hella**	32	0.7
	Selfoss Line 3	SE3	2016	**Selfoss-Þorlákshöfn**	28	28
	Seyðisfjörður Line 1	SF1	1996	**Eyvindará-Seyðisfjörður**	20.1	0.3
	Steingrímsstöð Line 1	ST1	2003	**Steingrímsstöð-Ljósafoss**	3.4	1
	Stuðlar Line 2	SR2	1983	**Stuðlar-Eskifjörður**	18.2	2.4
	Tálknafjörður Line 1	TA1	1985	**Mjólká-Keldeyri**	45.1	
	Vatnshamrar Line 2	VA2	1974	**Andakílsvirkjun-Vatnshamrar**	2	0.2
	Vegamót Line 1	VE1	1974	**Vatnshamrar-Vegamót**	63.8	
	Vogaskeið Line 1	VS1	1974	**Vegamót-Vogaskeið**	24.8	
	Vopnafjörður Line 1	VP1	1980	**Lagarfoss-Vopnafjörður**	58	0.15
	Þeistareykir Line 2	TR2	2013	**Þeistareykir-KS1 (Höfuðreiðarmúli)**	11	11
	Þorlákshöfn Line 1	TO1	1991	**Hveragerði-Þorlákhöfn**	19.3	0.1
				Total 66 kV	**1018.1**	**111.9**
33	**Húsavíkur Line 1**	HU1	1948	**Laxá-Húsavík**	26	0.1
	Vestmannaeyjar Line 1 (sub-sea cable)	VM1	1962	**Vestmannaeyjar-Rimakot**	16	16
	Vestmannaeyjar Line 2 (sub-sea cable)	VM2	1978	**Vestmannaeyjar-Rimakot**	16	15
	Vestmannaeyjar Line 3 (sub-sea cable)	VM3	2013	**Vestmannaeyjar-Rimakot**	16	16
				Total 33 kV	**74**	**47**
				Total	**3283**	**251**

Landsnet´s Substations in 2016

Substations	KKS code	Co-owner	Voltage [kV]	First year in service	No. of switchyard bays	Number of transformers
Aðveitustöð 12 / Substation 12	A12	OR	132	2006	1	0
Akranes	AKR	OR	66	2016	4	0
Andakíll	AND	OR	66	1974	3	0
Ásbrú	ASB		33	2011	8	0
Blanda	BLA	LV	132	1991	5	0
Bolungarvík	BOL		66/11	2014	3/8	0
Breiðidalur	BRD	OV	66	1979	4	0
Brennimelur	BRE	RA	220/132/66	1978	9/4/3	3
Búðarháls	BUD		220	2013	2	0
Búrfell	BUR		220/66	1999	8/4	0
Dalvík	DAL	RA	66	1981	1	0
Eskifjörður	ESK	RA	66	1993	5	0
Eyvindará	EYV	RA	132/66	1975	1/5	1
Fáskrúðsfjörður	FAS	RA	66	1998	3	0
Fitjar	FIT	HS	132	1990	5	0
Fljótsdalur	FLJ		220/132	2007	10/4	2
Flúðir	FLU	RA	66	1995	3	0
Geiradalur	GED	OV	132	1983	3	0
Geitháls	GEH		220/132	1969	7/9	2
Glerárskógar	GLE	RA	132	1980	3	0
Grundarfjörður	GRU	RA	66	1987	1	0
Hamranes	HAM		220/132	1989	7/8	2
Hella	HLA	RA	66	1995	4	0
Hnoðraholt	HNO	OR	132	1990	2	0
Hólar	HOL	RA	132	1984	5	0
Hrauneyjafoss	HRA	LV	220	1981	5	0
Hrútatunga	HRU	RA	132	1980	4	0
Hryggstekkur	HRY	RA	132	1978	6/5	1
Húsavík	HUS	RA	33	1978	2	0
Hveragerði	HVE	RA	66	1983	3	0
Hvolsvöllur	HVO	RA	66	1995	4	0
Írafoss	IRA	LV	220/132	1953	3/6	2
Ísafjörður	ISA	OV	66	2014	4	0
Keldeyri	KEL	OV	66	1979	2	0
Klafastaðir	KLA		220/16	2013	1/4	1
Kolviðarhóll	KOL		220	2006	7	0
Korpa	KOR	OR	132	1976	6	0
Kópasker	KOP	RA	66	1980	1	0
Krafla	KRA	LV	132	1977	4	0
Lagarfoss	LAG	RA	66	2007	5	0
Laxá	LAX		66/33	2003	6/1	1
Laxárvatn	LAV	RA	132	1977	3	0
Lindarbrekka	LIN	RA	66	1985	1	0
Ljósafoss	LJO	LV	66	1937	6	0
Mjólká	MJO	OV	132/66	1980	2/5	2
Nesjavellir	NES	OR	132	1998	6	0
Neskaupstaður	NKS	RA	66	1994	3	0
Ólafsvík	OLA	RA	66	1980	1	0
Prestbakki	PRB	RA	132	1984	3	0
Rangárvellir	RAN	RA	132/66	1974	8/7	2
Rauðimelur	RAU		132	2006	3	0
Reykjanes	REY	HS	132	2006	3	0
Rimakot	RIM	RA	66/33	1990	2/5	1

