nationalgrid

National Electricity Transmission System Performance Report 2016 – 2017

Report to the Gas and Electricity Markets Authority

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Report to the Gas and Electricity Markets Authority

Contents

Introduction

The electricity transmission networks in Great Britain are owned by National Grid Electricity Transmission plc (NGET) in England and Wales, SP Transmission plc (SPT) in South and Central Scotland and Scottish Hydro Electric Transmission plc (SHE Transmission) in the North of Scotland. These three networks form the Onshore Transmission System. The Offshore Transmission networks are owned by Transmission Capital (TC), Blue Transmission Investments Limited (BT), Greater Gabbard OFTO Ltd, Gwynt-Y-Mor OFTO Ltd, Thanet OFTO Ltd, Humber Gateway OFTO Ltd and West of Duddon Sands Transmission plc (WoDS). The National Electricity Transmission System (NETS) is comprised of the Onshore and Offshore Transmission System.

In addition to its role as the Transmission Owner in England and Wales, NGET became the Great Britain System Operator (GBSO) on 1 April 2005, and subsequently on 24th June 2009, National Electricity Transmission System Operator (NETSO) which includes the Offshore Transmission System.

In accordance with Standard Licence Condition C17 (Transmission System Security, Standard and Quality of Service) of its Transmission Licence, NGET, as NETSO, is required by the Gas and Electricity Markets Authority, to report National Electricity Transmission System performance in terms of availability, system security and the quality of service.

The Onshore and Offshore Transmission System broadly comprises circuits operating at 400, 275 and 132kV. The formal definition of the National Electricity Transmission System is contained in the NETS Grid Code and NETS Security and Quality of Supply Standard (NETS SQSS). The fully interconnected transmission system provides a consistently high quality of supply and also allows for the efficient bulk transfer of power from remote generation to demand centres.

Information relating to SP Transmission plc, Scottish Hydro Electric Transmission plc, TC Robin Rigg OFTO Limited, TC Barrow OFTO Limited, TC Gunfleet Sands OFTO Limited, TC Ormonde OFTO Limited, TC Lincs OFTO Limited, TC Westermost Rough OFTO Limited, BT Walney 1 Limited, BT Walney 2 Limited, BT Sheringham Shoal Limited, BT London Array Limited, Greater Gabbard OFTO Ltd*, Gwynt-Y-Mor OFTO Ltd*, Thanet OFTO Ltd*, Humber Gateway OFTO Ltd* and West of Duddon Sands Transmission plc have been provided by the Transmission Owners in accordance with Licence Condition D3 (Transmission System Security Standard and Quality of Service) of their Transmission Licences.

When considering the performance of the Scottish transmission networks it should be recognised that this can be influenced by both the Scottish Transmission Owners and the NETSO.

The National Electricity Transmission System is connected via interconnectors to transmission systems in France, Northern and Southern Ireland and The Netherlands. The Northern Ireland Interconnector is regulated by the Northern Ireland Regulator (NIAUR) and Southern Ireland is regulated by the Commission for Energy Regulation (CER) which both fall outside the scope of this report.

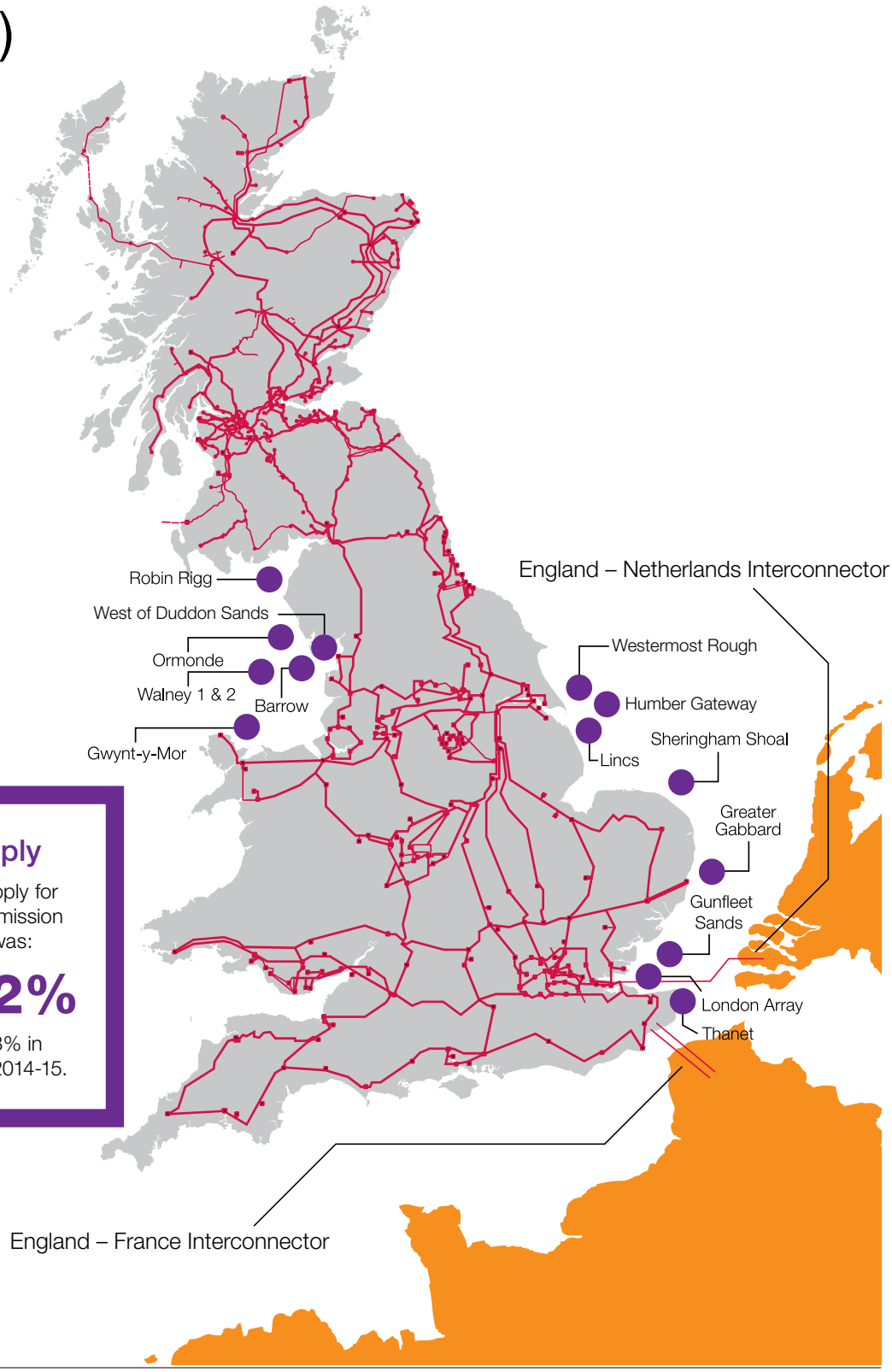
Information relating to the Interconnexion France – Angleterre (IFA) has been provided by National Grid Interconnectors Limited (NGIC) in accordance with Licence Condition D5 (Transmission System Security Standard and Quality of Service) of the NGIC Transmission Licence.

Information relating to the Interconnector between England and the Netherlands (BritNed Development Limited – "BritNed") has been provided by National Grid in conjunction with TenneT due to the joint ownership of the equipment.

* Greater Gabbard OFTO Ltd, Gwynt-Y-Mor OFTO Ltd, Thanet OFTO Ltd and Humber Gateway OFTO Ltd are operated by Balfour Beatty Power Transmission & Distribution (BB) on behalf of the respective owners.

Section One

National Electricity Transmission System (GB Network)



Reliability of Supply

The Overall Reliability of Supply for the National Electricity Transmission System during 2016-17 was:

99.999962%

compared with 99.999993% in 2015-16 and 99.99987% in 2014-15.

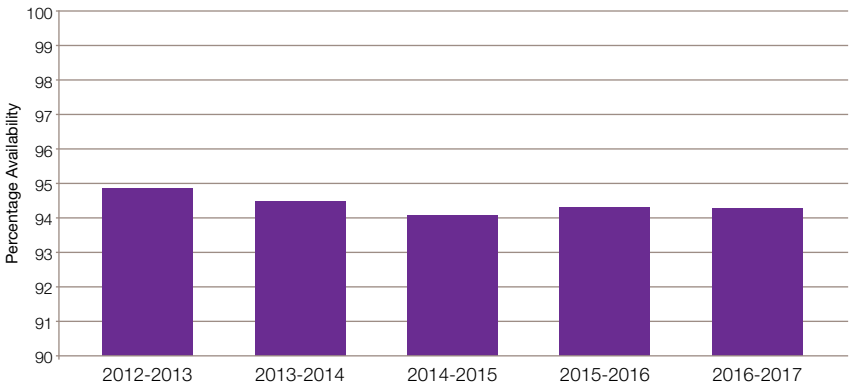
Availability

The definitions and criteria for system availability can be found in the Glossary of Terms at the end of this report.

National Electricity Transmission System performance is monitored by reporting variations in Annual System Availability, Winter Peak System Availability and Monthly System Availability.

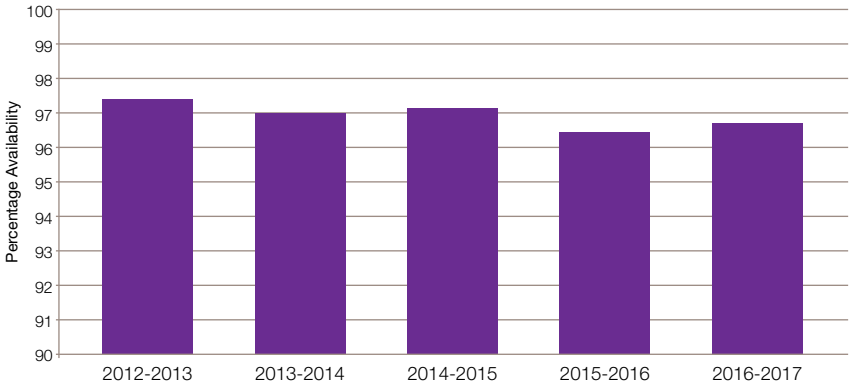
Capenhurst Substation

% Annual System Availability



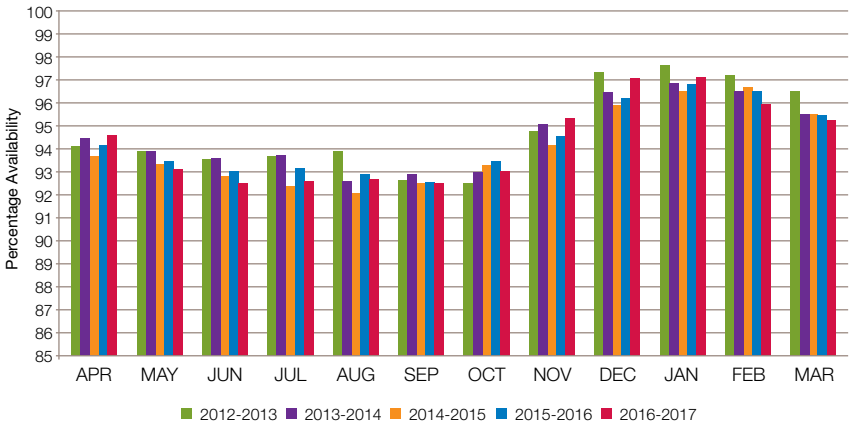
2012-13	2013-14	2014-15	2015-16	2016-17
94.75	94.50	94.09	94.36	94.31

% Winter Peak System Availability



2012-13	2013-14	2014-15	2015-16	2016-17
97.40	96.98	97.15	96.46	96.71

% Monthly System Availability



	2012-13	2013-14	2014-15	2015-16	2016-17
Apr	94.12	94.43	93.69	94.17	94.61
May	93.87	93.88	93.24	93.51	93.12
Jun	93.59	93.61	92.87	93.03	92.52
Jul	93.72	93.73	92.44	93.15	92.61
Aug	93.87	92.67	92.06	92.90	92.70
Sep	92.65	92.87	92.51	92.56	92.47
Oct	92.49	92.98	93.26	93.47	93.02
Nov	94.77	95.03	94.14	94.63	95.34
Dec	97.32	96.45	95.95	96.22	97.03
Jan	97.68	96.77	96.51	96.80	97.08
Feb	97.17	96.43	96.68	96.44	95.97
Mar	96.46	95.58	95.57	95.51	95.31

Annual System Availability

Annual System Availability of the National Electricity Transmission System for 2016-2017 was:

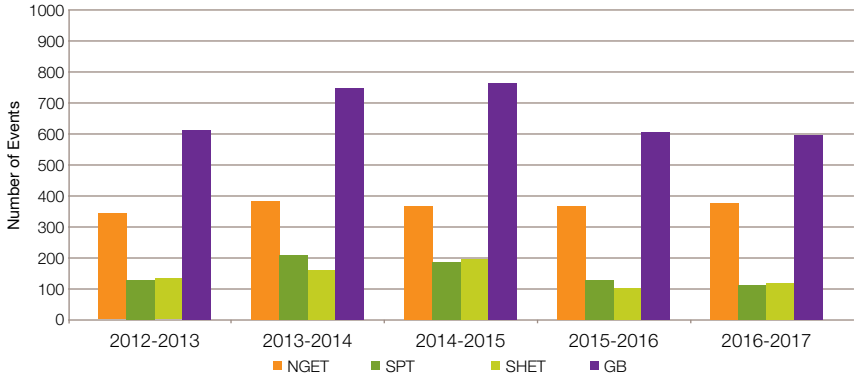
94.31%

Security

The definitions and criteria for system security can be found in the Glossary of Terms at the end of this report.

System performance is monitored by the Estimated Unsupplied Energy from the National Electricity Transmission System for each incident.

During 2016-17 there were 596 NETS events where transmission circuits were disconnected either automatically or by urgent manual switching. The vast majority of these events had no impact on electricity users with only 29 resulting in loss of supplies to customers.



	2012-13	2013-14	2014-15	2015-16	2016-17
NGET	351	384	371	374	379
SPT	130	204	190	126	108
SHET	133	160	199	104	109
GB	614	748	760	604	596

Electricity National Control Centre, UK

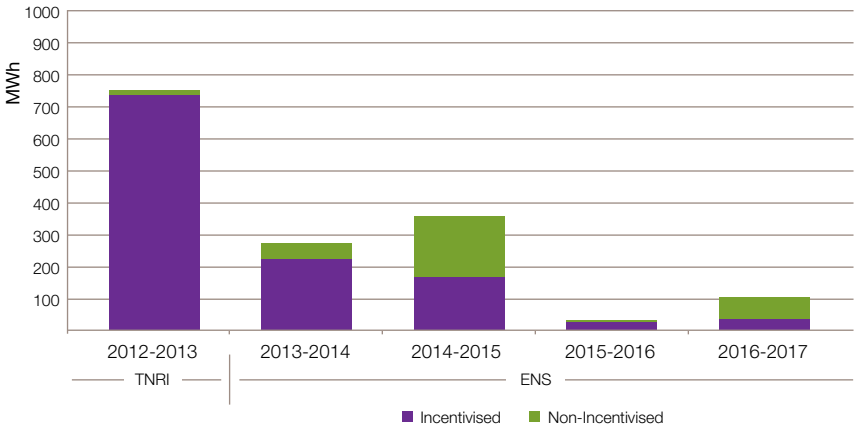
Number of Loss of Supply Incidents

The chart shows the annual comparison of the numbers of Loss of Supply Incidents that occurred within the National Electricity Transmission System. The chart separates the TNRI (2005 – 2013) and ENS (2013 to date) schemes for clarification.

	2012-13	2013-14	2014-15	2015-16	2016-17
Incentivised	30	17	8	6	11
Non-Incentivised	8	27	49	30	18

Total Estimated Unsupplied Energy

The chart shows the annual comparison of the Estimated Unsupplied Energy for Loss of Supply Incidents that occurs within the National Electricity Transmission System.



	2012-13	2013-14	2014-15	2015-16	2016-17
Incentivised	760.53	212.93	178.18	18.35	22.48
Non-Incentivised	6.90	45.37	196.01	1.67	82.53

Total Estimated Unsupplied Energy

The total Estimated Unsupplied Energy from the National Electricity Transmission System during 2016-17 was:

105.01 MWh

Traffic Lights, London

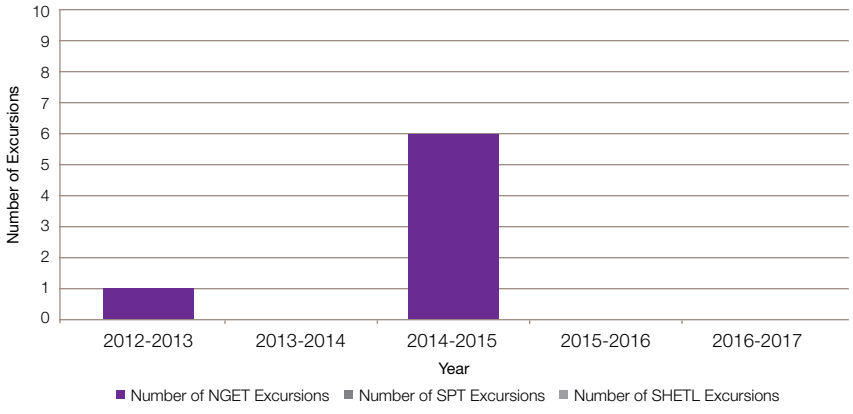
Quality of Service

Quality of service is measured with reference to system Voltage and Frequency. The criteria for reportable Voltage and Frequency Excursions can be found in the Glossary of Terms at the end of this report.

Voltage Excursions

During 2016-17 there were zero reportable Voltage Excursions within the National Electricity Transmission System.

The chart below summarises the reportable Voltage Excursions that have occurred on the National Electricity Transmission System within England and Wales.



	2012-13	2013-14	2014-15	2015-16	2016-17
Number of NGET Excursions	1	0	6	0	0
Number of SPT Excursions	0	0	0	0	0
Number of SHETL Excursions	0	0	0	0	0

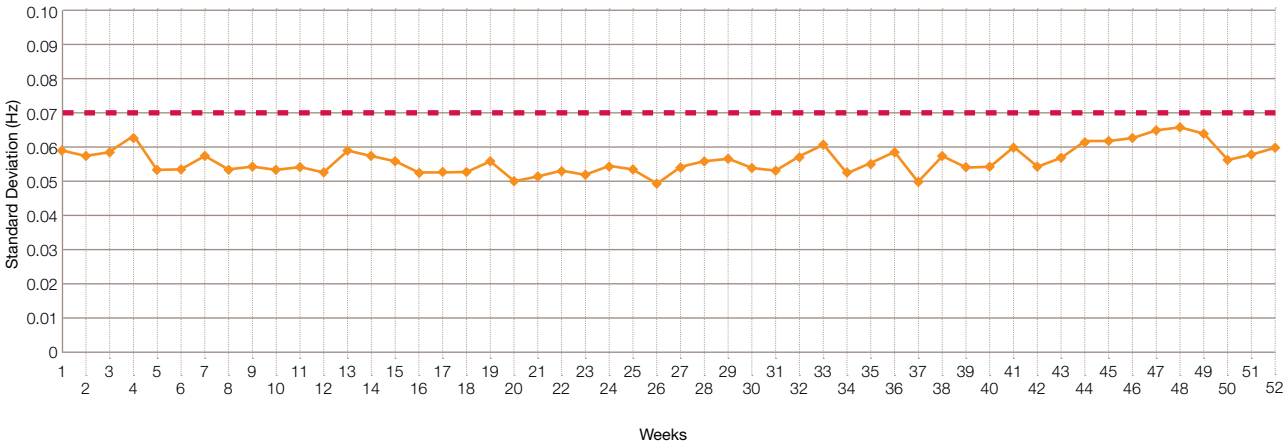
Frequency Excursions

During 2016-17 there has been no reportable Frequency Excursion within the National Electricity Transmission System.

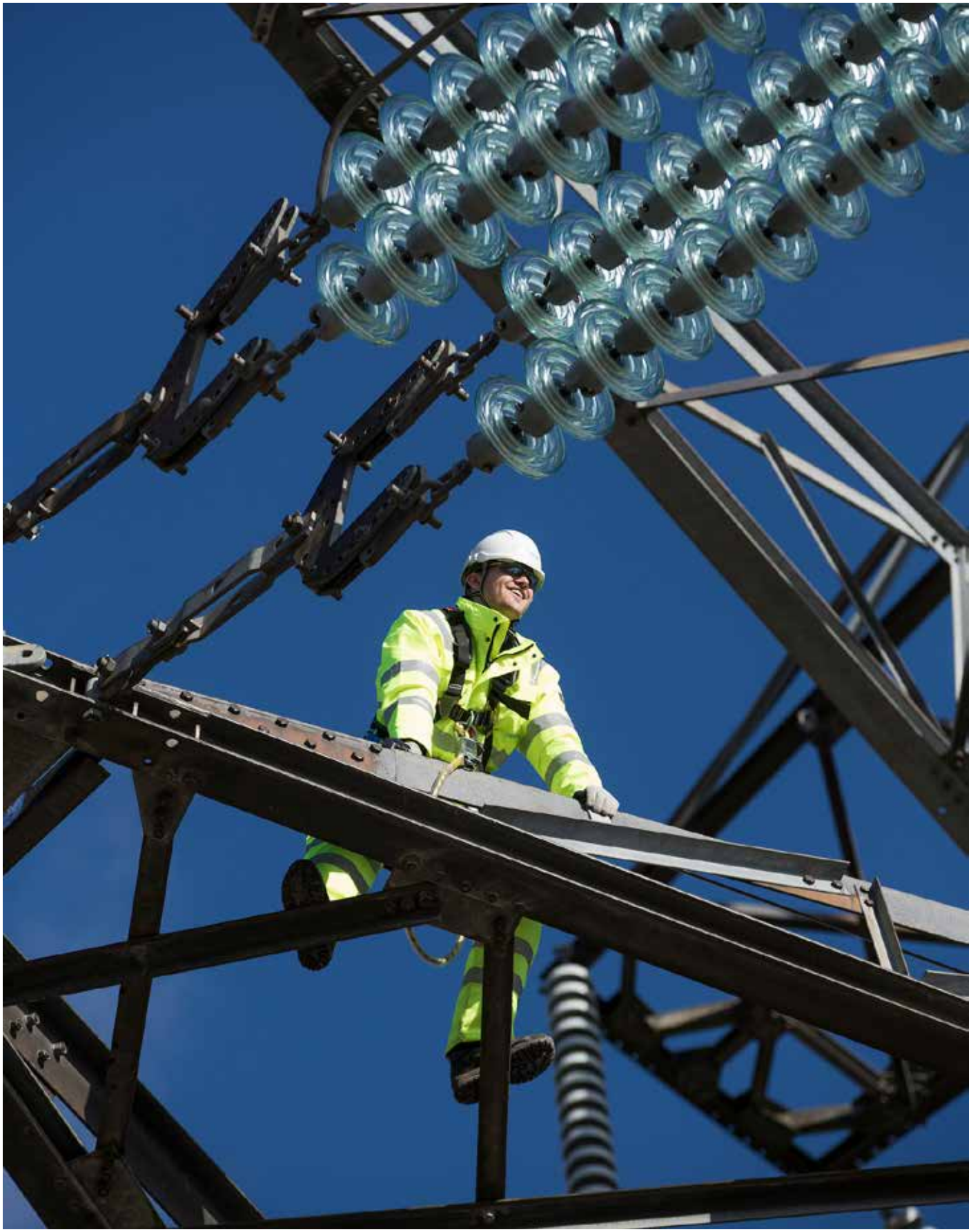
The last reported Frequency Excursion was in 2008-09 reporting period.

Frequency Standard Deviation

The chart below displays the recorded Frequency Standard Deviation from 50Hz on a weekly basis for the year 2016-17.



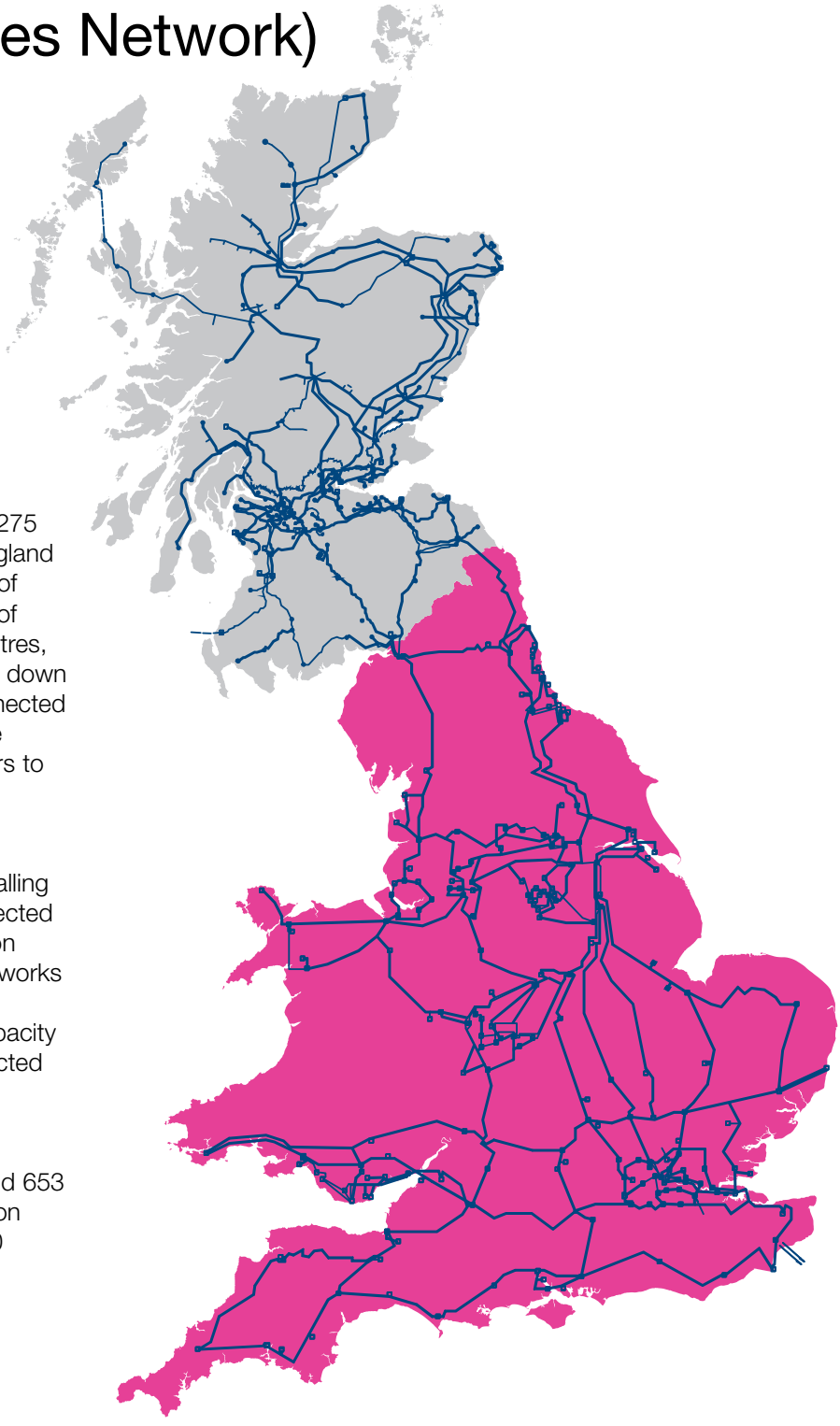
Solar Panels and Wind Turbines



A Linesman's Line of Sight

Section Two

NGET System (England & Wales Network)



System Description

The NGET network operates at 400, 275 and 132kV supplying electricity to England and Wales with a maximum demand of 45.7GW. The system covers an area of approximately 151,000 square kilometres, in accordance with the standards laid down in the Transmission Licence. It is connected to the SP Transmission System to the North and three HVDC Interconnectors to Southern Ireland, France and the Netherlands.

There are 51 large power stations totalling 46.6GW of generation capacity connected to the England and Wales transmission system. There are 12 Distribution Networks connected to the NGET system via 131.5GVA of installed transformer capacity and a small number of directly connected customers such as steelworks.

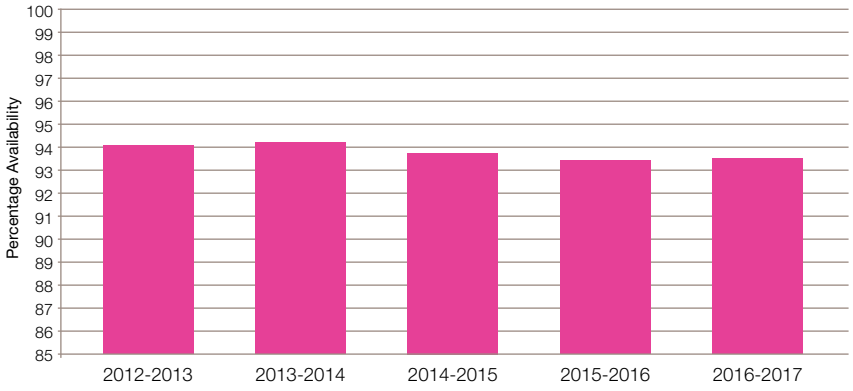
The Transmission System consists of 14,176 kilometres of overhead line and 653 kilometres of underground transmission cable routes interconnecting over 300 substations.

Availability

The definitions and criteria for system availability can be found in the Glossary of Terms at the end of this report.

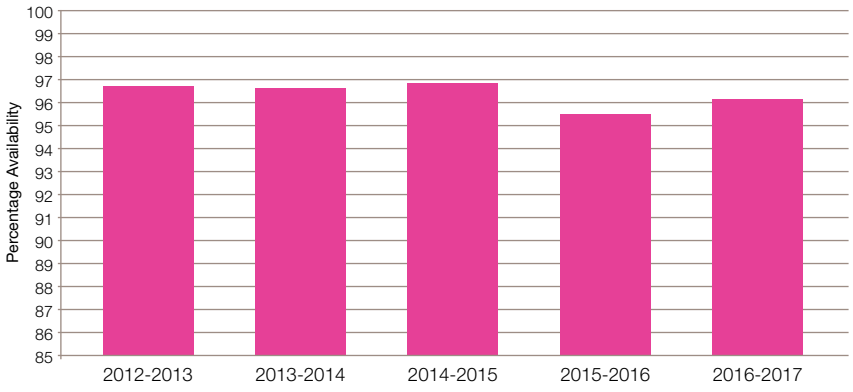
System performance is monitored by reporting variations in Annual System Availability, Winter Peak System Availability and Monthly System Availability. There is also a breakdown of Planned and Unplanned System Unavailability.