Substations	KKS code	Co-owner	Voltage [kV]	First year in service	No. of switchyard bays	Number of transformers
Sauðárkrókur	**SAU**	**RA**	66	1977	**3**	0
Selfoss	**SEL**	**RA**	66	2005	**5**	0
Seyðisfjörður	**SEY**	**RA**	66	1957	**2**	0
Sigalda	**SIG**	**LV**	220/132	1977	**7/1**	1
Silfurstjarnan	**SIL**	**RA**	66	1992	**1**	0
Stakkur	**STA**		132	2016	**3**	1
Steingrímsstöð	**STE**	**LV**	66	1959	**1**	0
Stuðlar	**STU**	**RA**	132/66	1980	**3/5**	2
Sultartangi	**SUL**		220	1999	**6**	0
Svartsengi	**SVA**	**HS**	132	1997	**4**	0
Teigarhorn	**TEH**	**RA**	132	2005	**3**	0
Varmahlíð	**VAR**	**RA**	132/66	1977	**3/1**	1
Vatnsfell	**VAF**		220	2001	**2**	0
Vatnshamrar	**VAT**	**RA**	132/66	1976	**4/6**	2
Vegamót	**VEG**	**RA**	66	1975	**4**	0
Vestmannaeyjar	**VEM**	**HS**	33	2002	**4**	0
Vogaskeið	**VOG**	**RA**	66	1975	**3**	0
Vopnafjörður	**VOP**	**RA**	66	1982	**1**	0
Þeistareykir	**THR**		66	2013	**1**	0
Þorlákshöfn	**TOR**	**RA**	66	1991	**3**	0
Öldugata	**OLD**		132	1989	**3**	0

RA=RARIK (Iceland State Electricity)
OV=Westfjord Power Company
HS=Sudurnes Regional Heating
LV=Landsvirkjun
OR=Reykjavík Energy

Annex 1: Definition of Indexes for Security of Supply

Power Interruption Index

This index is the ratio of the aggregate power curtailment and highest load on the system. The following equation applies to this index:

$$SRA = \frac{\sum P_i}{P_{Max}} MW / MW\ year$$

Where:

P_i: Power curtailment in curtailment i [MW]

P_{Max}: Maximum total feed-in of the year into the transmission system / distribution system [MW].

Average Outage Duration Index-Outage Minutes

This index assesses how long the curtailment has prevailed based on energy curtailment and total energy delivery. The following equation applies to this index:

$$SMS = \frac{\sum E_i}{E_{Total}} * 8760 * 60\ minutes / year$$

Where:

E_i: Energy curtailment in disturbance i [MWh].

E_{Total}: Total energy delivery to customers [MWh].

System Minutes

Index that indicates the severity of each case of curtailed energy delivery. The following equation applies to this index:

$$KM = \frac{E * 60}{P_{Max}} minutes$$

Where:

E: Energy curtailment in disturbance [MWh].

P_{Max}: Maximum load on the system, transmission system / distribution system [MW].