% Annual System Availability



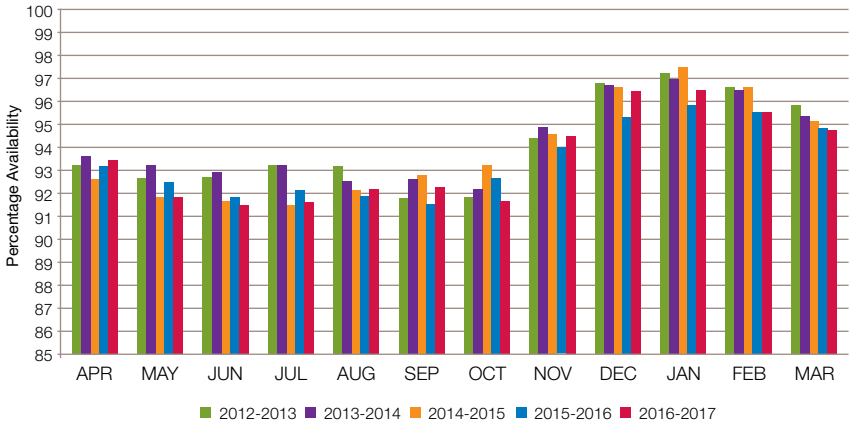
2012-13	2013-14	2014-15	2015-16	2016-17
94.03	94.16	93.82	93.42	93.48

% Winter Peak System Availability



2012-13	2013-14	2014-15	2015-16	2016-17
96.89	96.75	96.93	95.51	96.13

% Monthly System Availability

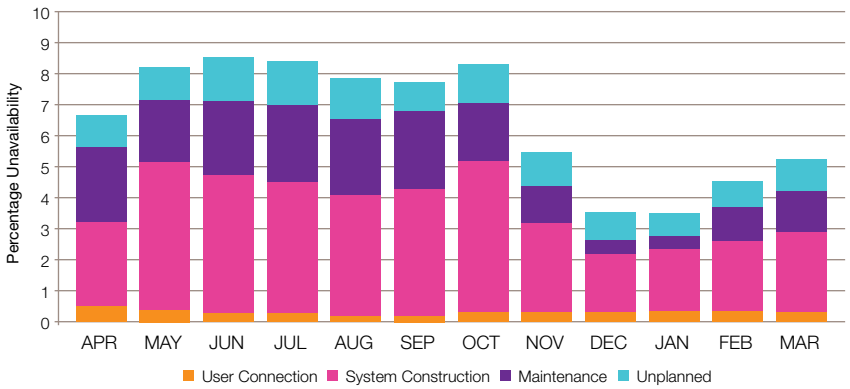


	2012-13	2013-14	2014-15	2015-16	2016-17
Apr	93.16	93.56	92.49	93.15	93.37
May	92.68	93.22	91.80	92.47	91.80
Jun	92.72	92.92	91.62	91.78	91.47
Jul	93.12	93.14	91.46	92.11	91.59
Aug	93.15	92.52	92.09	91.91	92.12
Sep	91.82	92.58	92.84	91.51	92.22
Oct	91.86	92.18	93.21	92.70	91.68
Nov	94.42	94.89	94.61	94.00	94.56
Dec	96.82	96.77	96.70	95.35	96.43
Jan	97.20	96.97	97.47	95.85	96.48
Feb	96.60	96.51	96.60	95.47	95.47
Mar	95.87	95.33	95.12	94.81	94.76

Planned and Unplanned System Unavailability

The table and the chart show the monthly variation in Planned and Unplanned System Unavailability.

Unavailability is defined as (100 – Availability) %



	User Connection	System Construction	Maintenance	Unplanned	Total
Apr	0.50	2.74	2.36	1.03	6.63
May	0.43	4.76	1.89	1.12	8.20
Jun	0.29	4.44	2.36	1.44	8.53
Jul	0.29	4.19	2.46	1.47	8.41
Aug	0.18	3.90	2.46	1.34	7.88
Sep	0.21	4.07	2.56	0.94	7.78
Oct	0.36	4.81	1.89	1.26	8.32
Nov	0.29	2.97	1.06	1.12	5.44
Dec	0.29	1.91	0.43	0.94	3.57
Jan	0.36	1.96	0.45	0.75	3.52
Feb	0.35	2.29	1.08	0.81	4.53
Mar	0.33	2.51	1.37	1.03	5.24

400kV Substation, Elstree, Watford

Security

The definitions and criteria for system security can be found in the Glossary of Terms at the end of this report.

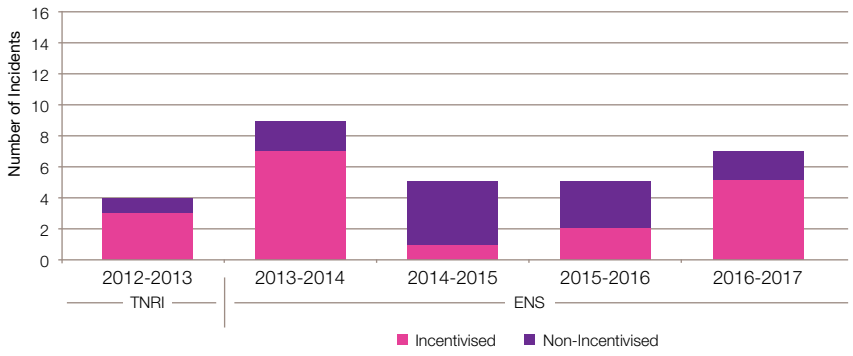
System performance is monitored by the Estimated Unsupplied Energy from the NGET Transmission System for each incident.

During 2016-17 there were 379 NGET system events where transmission circuits were disconnected either automatically or by urgent manual switching. The vast majority of these events had no impact on electricity users with only 7 resulting in loss of supplies to customers.

Safety Training at Staythorpe

Number of Loss of Supply Incidents

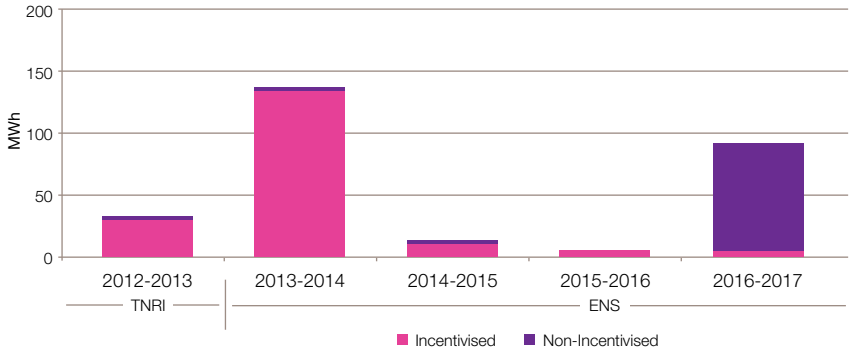
The chart shows the annual comparison of the numbers of Loss of Supply Incidents that occurred within the NGET Transmission System.



	2012-13	2013-14	2014-15	2015-16	2016-17
Incentivised	3	7	1	2	5
Non-Incentivised	1	2	4	3	2

Total Estimated Unsupplied Energy

The chart shows the annual comparison of the Estimated Unsupplied Energy for Loss of Supply Incidents that occurs within the NGET Transmission System.



	2012-13	2013-14	2014-15	2015-16	2016-17
Incentivised	31.5	135.03	8.69	4.45	6.77
Non-Incentivised	1.50	0.87	1.11	0.00	82.49

Total Estimated Unsupplied Energy

The total Estimated Unsupplied Energy from the NGET Transmission System during 2016-17 was:

89.26 MWh

Reliability of Supply

The Overall Reliability of Supply for the NGET Transmission System during 2016-17 was:

99.999964%

compared with 99.999998% in 2015-16 and 99.999996% in 2014-15.

Loss of Supply Incident Details

NGET Loss of Supply Incidents – Incentivised

Incident Date, Time & Location	MW Lost	Mins	MWh Unsupplied
7 June 2016 17:04 at Leighton Buzzard 25 kV substation The Cowley – Leighton Buzzard – Sundon 400kV circuit tripped due to a lightning strike, disconnecting Leighton Buzzard 25kV substation for 3 minutes and 16 seconds.	0.0	3.3	0.0
15 September 2016 11:55hrs at Rassau 132kV substation The Walham 400kV mesh circuit breakers opened, consequently off-loading the Walham-Rassau circuit resulting in a loss of supply at Rassau 132kV substation. Demand was restored in stages.	87.5	5.0	5.17†
16 September 2016 04:58 at Tynemouth 11kV substation The Blyth - South Shields – Tynemouth 275kV circuit tripped due to reported lightning activity in the area. This resulted in a loss of supply of 2.88MW at Tynemouth 11kV substation for 33 minutes and 17 seconds.	2.9	33.3	1.60
20 November 2016 09:36 at Frodsham 400kV substation SGT9 at Frodsham 400kV substation offloaded, resulting in a loss of supply to Network Rail for 2 hours 2 minutes and 6 seconds.	0.0	122.1	0.0
23 February 2017 10:13hrs at Frodsham 400kV substation All circuit breakers at Frodsham 400kV substation tripped consequently disconnecting Network Rail feeders to Crewe for 39 minutes.	0.0	39.0	0.0
		Total	**6.77 MWh**

NGET Loss of Supply Incidents – Non-Incentivised

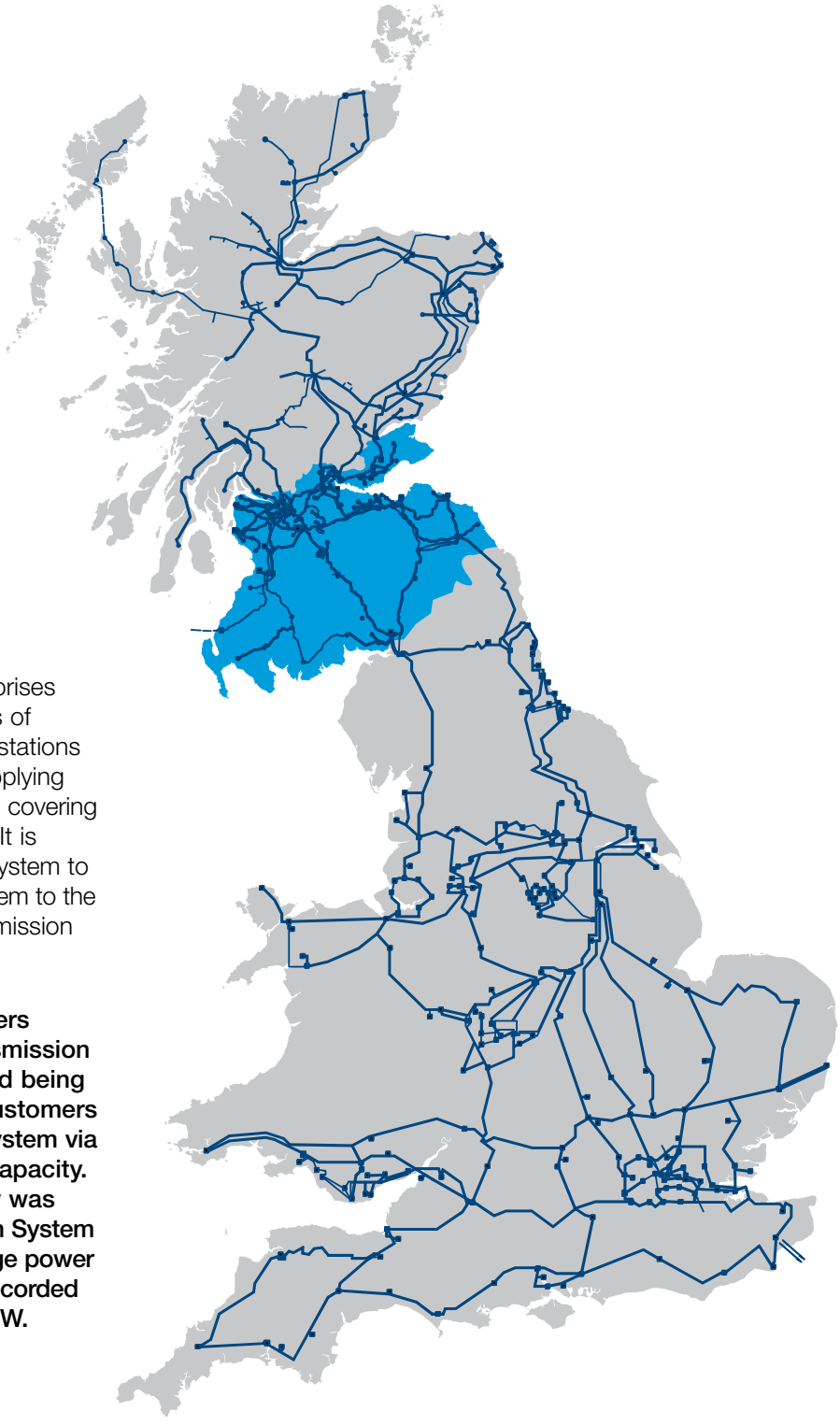
Incident Date, Time & Location	MW Lost	Mins	MWh Unsupplied
23 June 2016 01:48 at Redbridge 33kV substation Barking-Redbridge 1 & 2 275kV double circuit tripped, offloading Redbridge SGT1 and SGT2, resulting in a 42 second loss of supply at Redbridge 33kV substation.	50.0	0.7	0.58
23 February 2017 10:13 SPEN Ineos Chlor's industrial demand at Frodsham 400kV substation All circuit breakers at Frodsham 400kV substation tripped consequently disconnecting SPEN (DNO) feeder to Ineos Chlor chemical plant for 4 hours and 46 seconds.	20.25	240.8	81.26
15 September 2016 11:55hrs at Rassau 132kV substation The Walham 400kV mesh circuit breakers opened, consequently off-loading the Walham-Rassau circuit resulting in a loss of supply at Rassau 132kV substation. Demand was restored in stages.	-	-	0.65†
		Total	**82.49 MWh**

† During the incident 0.65MWh demand were restored within 3 minutes and thus this amount of demand was non-incentivised.

Deeside Substation

Section Three

SP Transmission System



System Description

The SPTL Transmission System comprises approximately 4,000 circuit kilometres of overhead line and cable and 147 substations operating at 400, 275 and 132kV supplying approximately 2 million customers and covering an area of 22,951 square kilometres. It is connected to the SHE Transmission System to the north, the NGET Transmission System to the south and the Northern Ireland Transmission System via an HVDC interconnector.

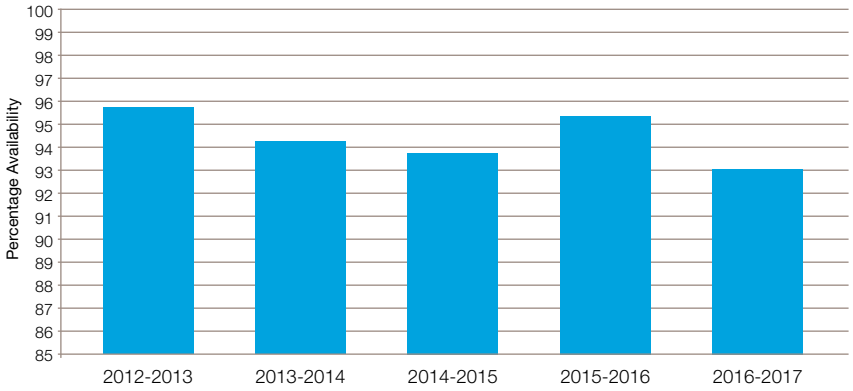
There are 9 major demand customers supplied directly from the SP Transmission System with the majority of the load being taken by approximately 2 million customers connected to the SP Distribution System via 14.2 GVA of installed transformer capacity. Over 7.3GW of generation capacity was connected to the SPTL Transmission System in 2016-17, including twenty one large power stations. In 2016-17 the maximum recorded demand on the network was 3.79GW.

Availability

The definitions and criteria for system availability can be found in the Glossary of Terms at the end of this report.

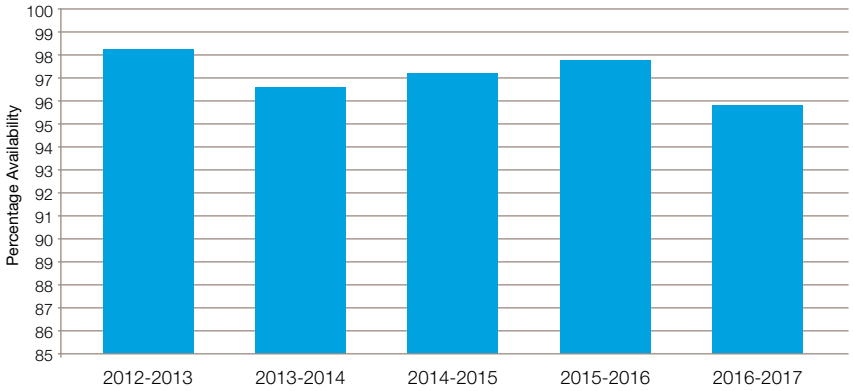
System performance is monitored by reporting variations in Annual System Availability, Winter Peak System Availability and Monthly System Availability. There is also a breakdown of Planned and Unplanned System Unavailability.

% Annual System Availability



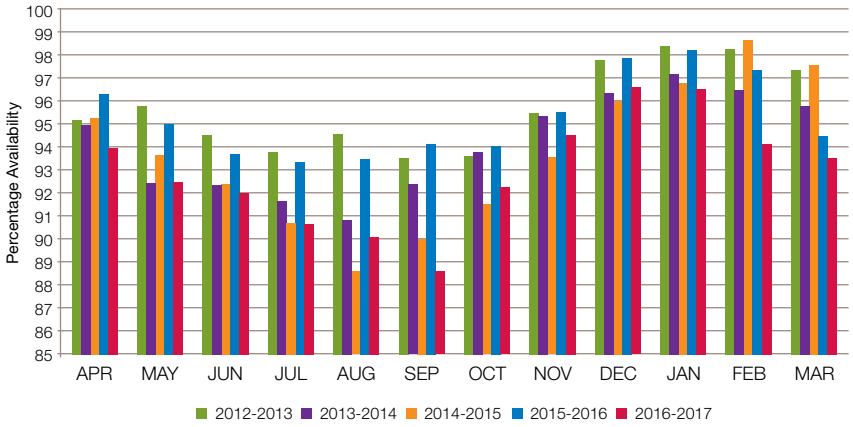
2012-13	2013-14	2014-15	2015-16	2016-17
95.72	94.14	93.88	95.29	93.01

% Winter Peak System Availability



2012-13	2013-14	2014-15	2015-16	2016-17
98.19	96.68	97.13	97.80	95.82

% Monthly System Availability

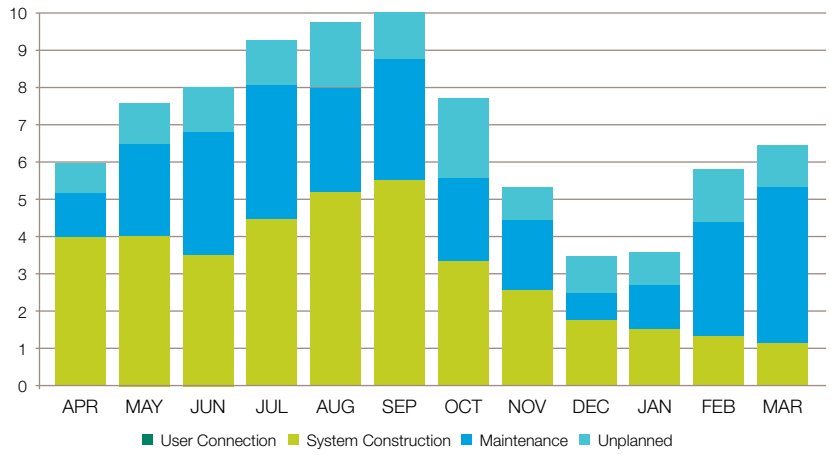


	2012-13	2013-14	2014-15	2015-16	2016-17
Apr	95.17	94.97	95.26	96.39	93.94
May	95.80	92.44	93.69	94.99	92.45
Jun	94.61	92.31	92.35	93.70	91.99
Jul	93.85	91.70	90.70	93.37	90.69
Aug	94.57	90.88	88.65	93.48	90.24
Sep	93.56	92.41	90.00	94.12	88.59
Oct	93.62	93.85	91.50	94.06	92.21
Nov	95.49	95.31	93.61	95.55	94.67
Dec	97.83	96.33	95.99	97.86	96.60
Jan	98.46	97.21	96.83	98.20	96.54
Feb	98.28	96.48	98.73	97.32	94.17
Mar	97.39	95.85	97.58	94.49	93.51

Planned and Unplanned System Unavailability

The table and the chart show the monthly variation in Planned and Unplanned System Unavailability.

Unavailability is defined as (100 – Availability) %



	User Connection	System Construction	Maintenance	Unplanned	Total
Apr	0.00	3.99	1.17	0.90	6.06
May	0.00	4.03	2.45	1.07	7.55
Jun	0.00	3.52	3.34	1.15	8.01
Jul	0.00	4.51	3.59	1.21	9.31
Aug	0.00	5.17	2.87	1.72	9.76
Sep	0.00	5.45	3.31	2.65	11.41
Oct	0.00	3.34	2.24	2.21	7.79
Nov	0.00	2.52	1.96	0.85	5.33
Dec	0.00	1.71	0.81	0.88	3.40
Jan	0.00	1.51	1.15	0.80	3.46
Feb	0.00	1.40	2.91	1.52	5.83
Mar	0.00	1.15	4.13	1.21	6.49

Heddon Tee Work to Increase Scottish Transfer Capacity

Security

The definitions and criteria for system security can be found in the Glossary of Terms at the end of this report.

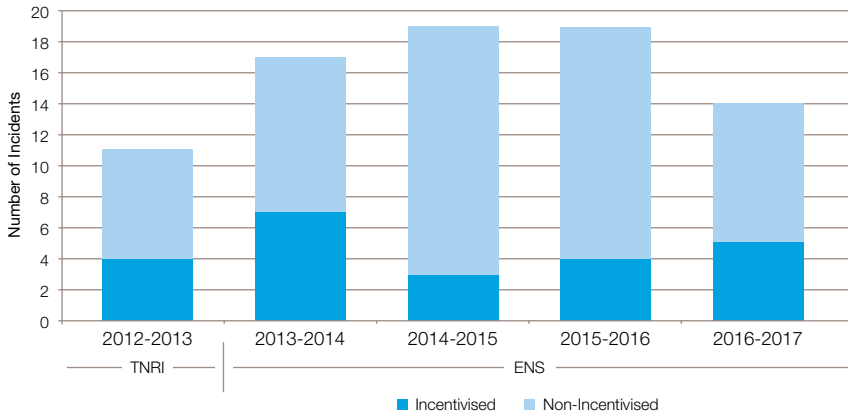
System performance is monitored by the estimated unsupplied energy from the SP Transmission System for each incident.

During 2016-17 there were 108 SPT system events where transmission circuits were disconnected either automatically or by urgent manual switching. The vast majority of these events had no impact on electricity users with only 14 resulting in loss of supply to customers.

Work at Substation

Number of Loss of Supply Incidents

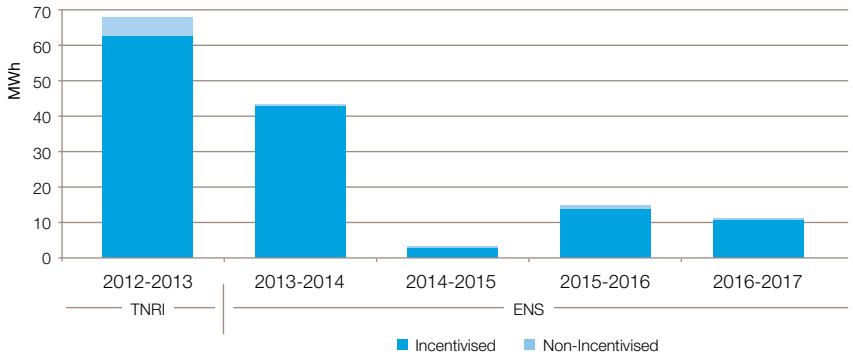
The chart shows the annual comparison of the numbers of Loss of Supply Incidents that occurred within the SP Transmission System.



	2012-13	2013-14	2014-15	2015-16	2016-17
Incentivised	4	7	3	4	5
Non-Incentivised	7	10	16	15	9

Total Estimated Unsupplied Energy

The chart shows the annual comparison of the Estimated Unsupplied Energy, incentivised, for Loss of Supply Incidents that occur within the SP Transmission System.



	2012-13	2013-14	2014-15	2015-16	2016-17
Incentivised	62.80	42.30	2.80	13.90	11.31
Non-Incentivised	5.40	0.10	0.20	0.80	0.04

Total Estimated Unsupplied Energy

The total Estimated Unsupplied Energy from the SP Transmission System during 2016-17 was:

11.35 MWh

Reliability of Supply

The Overall Reliability of Supply for the SP Transmission System during 2016-17 was:

99.999939%

compared with 99.999920% in 2015-16 and 99.99998% in 2014-15.

Loss of Supply Incident Details

SPT Loss of Supply Incidents – Incentivised

Incident Date, Time & Location	MW Lost	Mins	MWh Unsupplied
13 April 2016 09:21 at Coatbridge 33kV Substation LVOC Protection operated at Coatbridge initiating the opening of SG1C Circuit Breaker, this resulted in supplies being lost to 17,187 customer for 7 minutes.	25.8	7	3.01
5 July 2016 23:38 at Earlstoun 132kV Substation Protection operation and auto-reclose on Glenlee/Tongland/Earlston 132kV circuit, switched 65 customers off for 5 minutes.	0.1	5	0.01
11 July 2016 20:44 at Dewar Place 275kV Substation Transformer cooling protection operated on both Transformers tripping the circuits and switching 61225 customers off for 5 minutes.	70.0	5	5.99
30 July 2016 04:25 at Tongland 132kV Substation Main protection operated on Tongland/Glenlee 132kV circuit switched 11,927 customers off for 11 minutes.	9.0	11	1.30
22 December 2016 16:38 at Hadyard Hill Windfarm Overcurrent protection at Maybole Circuit Breaker 320 operated taking wind farm off for 1 hour.	1.0	60	1.00
		Total	**11.31 MWh**

SPT Loss of Supply Incidents – Non-Incentivised

Incident Date, Time & Location	MW Lost	Mins	MWh Unsupplied
15 April 2016 09:13 at Markhill 275kV Substation Intertrip receive from AREC wind farm on T1A circuit.	0.0	221970	0.0
14 July 2016 07:13 at Kilmarnock South 275kV Substation A bird strike within the substation tripped SGT3 and switched 4819 customers off for 1 minute.	2.3	1	0.04
31 July 2016 06:06 at Whitelee Extension Substation Whitelee Extension SGT3 circuit busbar protection operation on customers G3 Circuit Breaker, Grid SG3 tripped. Customer internal issue.	0.0	0	0.0
9 September 2016 07:56 at Maybole 132kV Substation Maybole CB 320 tripped open due to operation of the Maybole Load Management Scheme. This tripped off Hadyard Hill wind farm.	0.0	12	0.0
23 October 2016 18:44 at Coylton Substation Dersaloch wind farm Grid 1 CB tripped suspect 33kV VT fault or cable fault.	0.0	1427	0.0
13 January 2016 01:54 at Galawhistle Substation Galawhistle wind farm tripped after exceeding load restrictions.	0.0	592	0.0
23 February 2017 11:32 at Markhill 275kv Substation Protection operation and auto reclose operation taking 4 wind farms off for 1 minute.	0.0	1	0.0
23 February 2017 11:48 at Markhill 275kv Substation Protection operation and auto reclose operation when SONI switched in DC link taking 4 wind farms off for 1 minute.	0.0	1	0.0
23 February 2017 12:26 at Markhill 275kv Substation Coylton/Auchencrosh/Mark Hill circuit switched out due to fault taking 4 wind farms off for 785 minute.	0.0	785	0.0
		Total	**0.04 MWh**

Section Four

SHE Transmission System

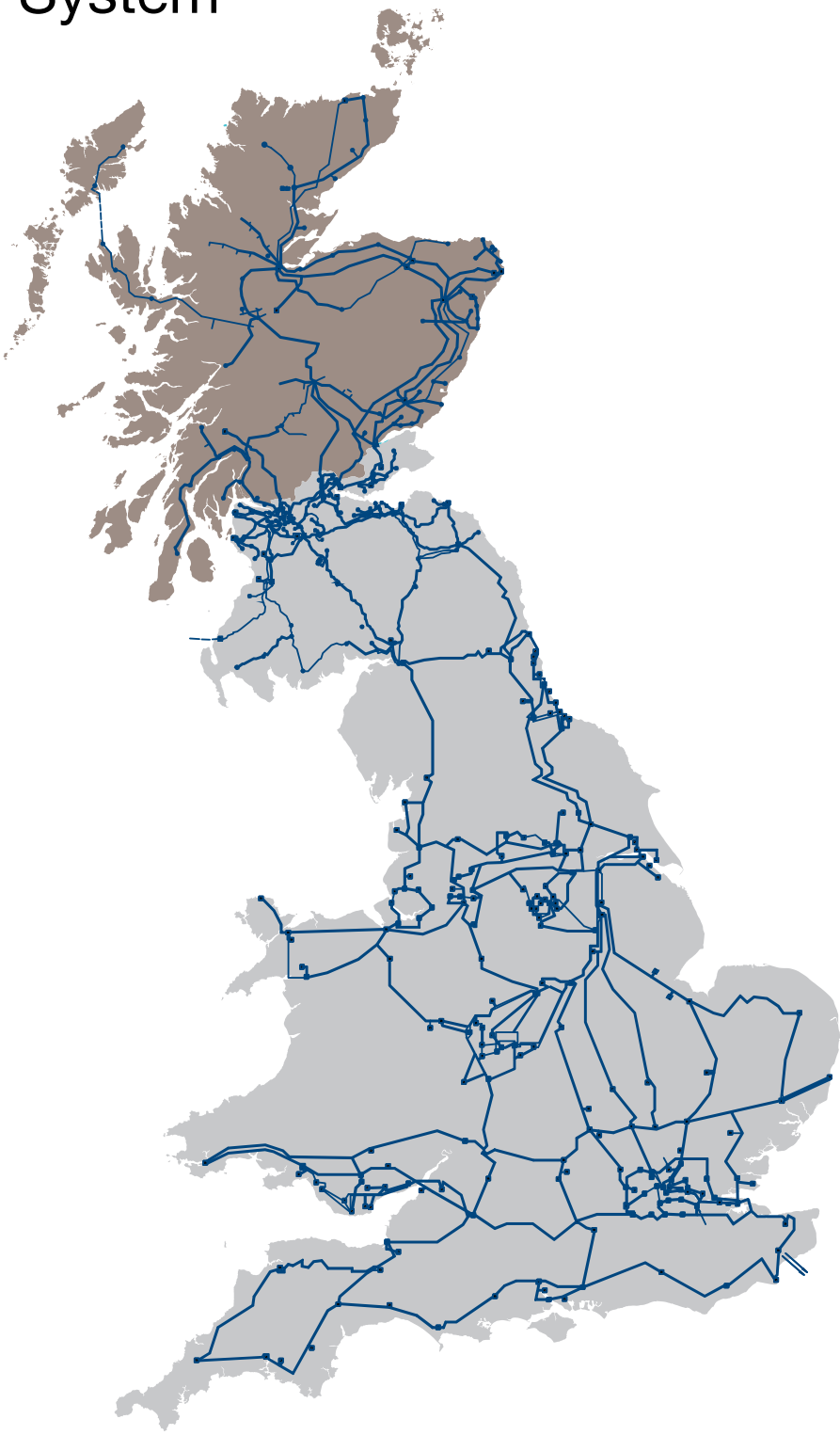
System Description

The SHE Transmission System comprises of 4,800 circuit kilometres of overhead line and over 280 circuit kilometres of underground transmission cable routes interconnecting 126 substations operating at 400, 275 and 132kV. The system covers an area of approximately 55,000 square kilometres or 24% of the Great Britain land mass. It is connected to the SP Transmission System to the South. In 2016-17 the maximum recorded demand on the network was 1.54GW.