Power Energy Curtailment Index

This index is the ratio of energy curtailment if the load had been unchanged over the whole curtailment period and the total load on the system. The following equation applies to this index:

MW hour / MW year

$$SSO = \frac{\sum T_i * P_i}{P_{Max}}$$

Where:

P_i: Power curtailment MW, in curtailment i.

T_i: Duration of curtailment, hours.

P_{Max}: Maximum load (one hour average) of feed-in, MW.

Power Supply Average Curtailment per Disturbance

This index is an indication of the average curtailment of each disturbance. The following equation applies to this index:

MW / disturbance

$$SMA = \frac{\sum P_i}{N}$$

Where:

P_i: Load curtailment, MW, in disturbance i.

N: No. of disturbances.

Index of Reliability

Index that shows the reliability of the system as a proportion of the number of hours during the year.

$$AS = \frac{8760 - duration\ of\ outage\ in\ hrs)}{8760}$$

Where: Duration of outage is defined according to the Average Outage Duration Index, outage minutes.

Annex 2: Definition of Incident Classification Scale for the Icelandic Transmission System

The highest severity is read from # 1 and down to # 18 according to ENTSO-E

Severity level of disturbances in the power system (based in part on ENTSO-E Incidnet Classification Scale)

Green (Scale 0) Anomaly		Yellow (Scale 1) Noteworthy Incidents		Red (Scale 2) Extensive Incidents		Black (Scale 3) Major Incidents or Widespread Incidents	
		#9 L1	Disconnection of load (5-15%)	#2 L2	Disconnection of load, 15-70% (330-1500MW)	#1 OB3	Blackout (>70% of load)
				LN-ÁL2	>25% courtail to any aluminum smelter í >1 klst	LN-ÁL3	>25% courtail to any aluminum smelter >2 hours
LN-FD0	Trip <2,5% af distribution customers (<9MW)	LN-FD1	Trip of 2,5-7,5% distribution customers (9-27MW)	LN-FD2	Trip of 7,5-35% distribution customers (27-126MW)	LN-FD3	Trip of >7,5% distribution customers >5 hours (>27MW)
LN-FS0	Trip <5% af power intensive customers (<80MW)	LN-FS1	Trip 5-15% power intensive customers (80-240 MW)	LN-FS2	Trip 15-70% power intensive customers (240-1120 MW)	LN-FS3	Trip >15% power intensive customers >5klst (>240 MW)
#18 T0	Disturbance in transmission network within operational security.	#11 T1	disturbance in 220 kV network vith ENS or transmission circuits				
#19 G0	Trip of biggest unit in the system = 115 MW	#12 G1	Loss of generation, units (>115 MW)	#5 G2	Island system- biggest power station		
#21 OR0	Lack of reserve >20% for 15-20 min (OR0)	#15 OR1	Lack of reserve (OR1)				
		#16 LT1	Loss of tools and facilities (LT1)	#8 LT2	Loss of tools and facilities (LT2)		
#20 OV0	Violation of standards on voltage (OV0)	#14 OV1	Violation of standards on voltage (OV1)				
#17 F0	Incidents leading to frequency degradation (F0)	#10 F1	Incidents leading to frequency degradation (F1)	#3 F2	Incidents leading to frequency degradation (F2)		

Severity

Scope

Reliability of Supply and Quality of Delivered Electricity
Performance Report 2016

Authors:
Kjartan Sigurjónsson, Ragnar Stefánsson, Kristveig Þorbergsdóttir, Daniel Leó Ólason,
Íris Baldursdóttir, Jón Vilhjálmsson (Efla Consulting Engineers), Kolbrún Reinholdsdóttir
(Efla Consulting Engineers) and
Ingvar Baldursson (Efla Consulting Engineers)

Project manager:
Kjartan Sigurjónsson

Abstract:
This report shows statistics about security of supply in the Icelandic power system, outages and voltage and frequency quality. It further includes general information on Landsnet and the transmission system in Iceland

Supervision and layout:
Athygli PR

Photos
Landsnet

Graphics:
Effekt

Landsnet –Report no. 17008
May 2017

LANDSNET

LANDSNET HF. - GYLFAFLÖT 9 - 112 REYKJAVÍK - ICELAND - TEL (+354) 563 9300 - LANDSNET@LANDSNET.IS