There is over 6.61GW of generation capacity in the SHE Transmission area and 1 major customer supplied directly from the SHE Transmission System. The majority of the load is taken by approximately 0.77 million customers connected to the Scottish Hydro Electric Power Distribution Network via 7.94GVA of installed transformer capacity. There are 37 Large Power Stations directly connected to the SHE Transmission system.

80% of these transmission assets form the main interconnected transmission system whilst the remaining 20% radially supply the more remote areas of the territory including the outlying islands. Some connections, mainly in the more remote areas, can involve non-standard connection or running arrangements chosen by the customer.

When considering 132kV systems as transmission voltages it should be borne in mind that amounts of power transmitted at this voltage level are generally lower than at 275 and 400kV and as such may have lower security standards applied.

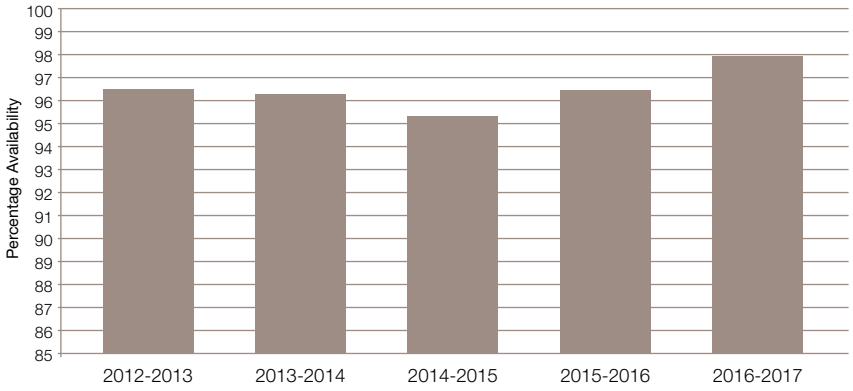


Availability

The definitions and criteria for system availability can be found in the Glossary of Terms at the end of this report.

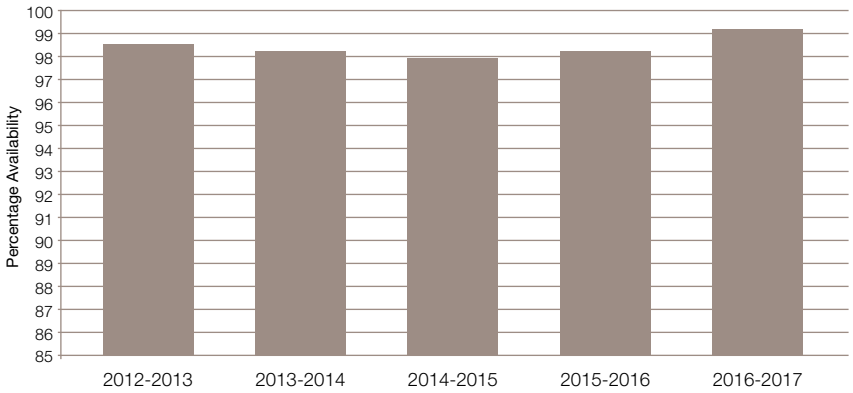
System performance is monitored by reporting variations in Annual System Availability, Winter Peak System Availability and Monthly System Availability. There is also a breakdown of Planned and Unplanned System Unavailability.

% Annual System Availability



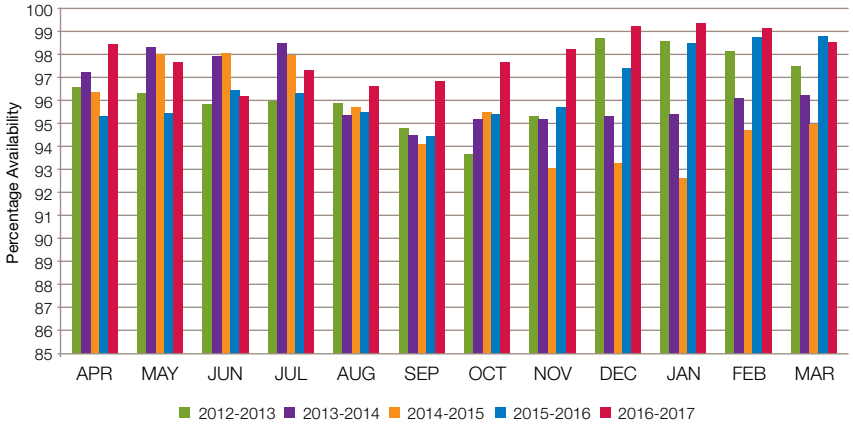
2012-13	2013-14	2014-15	2015-16	2016-17
96.48	96.29	95.32	96.53	97.92

% Winter Peak System Availability



2012-13	2013-14	2014-15	2015-16	2016-17
98.50	98.26	97.97	98.21	99.22

% Monthly System Availability

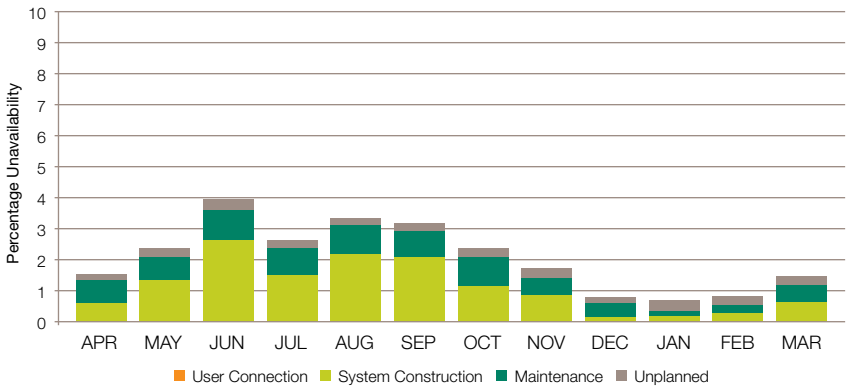


	2012-13	2013-14	2014-15	2015-16	2016-17
Apr	96.67	97.26	96.34	95.29	98.41
May	96.36	98.29	97.99	95.45	97.62
Jun	95.83	97.94	98.03	96.44	96.08
Jul	95.96	98.55	97.96	96.30	97.33
Aug	95.91	95.39	95.73	95.56	96.66
Sep	94.85	94.58	94.09	94.44	96.81
Oct	93.67	95.17	95.42	95.40	97.67
Nov	95.32	95.22	93.01	95.74	98.25
Dec	98.74	95.30	93.13	97.42	99.19
Jan	98.66	95.46	92.66	98.50	99.34
Feb	98.10	96.04	94.70	98.74	99.12
Mar	97.68	96.26	94.98	98.81	98.58

Planned and Unplanned System Unavailability

The table and the chart show the monthly variation in Planned and Unplanned System Unavailability.

Unavailability is defined as (100 – Availability) %



	User Connection	System Construction	Maintenance	Unplanned	Total
Apr	0.00	0.66	0.68	0.25	1.59
May	0.00	1.36	0.71	0.31	2.38
Jun	0.00	2.69	1.00	0.23	3.92
Jul	0.00	1.57	0.77	0.32	2.67
Aug	0.01	2.23	0.87	0.23	3.34
Sep	0.00	2.15	0.81	0.23	3.19
Oct	0.00	1.17	0.93	0.23	2.33
Nov	0.00	0.95	0.51	0.29	1.75
Dec	0.00	0.18	0.40	0.23	0.81
Jan	0.00	0.24	0.15	0.27	0.66
Feb	0.00	0.32	0.27	0.29	0.88
Mar	0.00	0.62	0.58	0.23	1.42

Construction of Beauly - Denny Route

Security

The definitions and criteria for system security can be found in the Glossary of Terms at the end of this report.

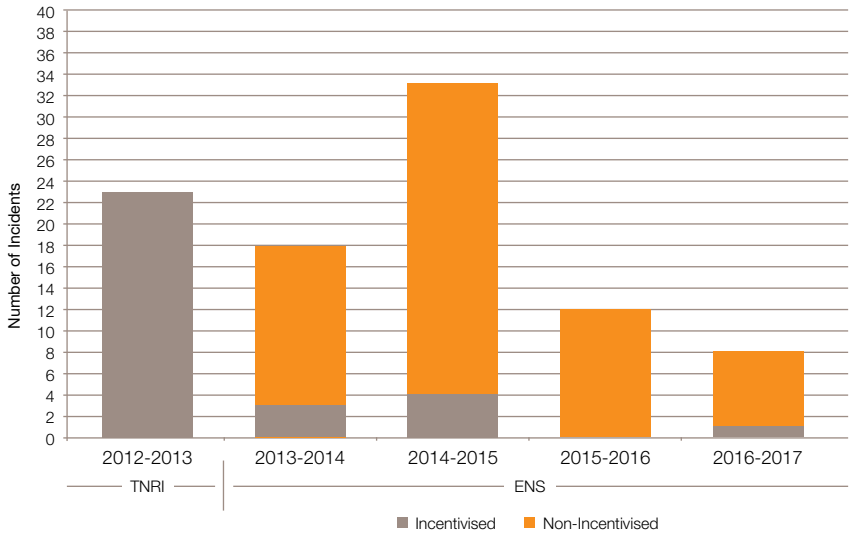
System performance is monitored by the Estimated Unsupplied Energy from the SHE Transmission System for each incident.

During 2016-17 there were 109 SHE Transmission system events where transmission circuits were disconnected either automatically or by urgent manual switching. The vast majority of these events had no impact on electricity users with 8 resulting in loss of supplies to customers.

A View of the Blackhillock 132kV Substation Compound

Number of Loss of Supply Incidents

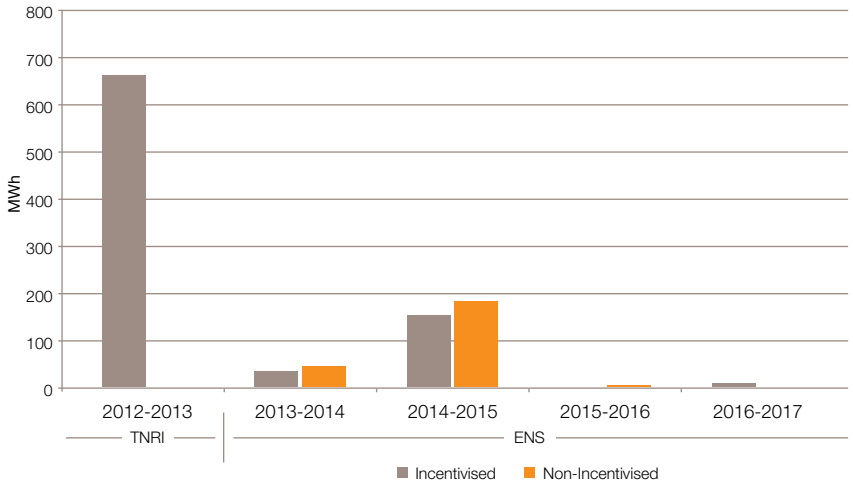
The chart shows the annual comparison of the numbers of Loss of Supply Incidents that occurred within the SHE Transmission System.



	2012-13	2013-14	2014-15	2015-16	2016-17
Incentivised	23	3	4	0	1
Non-Incentivised	0	15	29	12	7

Total Estimated Unsupplied Energy

The chart shows the annual comparison of the Estimated Unsupplied Energy for Loss of Supply Incidents that occur within the SHE Transmission System.



	2012-13	2013-14	2014-15	2015-16	2016-17
Incentivised	666.23	35.60	166.69	0.00	4.40
Non-Incentivised	0.00	44.40	194.70	0.87	0.00

Total Estimated Unsupplied Energy

The total Estimated Unsupplied Energy from the SHE Transmission System during 2016-17 was:

4.40 MWh

Reliability of Supply

The Overall Reliability of Supply for the SHE Transmission System during 2016-17 was:

99.999925%

compared with 99.999987% in 2015-16 and 99.99452% in 2014-15.

Loss of Supply Incident Details

SHE Transmission Loss of Supply Incidents – Incentivised

Incident Date, Time & Location	MW Lost	Mins	MWh Unsupplied
23 February 2017 10:07 at Sloy 132kV Substation The Sloy - Whistlefield - Dunoon 132kV circuit tripped and auto-reclosed during a period of high winds and rain.	**11.6**	**25**	**4.40**
		Total	**4.40 MWh**

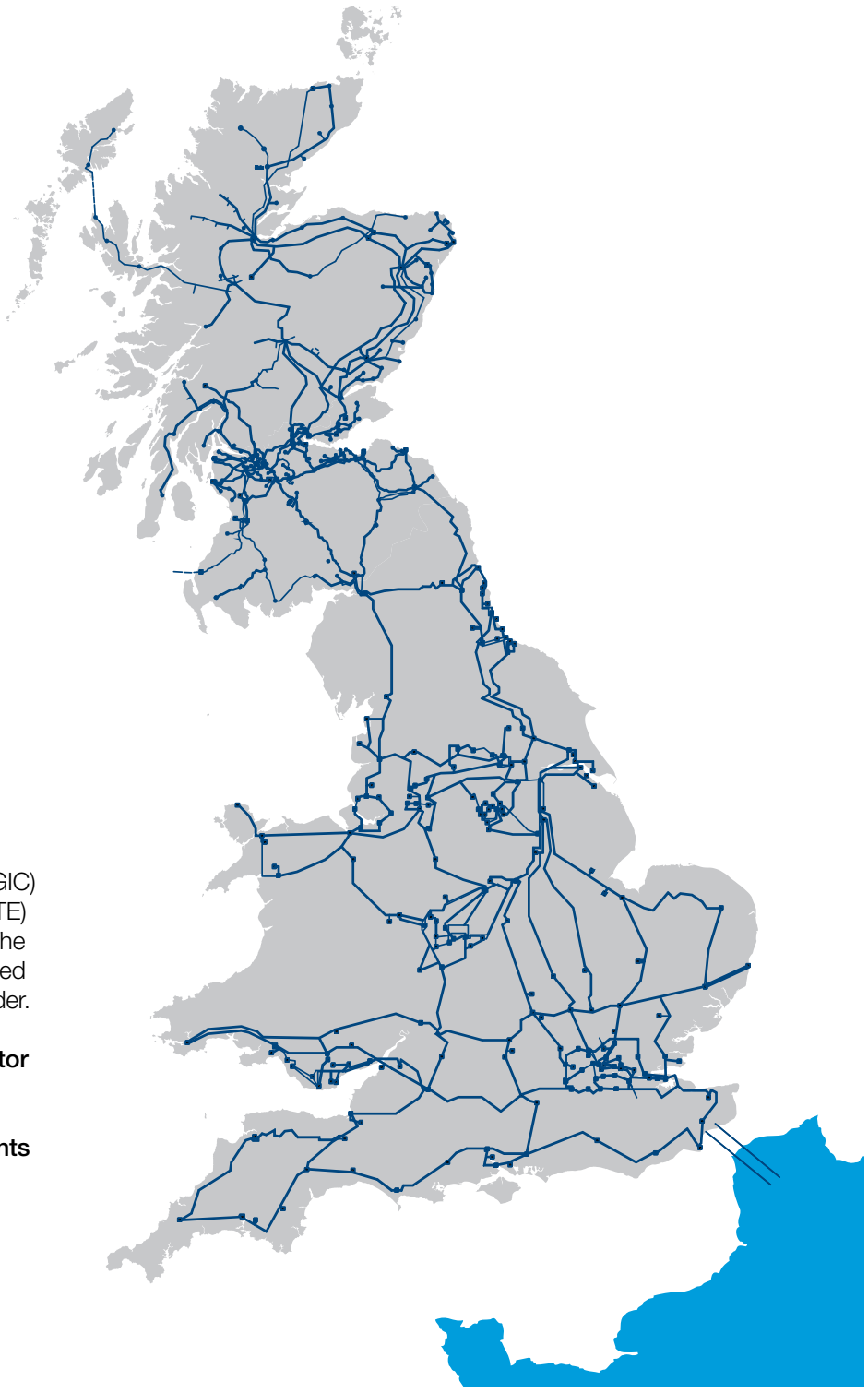
SHE Transmission Loss of Supply Incidents – Non-Incentivised

Incident Date, Time & Location	MW Lost	Mins	MWh Unsupplied
1 April 2016 18:00 at Fort Augustus 132kV Substation The Fort Augustus - Invergarry - Fort William - Kinlochleven 132kV circuit tripped and auto-reclosed during a period of high winds and rain.	**0.0**	**0.5**	**0.0**
9 September 2016 10:49 at Mybster 132kV Substation Mybster GT3 tripped during a period of high winds and rain due to a protection mal-operation.	**0.0**	**10**	**0.0**
16 November 2016 23:06 at Inveraray 132kV Substation The Inveraray - An Suidhe - Port Ann - Crossaig132kV circuit tripped and auto-reclosed during a period of lightning strikes.	**0.0**	**0.5**	**0.0**
16 November 2016 23:06 at Inveraray 132kV Substation The Inveraray - Crarae - Port Ann - Crossaig 132kV circuit tripped and auto-reclosed during a period of lightning strikes.	**0.0**	**0.5**	**0.0**
24 December 2016 06:14 at Grudie Bridge 132kV Substation Grudie Bridge GT1 tripped to clear a fault on the DNO network.	**0.0**	**12**	**0.0**
1 February 2017 19:06 at Mybster 132kV Substation Mybster GT4 tripped to clear a fault on the DNO network.	**0.0**	**155**	**0.0**
29 March 2017 12:37 at Shin 132kV Substation The Shin - Lairg - Cassley 132kV circuit tripped and auto-reclosed following switching error.	**0.0**	**1**	**0.0**
		Total	**0.0 MWh**

Section Five

Interconnectors

England – France Interconnector



System Description

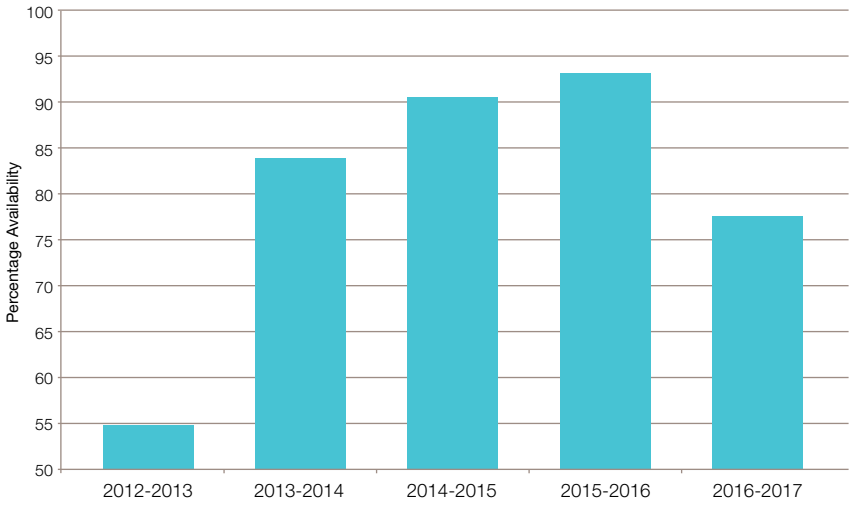
The National Grid transmission system between the English and French transmission systems is jointly owned by National Grid Interconnectors Limited (NGIC) and Réseau de Transport d'Electricité (RTE) the French transmission system owner. The information in this report has been provided by NGIC, the Interconnector Licence holder.

The total capability of the Interconnector is 2000MW. This is made up of four 'circuits', each of 500MW. There is no redundancy of the major components making up each circuit, hence all outages effect real time capability.

Annual Availability

Annual Availability of England – France Interconnector – 77.54 %

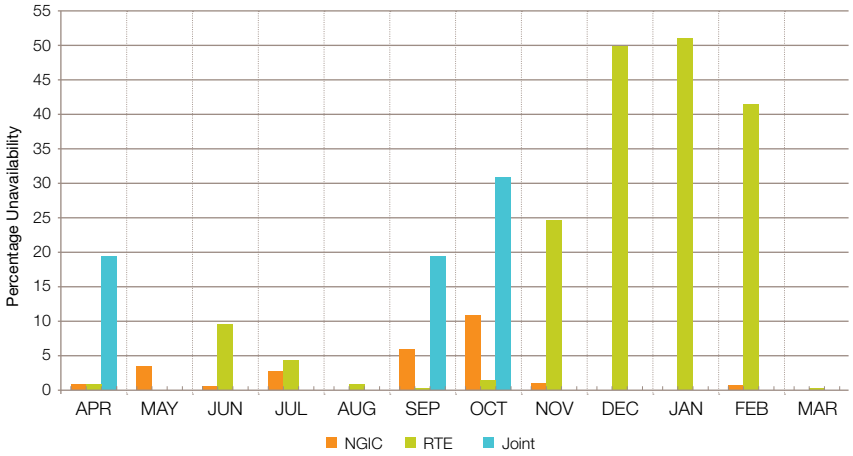
The chart below shows the annual comparison of availability of the England – France Interconnector.



2012-13	2013-14	2014-15	2015-16	2016-17
54.90	83.84	90.46	92.94	77.54

Monthly Unavailability

% England – France Interconnector Monthly Unavailability



	NGIC	RTE	Joint
Apr	0.44	0.45	18.80
May	3.79	0.0	0.0
Jun	0.14	9.48	0.0
Jul	2.91	4.26	0.0
Aug	0.0	0.45	0.0
Sep	5.96	0.19	19.06
Oct	11.03	1.73	30.73
Nov	1.25	24.69	0.0
Dec	0.0	50.0	0.0
Jan	0.0	51.03	0.0
Feb	1.08	41.73	0.0
Mar	0.0	0.25	0.0
Average	2.22	15.36	5.72

Annual System Availability

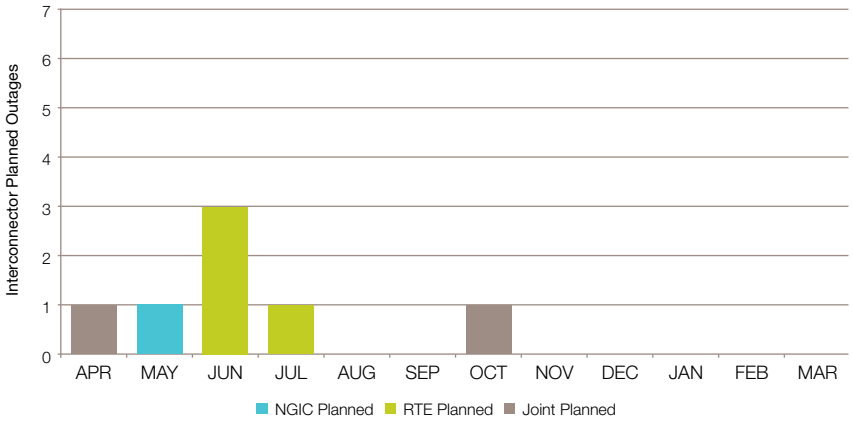
Annual Availability of
England – France Interconnector:

77.54%

Outages 2016-17 (April - March)

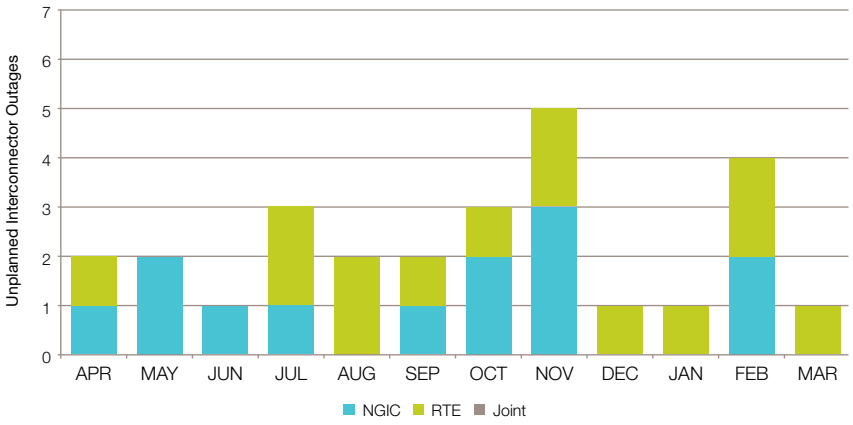
Notes: The charts below refer to Planned and Unplanned Outages. In this context Planned are notified prior to Day Ahead. Unplanned are notified at Day Ahead or within Contract Day.

Chart 1 below shows the Interconnector Planned Outages on a per month basis.



NGIC	1
RTE	4
Joint	2
Total	**7**

Chart 2 below shows the Interconnector Unplanned Outages on a per month basis.

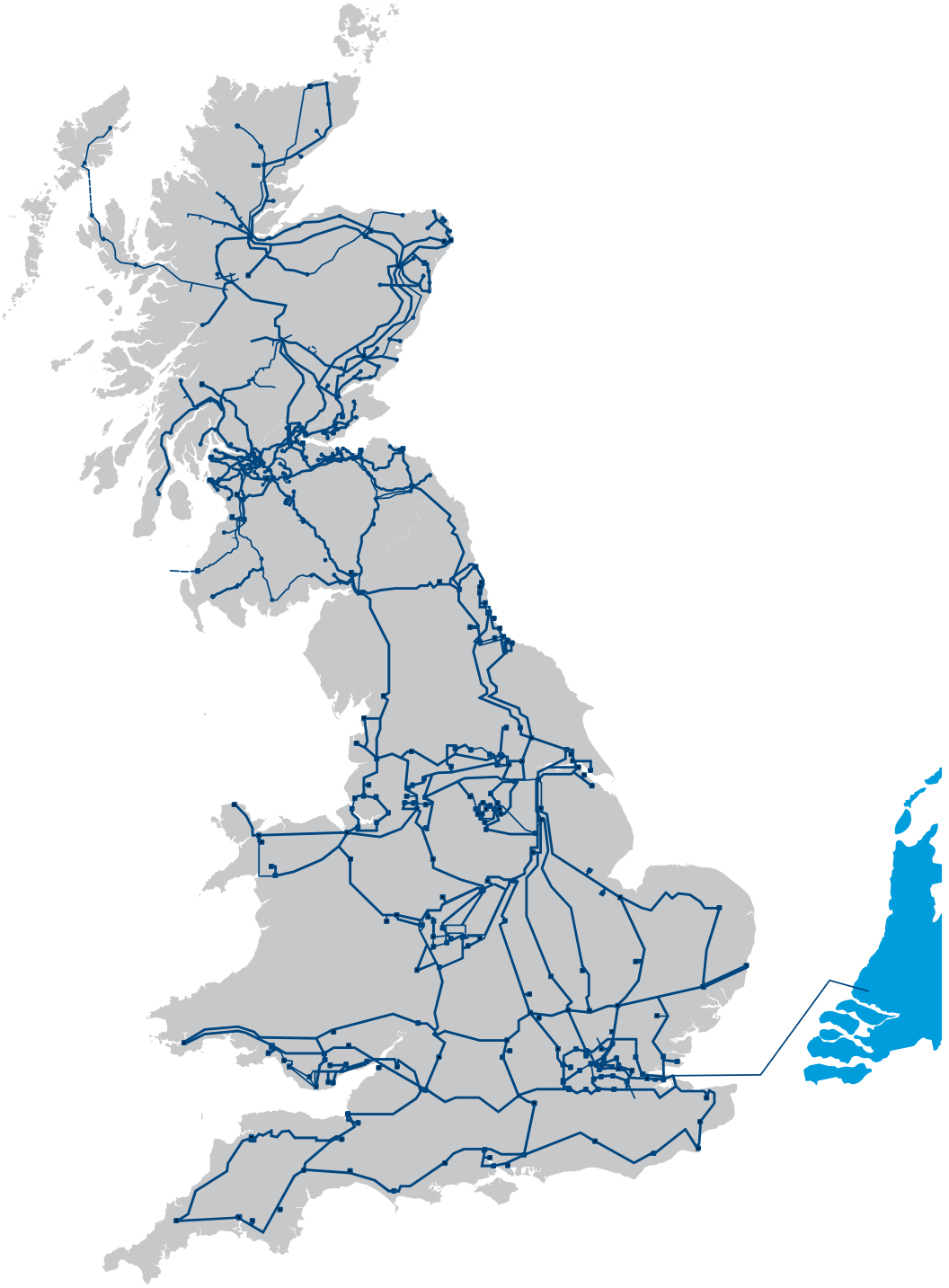


NGIC	13
RTE	14
Joint	0
Total	**27**

BritNed Shorelanding, Grain

Interconnectors

England – Netherlands Interconnector



System Description

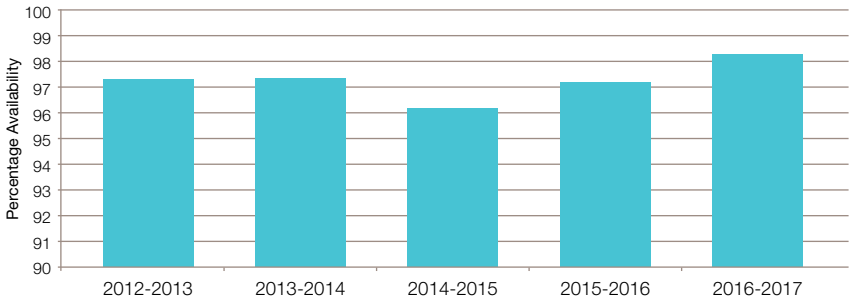
The NGET transmission system is interconnected with The Netherlands via a 260km subsea cable owned and operated by BritNed Development Limited ("BritNed"). The total capability of BritNed is 1000 MW and is made up of two 'poles', 500 MW each.

BritNed is jointly owned by National Grid and TenneT, and operated independently from their regulated businesses.

Annual Availability

The definitions and criteria for system availability can be found in the Glossary of Terms at the end of this report.

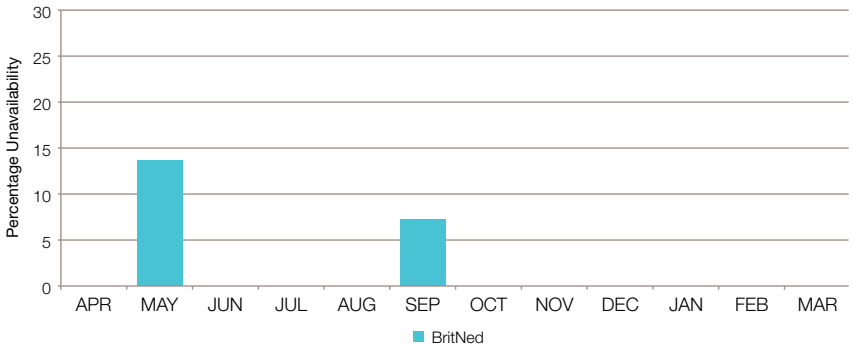
The chart below shows the availability of the England – Netherlands Interconnector.



2012-13	2013-14	2014-15	2015-16	2016-17
97.32	97.37	96.15	97.22	98.20

Monthly Unavailability

% England – Netherlands Interconnector Monthly Unavailability

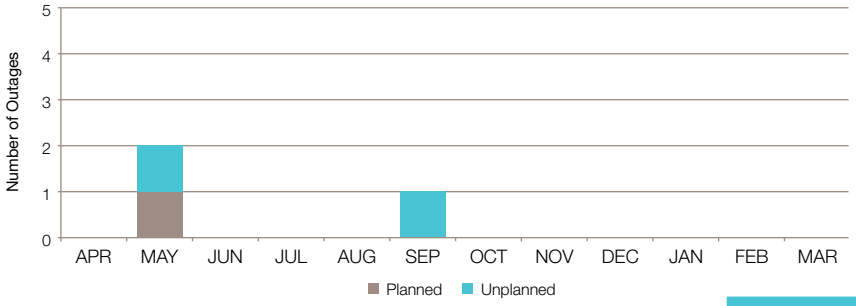


	BritNed
Apr	0.0
May	13.52
Jun	0.0
Jul	0.0
Aug	0.0
Sep	7.29
Oct	0.0
Nov	0.0
Dec	0
Jan	0.0
Feb	0.0
Mar	0
Average	1.73

Outages 2016-17 (April – March)

The chart refers to Planned and Unplanned Outages. In this context Planned are notified prior to Day Ahead and Unplanned are notified at Day Ahead or within the Contract Day.

Chart 1 below shows the Interconnector Planned and Unplanned Outages on a per month basis.



	Planned	Unplanned
Apr	0	0
May	1	1
Jun	0	0
Jul	0	0
Aug	0	0
Sep	1	0
Oct	0	0
Nov	0	0
Dec	0	0
Jan	0	0
Feb	0	0
Mar	0	0
Total	2	1

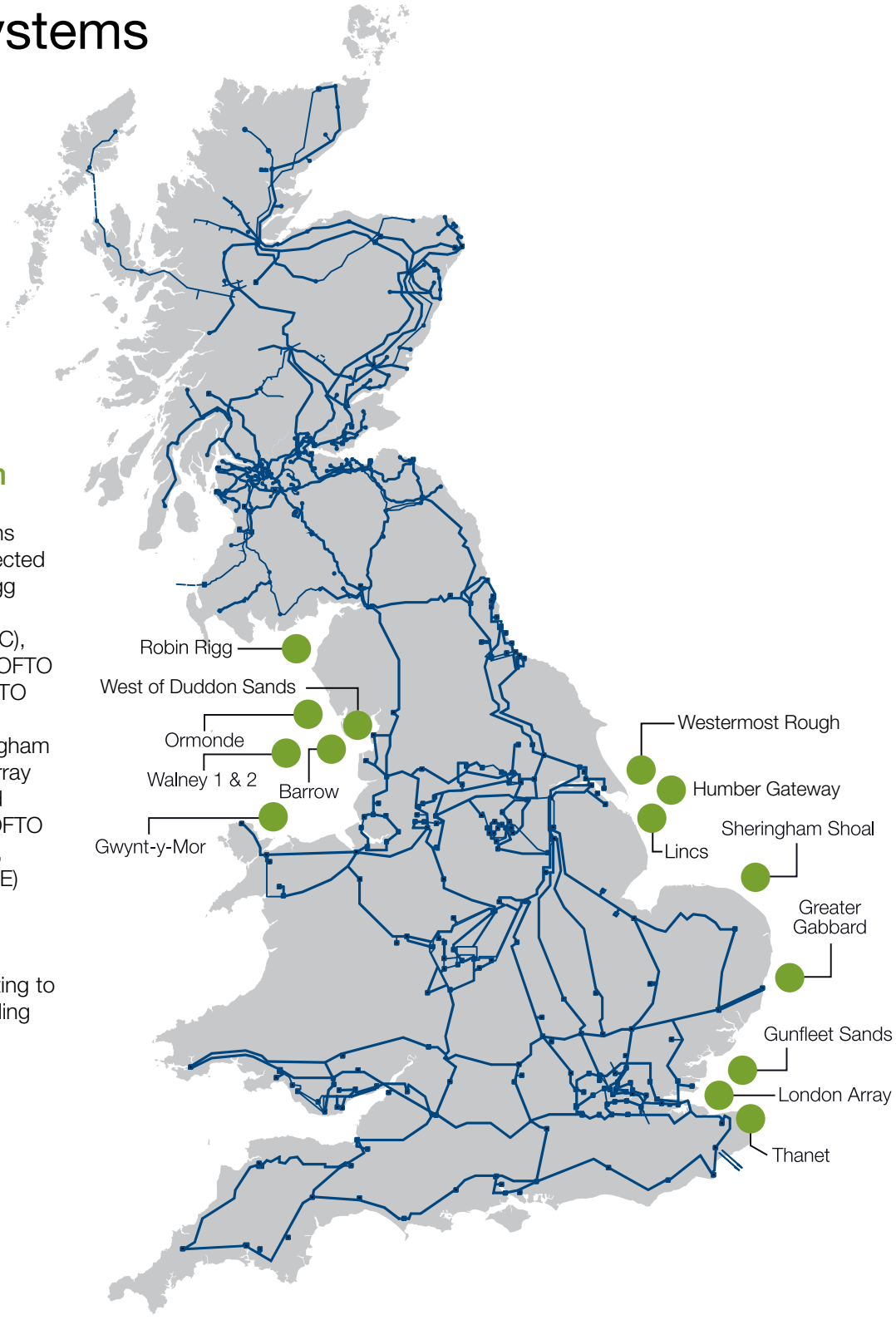
Annual System Availability

Annual Availability of
England – Netherlands Interconnector:

98.20%

Section Six

Offshore Systems



System Description

The following section contains details of the currently connected offshore networks; Robin Rigg OFTO (TC[‡]), Gunfleet Sands OFTO (TC), Barrow OFTO (TC), Ormonde OFTO (TC), Lincs OFTO (TC), Westermost Rough OFTO (TC), Walney 1 OFTO (BT[§]), Walney 2 OFTO (BT), Sheringham Shoal OFTO (BT), London Array OFTO (BT), Greater Gabbard OFTO (EQ[**]), Gwynt-Y-Mor OFTO (BBE[††]), Thanet OFTO (BBE), Humber Gateway OFTO (BBE) and West of Duddon Sands OFTO (WoDS). The offshore network consists of 1077 kilometres of circuit, connecting to 15 offshore substations totalling over 4.33GW of generating capacity.

[‡] TC: Transmission Capital [§] Blue Transmission Investments Limited [**] EQ: Equitix [††] BBE: Balfour Beatty & Equitix Consortium

Offshore Transmission Networks

Offshore Transmission Networks						
	Go Live	Number of Circuits	Circuit Length km	Generating Capacity MW	Connection Voltage	Interfacing Party
TC Robin Rigg	02/03/2011	2	28.8	184	132 kV	DNO
TC Gunfleet Sands	19/07/2011	1	12.76	163.9	132 kV	DNO
TC Barrow	27/09/2011	1	30.1	90	132 kV	DNO
TC Ormonde	10/07/2012	1	44.3	150	132 kV	DNO
TC Lincs	11/11/2014	2	122.6	250	400 kV	Transmission
TC Westermost Rough	11/02/2016	1	26.16	210	275 kV	Transmission
BT Walney 1	31/10/2011	1	48	182	132 kV	Transmission
BT Walney 2	04/10/2012	1	49	182	132 kV	DNO
BT Sheringham Shoal	05/07/2013	2	88	315	132 kV	DNO
BT London Array	18/09/2013	4	216	630	400 kV	Transmission
EQ Greater Gabbard	29/11/2013	3	135	500	132 kV	Transmission
BBE Gwynt Y Mor	17/02/2015	4	126.8	574	132kV	Transmission
BBE Thanet	17/12/2014	2	28.9	300	132kV	DNO
BBE Humber Gateway	15/09/2016	2	78	219	275kV	Transmission
West of Duddon Sands	25/08/2015	2	43	382	400kV	Transmission

Availability

Offshore Transmission Systems are radial and only connect offshore generation to the wider NETS. OFTOs' performance to be subject to regulatory incentivisation is different from that for onshore TOs', and is based on availability rather than loss of supply. OFTO provides availability information including all outages originating on an OFTO's system, but excluding outages that originate elsewhere, for example on a generator, DNO or TO's system. The OFTO availability incentive would adjust the outage data differently to calculate incentivised performance for each OFTO.

System performance is monitored by reporting variations in Annual System Availability, Winter Peak System Availability and Monthly System Availability. There is also a breakdown of Planned and Unplanned System Unavailability.

% Annual System Availability

Offshore Transmission Networks % Annual Availability					
	2012-13	2013-14	2014-15	2015-16	2016-17
TC Robin Rigg	99.89	99.85	98.19	99.99	98.08
TC Gunfleet Sands	100	100	99.53	100	99.95
TC Barrow	100	99.64	100	99.88	100
TC Ormonde	100	100	99.93	100	99.59
TC Lincs	N/A	N/A	100	99.96	99.93
TC Westermost Rough	N/A	N/A	N/A	100	100
BT Walney 1	97.47	99.99	100	100	99.62
BT Walney 2	100	94.89	100	92.47	100
BT Sheringham Shoal	N/A	99.20	99.84	100	99.95
BT London Array	N/A	99.97	99.90	99.98	98.88
EQ Greater Gabbard	N/A	99.81	100	100	99.78
BBE Gwynt Y Mor	N/A	N/A	82.59	82.58	99.73
BBE Thanet	N/A	N/A	82.47	83.05	96.15
BBE Humber Gateway	N/A	N/A	N/A	N/A	100
West of Duddon Sands	N/A	N/A	N/A	100	99.64

% Winter Peak System Availability

Offshore Transmission Networks % Annual Availability					
	2012-13	2013-14	2014-15	2015-16	2016-17
TC Robin Rigg	100	100	100	100	100
TC Gunfleet Sands	100	100	100	100	100
TC Barrow	100	100	100	100	100
TC Ormonde	100	100	100	100	100
TC Lincs	N/A	N/A	100	100	100
TC Westermost Rough	N/A	N/A	N/A	100	100
BT Walney 1	100	100	100	100	100
BT Walney 2	100	100	100	3.87	100
BT Sheringham Shoal	N/A	99.01	100	100	100
BT London Array	N/A	99.98	100	100	100
EQ Greater Gabbard	N/A	100	100	100	100
BBE Gwynt Y Mor	N/A	N/A	100	76.24	99.94
BBE Thanet	N/A	N/A	96.93	100	100
BBE Humber Gateway	N/A	N/A	N/A	N/A	100
West of Duddon Sands	N/A	N/A	N/A	100	100

% Monthly System Availability

Offshore Transmission Networks												
	April	May	June	July	August	September	October	November	December	January	February	March
TC Robin Rigg	100	100	100	99.91	88.03	89.14	100	100	100	100	100	100
TC Gunfleet Sands	100	100	99.87	99.52	100	100	100	100	100	100	100	100
TC Barrow	100	100	100	100	100	100	100	100	100	100	100	100
TC Ormonde	95.02	100	100	100	100	100	100	100	100	100	100	100
TC Lincs	100	100	100	100	99.20	100	100	100	100	100	100	100
TC Westermost Rough	100	100	100	100	100	100	100	100	100	100	100	100
BT Walney 1	100	100	100	100	100	100	95.58	100	100	100	100	100
BT Walney 2	100	100	100	100	100	100	100	100	100	100	100	100
BT Sheringham Shoal	100	100	100	100	100	100	100	100	100	100	100	99.36
BT London Array	100	100	100	100	100	86.42	100	100	100	100	100	100
EQ Greater Gabbard	100	100	100	100	97.38	100	100	100	100	100	100	100
BBE Gwynt Y Mor	100	100	100	100	97.05	99.85	100	100	100	100	99.82	100
BBE Thanet	53.99	100	100	100	100	100	99.79	100	100	100	100	100
BBE Humber Gateway	N/A	N/A	N/A	N/A	N/A	100	100	100	100	100	100	100
West of Duddon Sands	100	100	100	99.10	100	99.22	100	100	100	100	100	97.46

Annual System Availability

Annual Availability of
Offshore Networks for 2016-17

99.36%

Robin Rigg Wind Farm Onshore Substation

Monthly Planned & Unplanned Unavailability

The table shows the monthly variation in Planned and Unplanned System Unavailability for the Offshore Transmission Networks.

The unavailability has been classified by network responsibility i.e. OFTO or as a result of Non-OFTO.

Monthly Planned & Unplanned Unavailability													
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
TC Robin Rigg	OFTO Planned	0	0	0	0.09	0	10.86	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	11.97	0	0	0	0	0	0	0
	Non-OFTO	0	0	0.41	1.55	1.73	0	0.76	0.48	6.53	0	9.74	0
TC Gunfleet Sands	OFTO Planned	0	0	0.13	0.48	0	0	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0	0	0	0	0	0	0
	Non-OFTO	0	0	0	1.96	0	0	0	0	0	0	0	0
TC Barrow	OFTO Planned	0	0	0	0	0	0	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0	0	0	0	0	0	0
	Non-OFTO	0	0	0	0	0	0	0.62	0	0	0	0	0
TC Ormonde	OFTO Planned	4.98	0	0	0	0	0	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0	0	0	0	0	0	0
	Non-OFTO	0	0	0	0	0	0	0	27.36	0	0	0	0
TC Lincs	OFTO Planned	0	0	0	0	0.80	0	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0	0	0	0	0	0	0
	Non-OFTO	0	0	0	0	0	7.88	0	0	0	0	0	0
TC Westermost Rough	OFTO Planned	0	0	0	0	0	0	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0	0	0	0	0	0	0
	Non-OFTO	0	0	0	0	0	0	0	0	0	0	0	0
BT Walney 1	OFTO Planned	0	0	0	0	0	0	4.42	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0	0	0	0	0	0	0
	Non-OFTO	0	0	0	0	0	0.51	0	0	0	0	0	0
BT Walney 2	OFTO Planned	0	0	0	0	0	0	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0	0	0	0	0	0	0
	Non-OFTO	0	0	0	0	16.78	0	0	0	0	0	0	0
BT Sheringham Shoal	OFTO Planned	0	0	0	0	0	0	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0	0	0	0	0	0	0
	Non-OFTO	0	0	0	0	0	0.47	0.10	0	0	0	0	0
BT London Array	OFTO Planned	0	0	0	0	0	1.78	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	11.80	0	0	0	0	0	0
	Non-OFTO	0	0	0	0	0	0	0	0	0	0	0	0
EQ Greater Gabbard	OFTO Planned	0	0	0	0	2.62	0	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0	0	0	0	0	0	0
	Non-OFTO	0	0	0	0	0	0	0	0	0	0	0.29	0
BBE Gwynt Y Mor	OFTO Planned	0	0	0	0	2.95	0	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0.15	0	0	0.18	0	0	0
	Non-OFTO	0	0	0	0	0	0	0	0	0	0	0	0
BBE Thanet	OFTO Planned	0	0	0	0	0	0	0.21	0	0	0	0	0
	OFTO Unplanned	46.01	0	0	0	0	0	0	0	0	0	0	0
	Non-OFTO	0	0	0	0	9.09	50	18.58	0	0	0	0	0
BBE Humber Gateway	OFTO Planned	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0
	OFTO Unplanned	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0
	Non-OFTO	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0
West of Duddon Sands	OFTO Planned	0	0	0	0.90	0	0.78	0	0	0	0	0	0
	OFTO Unplanned	0	0	0	0	0	0	0	0	0	0	0	2.54
	Non-OFTO	0	0	0	0	0	0	0	0	0	0	0	0

Outage Details

Offshore system outages are calculated using MW of offshore transmission capacity unavailable not generation lost.

TC Robin Rigg			
Outage Date & Time	**Reason**	**Days & Hours**	**MWh**
5 June 2016 09:09 DNO request (Robin Rigg West Outage)	Non-OFTO	2.97 hours	272.93
6 July 2016 08:02 Generator maintenance (Robin Rigg East Outage)	Non-OFTO	11.50 hours	1058.00
21 July 2016 07:11 Restoration of reactive power compensation system (Robin Rigg East Outage)	OFTO	0.25 hours	23.00
21 July 2016 07:40 Restoration of reactive power compensation system (Robin Rigg West Outage)	OFTO	0.42 hours	38.33
2 August 2016 08:10 Generator maintenance (Robin Rigg West Outage)	Non-OFTO	12.90 hours	1186.80
19 August 2016 18:47 To investigate root cause and top up SF6 gas levels of Circuit Breaker 290 (Robin Rigg West Outage)	OFTO	3 days 16.37 hours	8129.73
26 August 2016 10:33 To top up SF6 gas levels of Circuit Breaker 290 (Robin Rigg West Outage)	OFTO	0.68 hours	62.87
3 September 2016 11:31 To top up SF6 gas levels of Circuit Breaker 290 (Robin Rigg West Outage)	OFTO	0.88 hours	81.27
11 September 2016 11:32 To top up SF6 gas levels of Circuit Breaker 290 (Robin Rigg West Outage)	OFTO	0.77 hours	70.53
18 September 2016 11:29 To top up SF6 gas levels of Circuit Breaker 290 (Robin Rigg West Outage)	OFTO	0.48 hours	44.47
27 September 2016 08:07 Circuit Breaker 290 repair to address SF6 gas leak (Robin Rigg West Outage)	OFTO	3 days 7.05 hours	6996.60
17 October 2016 07:26 DNO request (Robin Rigg East Outage)	Non-OFTO	2.00 hours	184.00
31 October 2016 12:03 DNO request (Robin Rigg West Outage)	Non-OFTO	3.65 hours	335.80
10 November 2016 12:50 DNO request (Robin Rigg West Outage)	Non-OFTO	3.45 hours	317.40
10 December 2016 07:25 DNO request (Robin Rigg West Outage)	Non-OFTO	5.78 hours	532.07
10 December 2016 13:13 DNO request (Robin Rigg 99MW restriction)[ß]	Non-OFTO	1 day 18.27 hours	3592.67
12 December 2016 07:30 DNO request (Robin Rigg West Outage)	Non-OFTO	0.50 hours	46.00
6 February 2017 08:24 DNO request (Robin Rigg West Outage)	Non-OFTO	1 day 9.35 hours	3068.20
13 February 2017 09:20 DNO request (Robin Rigg West Outage)	Non-OFTO	1 day 8.08 hours	2951.67
		Total	**28992.33 WWh**

TC Gunfleet Sands			
Outage Date & Time	**Reason**	**Days & Hours**	**MWh**
28 June 2016 08:25 Offshore Transformer (T1) was taken out of service to carry out annual maintenance[‡‡]	OFTO	4.65 hours	152.43
2 July 2016 14:59 Offshore Transformer (T1) was taken out of service as per generator request[ß]	Non-OFTO	3 days 0.87 hours	2388.57
13 July 2016 08:34 Offshore Transformer (T1) was taken out of service to carry out annual maintenance[ß]	OFTO	9.68 hours	317.42
14 July 2016 09:42 Offshore Transformer (T2) was taken out of service to carry out annual maintenance[§§]	OFTO	8.17 hours	267.70
		Total	**3126.12 MWh**

[ß] This was a generation restriction of the wind farm to 99MW as requested by the DNO.
[‡‡] This offshore transformer (T1) outage resulted in 80% availability.
[§§] This offshore transformer (T2) outage resulted in 80% availability

TC Barrow

Outage Date & Time	Reason	Days & Hours	MWh
22 October 2016 10:29 DNO request	Non-OFTO	4.62 hours	415.50
		Total	415.50 MWh

TC Ormonde

Outage Date & Time	Reason	Days & Hours	MWh
19 April 2016 07:21 Harmonic filter works, excluded under licence	OFTO	1 day 11.88 hours	5382.50
5 November 2016 10:20 DNO request to repair disconnector 404	Non-OFTO	8 days 5 hours	29550.00
		Total	34932.50 MWh

TC Lincs

Outage Date & Time	Reason	Days & Hours	MWh
28 August 2016 06:01 SVC controller sent a 400kV trip – reason for trip signal is under investigation	OFTO	5.98 hours	1495.83
6 September 2016 07:56 NGET request	Non-OFTO	2 days 8.75 hours	14187.50
		Total	15683.33 MWh

TC Westermost Rough

Outage Date & Time	Reason	Days & Hours	MWh
-None-			
		Total	0MWh

BT Walney 1

Outage Date & Time	Reason	Days & Hours	MWh
11 October 2016 08:54 Planned outage for transformer and protection maintenance	OFTO	1 day 8.86 hours	5521.60
14 September 2016 10.37 32.14% reduction in availability after GT trip caused by Generator fault.	NON-OFTO	7.08hrs	382.5
16 September 2016 07:42 32.14% reduction in availability after GT trip caused by Generator fault	NON-OFTO	4.35hrs	234.9
		Total	6109.00 MWh

BT Walney 2

Outage Date & Time	Reason	Days & Hours	MWh
07 August 2016 08:12 DNO Outage for ENWL maintenance	NON-OFTO	5 Days 4.65hrs	22,686.30
		Total	0MWh

BT London Array

Outage Date & Time	Reason	Days & Hours	MWh
06 September 2016 08:12 Export circuit 2 / SGT2A maintenance	OFTO	11.30 hours	1627.00
09 September 2016 05:50 400kV Circuit Breaker X190 failure	OFTO	7 days 17.78 hours	53506.00
20 September 2016 07:32 Export circuit 4 / SGT2B maintenance	OFTO	11.21 hours	1615.00
26 September 2016 07:07 Export circuit 1 / SGT1A maintenance	OFTO	11.78 hours	1697.00
28 September 2016 07:56 SGT 2A & 2B Filter Installation	OFTO	10.93 hours	3149.00
		Total	61594.00 MWh

BT Sheringham Shoal

Outage Date & Time	Reason	Days & Hours	MWh
08 March 2017 07:11 4 Inspection of Fibre Optic Earth Pits	OFTO	4.73 hours	1491.00
16 September 2016 06:34 50% Reduction in availability to allow switching for DNO planned outage	NON-OFTO	2.55hrs	401.63
22 September 2016 15:04 9.14% Reduction in availability to allow isolation of Generator equipment	NON-OFTO	23.36hrs	673.92
08 October 2017 12:32 50% Reduction in availability to allow switching for DNO planned outage	NON-OFTO	0.48hrs	76.13
11 October 2017 06:34 50% Reduction in availability to allow switching for DNO planned outage	NON-OFTO	0.45hrs	70.88
28 October 2017 16:16 50% Reduction in availability to allow switching for DNO planned outage	NON-OFTO	0.50hrs	78.75
		Total	2792.31 MWh

Equitix Greater Gabbard

Outage Date & Time	Reason	Days & Hours	MWh
15 August 2016 06:24 Export Circuit 1 - Onshore & Offshore Planned Maintenance Campaign	OFTO	11.65 hours	1941.67
16 August 2016 06:21 Export Circuit 2 - Onshore & Offshore Planned Maintenance Campaign	OFTO	1 day 10.65 hours	5775.00
18 August 2016 06:24 Export Circuit 3 - Onshore & Offshore Planned Maintenance Campaign	OFTO	12.18 hours	2030.56
31 March 2017 09:20 Export Circuit 2 - Galloper construction works at Leiston 132kV substation	Non-OFTO	6.56 hours	1097.22
		Total	10844.45 MWh

BBE Gwynt-Y-Mor

Outage Date & Time	Reason	Days & Hours	MWh
24 August 2016 08:50 Export Circuit 3 - Offshore Switchgear Inspection	OFTO	1 day 7.16 hours	4472.42
27 August 2016 09:35 Export Circuit 4 - Offshore Switchgear Inspection	OFTO	1 day 5.80 hours	4276.30
30 August 2016 10:52 Export Circuit 2 - Offshore Switchgear Inspection	OFTO	1 day 2.73 hours	3836.23
13 September 2016 10:15 400kV Export Circuit 1 trip due to SVC system fault	OFTO	1.28 hours	368.32
13 September 2016 17:40 400kV Export Circuit 1 trip due to SVC system fault	OFTO	0.93 hours	267.87
19 December 2016 10:35 400kV Export Circuit 2 trip due to SVC system fault	OFTO	1.37 hours	392.23
19 December 2016 12:04 400kV Export Circuit 1 trip due to SVC system fault	OFTO	1.27 hours	363.53
		Total	13976.90 MWh

BBE Thanet

Outage Date & Time	Reason	Days & Hours	MWh
1 April 2016 00:00 (continued from previous year) - Export Cable 2 Primary System Fault	OFTO	27 days 14.48 hours	99373.00
30 August 2016 10:39 GT2 Radiator replacement works & Export Cable 2 Transition Joint Bay Replacement	Non-OFTO	43 days 1.80 hours	155069.92
27 October 13:01 GT1 Tap Changer check	OFTO	3.15 hours	472.50
		Total	254915.42 MWh

BBE Humber Gateway			
Outage Date & Time	Reason	Days & Hours	MWh
-None-			
		Total	0MWh

West of Duddon Sands			
Outage Date & Time	Reason	Days & Hours	MWh
27 July 2016 09:20 OFTO planned maintenance - Circuit 1	OFTO	14.02 hours	2565.05
14 September 2016 09:23 OFTO planned maintenance - Circuit 2	OFTO	12.27 hours	2133.08
17 March 2017 00:47 Trip - Circuit 2	OFTO	1 day 18.67 hours	7230.90
		Total	11929.03 MWh

Annual System Availability

Annual Availability of Offshore Networks for 2016-17 was:

99.36%

Walney 1 Offshore Substation Platform Walkway

Glossary of Terms

This glossary provides explanations and definitions for common terms used throughout this report.

System Availability

System availability is reduced whenever a circuit is taken out of operation for either planned purposes or as a result of a fault.

Planned outages are required for system construction and new user connections in addition to the maintenance necessary to retain a high level of system reliability to ensure that licence standards of security are met.

System Availability is calculated by the formula:

$$\left(\frac{\text{The sum for all circuits of hours available}}{\text{(No. of circuits) x (No. of hours in period)}} \right) \text{X100\%}$$

A circuit is defined as equipment on the transmission system, e.g. overhead line, transformer or cable which either connects two bussing points or connects two or more circuit breakers/disconnectors, excluding busbars.

Winter Peak Availability is defined as the average System Availability over the three months of December, January and February.

System Unavailability

System Unavailability is calculated by the formula:

(100 - Availability) %

Unavailability falls into 4 categories, 3 of which are planned and the other unplanned:

- Maintenance Outages are planned outages required for maintenance;
- System Construction Outages are planned outages required to construct or modify assets which are not provided for the exclusive benefit of specific users;
- User Connection Outages are planned outages required to construct or modify assets which are provided to facilitate connection for the exclusive benefit of specific system users; and
- Unplanned Unavailability is due to outages occurring as a result of plant or equipment failure, i.e. outages required and taken at less than 24 hours' notice.

Offshore System Availability

OFTO availability is calculated using the formula:

$$\left(\frac{\text{Total MWh system is capable of delivering - MWh unavailable}}{\text{Total MWH system is capable of delivering}} \right) \text{X100\%}$$

NETS Grid Code and NETS Security and Quality of Supply Standard

The NETS Grid Code and NETS Security and Quality of Supply Standard (NETS SQSS) define the required security level to which the system is planned. The required security level at a substation increases with the amount of demand connected to the substation and so the planned level of demand security is normally higher for 400 kV and 275 kV transmission voltages than for 132 kV. Additionally, the 132 kV network is, in parts, less interconnected than the higher voltage systems and so losses of 132 kV transmission circuits (for example due to weather related transient faults) are more likely to lead to temporary losses of supply.

Loss of Supply Incidents

A loss of supply incident is defined as any incident on the transmission system that results in an actual unsupplied energy incident to a customer or customers including pumped storage units operating in pump mode.

All transmission system incidents that resulted in a loss of supplies are reported individually giving information about the cause of the incident, its location, duration and an estimate of unsupplied energy.

Loss of Supply Incidents at '3 or less customers' sites

(TNRI – 2005-2013)

The TNRI '3 or less customers' category covers locations where major industrial customers are directly connected to the transmission system. The customer could be a steelworks, refinery or other large industrial processing site. Connection arrangements are chosen by the customer and often have a level of design and operational security below that normally required to satisfy the NETS SQSS. This may be reflected in a reduced cost of the connection. In some cases, customers have also chosen to secure their supplies using their own generation to compensate for this reduced level of transmission system security. Distribution Network Operators and domestic customers do not come within this category.

Loss of Supply Incidents – Non-Incentivised

(ENS – 2013 to date)

The ENS 'Non-Incentivised' category covers only connection arrangements that are chosen by the customer and often have a level of design and operational security below that normally required to satisfy the NETS SQSS. This may be reflected in a reduced cost of the connection. In some cases customers have also chosen to secure their supplies using their own generation to compensate for this reduced level of transmission security. Loss of supply incidents that are less than 3 minutes in duration are also part of the ENS 'Non-Incentivised' category. Distribution Network Operators and domestic customers do not come within this category.

Overall Reliability of Supply

The Overall Reliability of Supply for a transmission system is calculated using the formula:

$$\left[1-\left(\frac{\text{Estimated Unsupplied Energy}}{\text{Total energy that would have been supplied by the transmission system}}\right)\right]\times 100\%$$

Voltage Excursions

The Electricity Safety, Quality and Continuity Regulations 2002 permit variations of voltage not exceeding 10% above and below the nominal at voltages of 132 kV and above and not exceeding 6% at lower voltages. Any Voltage Excursions in excess of 15 minutes will be reported.

The NETS Grid Code reflects these limits, and imposes a further constraint for the 400 kV system in that voltages can only exceed +5% for a maximum of 15 minutes.

Consumers may expect the voltage to remain within these limits, except under abnormal conditions e.g. a system fault outside of the limits specified in the NETS SQSS.

Normal operational limits are agreed and monitored individually at connection points with customers to ensure that voltage limits are not exceeded following the specified credible fault events described in NETS SQSS.

Frequency Excursions

The Electricity Safety, Quality and Continuity Regulations 2002 permit variations in frequency not exceeding 1% above and below 50 Hz: a range of 49.5 to 50.5 Hz. Any frequency excursions outside these limits for 60 seconds or more will be reported.

The system is normally managed such that frequency is maintained within operational limits of 49.8 and 50.2 Hz.

Frequency may, however, move outside these limits under fault conditions or when abnormal changes to operating conditions occur. Losses of generation between 1320 and 1800 MW are considered abnormal and a maximum frequency change of 0.8Hz may occur, although operation is managed so that the frequency should return within the lower statutory limit of 49.5 Hz within 60 seconds.

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