



NETWORKS



ESB NETWORKS PERFORMANCE REPORT 2016



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1. Executive Summary

In 2016 ESB Networks commenced its Price Review 4 (“PR4”) programme of €1.84bn of capital investment and €1.36bn of operational activities and services. ESB Networks delivered €386m of capital investment in 2016, renewing and extending the distribution and transmission systems in Ireland. This year ESB Networks began the transition towards condition and risk-based network management, and met the demands of a steep uptake in new domestic connections.

In 2016, ESB Networks continued to progress its wide range of R&D projects. This included projects funded under the European Commission’s Horizon 2020 framework such as RealValue and EVOLVE DSO. ESB Networks also contributed to and presented at a range of international events throughout the year, with Eurelectric, Cigre and the ‘Smart Cities’ conference in Chicago.

In 2016 ESB Networks’ customer satisfaction performance remained high, at 80.72%. This was a hard earned improvement from the 2015 satisfaction figure of 80.14% and continued an improving trend seen in 2015.

By the end of 2016 the number of applicants for Gate 3 distribution system access for new distributed generation that had accepted their offers stood at 112, or 1,694 MW of contract acceptances. As Gate 3 offers draw to a close, there was one offer of 16.1 MW accepted in 2016, and by the end of the year, only one remaining Gate 3 distribution offer to be accepted.

In 2016, 185 MW of generation was newly connected to the distribution system, of which 113 MW (61%) was wind generation. This brings the total generation connected to the distribution system to 1,774 MW at the end of 2016, of which 1,526 MW was wind generation. By the end of 2016, 57.4% of all wind generation capacity and 82% of individual wind generation customers in the Republic of Ireland were connected to the distribution system. Approximately 66% of developers offered connections through the Gate 3 process have opted to build their shallow connections contestably.

In addition to continued management of the Gate 3 process, there were 56 modifications to previous offers and 82 offers issued by ESB Networks to “non-GPA” projects during 2016. These offers represent a total generation capacity of 328 MW, including 1 biogas project, 4 biogas / anaerobic digestion projects, 3 biomass projects, 1 LFG project, 69 solar projects and 4 wind generation projects. The first of these 82 projects were connected before the end of 2016. For a wind project to qualify as a non-GPA project it was required to have an MEC less than or equal to 0.5 MW, while there was no MW threshold for non-wind renewables.

2. Introduction

ESB Networks complies with its conditions of Distribution System Operator (DSO) Licence and the Transmission System Owner (TAO) Licence. Condition 13 of the DSO Licence requires the DSO to report annually on its performance and Condition 11 of the TAO Licence requires the TAO to report annually on its performance. This report has been prepared by ESB Networks on behalf of the DSO and TAO for the year ending December 2016 in order to fulfil these licence obligations.

The criteria reported upon in this report have been approved by the CRU (Commission for Regulation of Utilities) in accordance with Condition 13 of the DSO Licence and Condition 11 of the TAO Licence. A copy of each of these licences and the approved performance criteria can be found at the following link:

<https://www.esbnetworks.ie/tns/publications/-in-category/categories/publications/licences-codes>

Performance is reported under the following headings:

- Customer Service – Page 5
- Cost Performance – Page 11
- Capital Programme – Page 14
- Supply Quality & Reliability – Page 19
- Safety – Page 24
- Sustainability – Page 28
- Service Level Agreements Performance – Page 32
- Compliance with licence requirements – Page 39

2.1 Publication of Report on ESB Networks Website

In compliance with conditions 13 & 17 of the DSO Licence and Condition 11 of the TAO Licence, this performance report will be published on the ESB Networks website at the following link:

<https://www.esbnetworks.ie/tns/publications/-in-category/categories/publications/annual-reports/performance-reports>

3. Customer Service

Key indicators of customer service performance include service delivery by the Customer Contact Centre and the treatment of complaints by ESB Networks staff. The percentage of calls answered within 20 seconds and the percentage of calls dropped are key performance criteria used to measure the quality of service provided to customers. Table 1 summarises the call answering performance of the contact centre. Graphs 1 and 2 show the trends in call handling response since 2012.

Table 1 – Customer Service Key Indicator

Description of Criteria	2015	2016
Call Handling Response¹		
Percentage of calls answered within 20 seconds	89.9%	91.4%
Percentage of calls dropped ²	2.6%	2.3%
Networks customer calls to the call centre ³	504,935	469,195

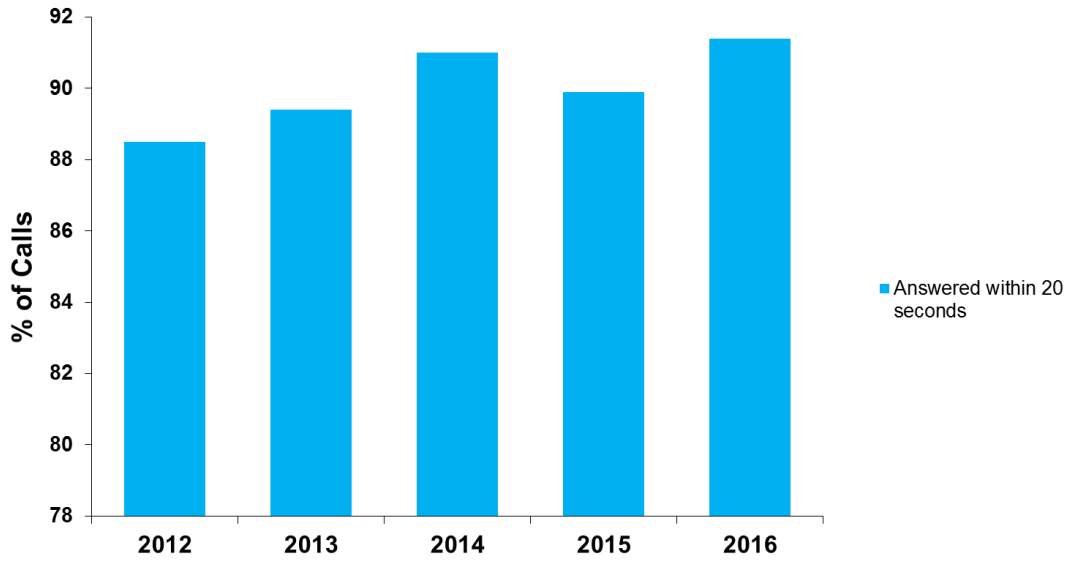
In 2016 both call handling response measures improved from 2015, which continued a trend of improvement in recent years. Our abandoned rate was down to 2.3%, this can be attributed to the use of PowerCheck App of which usage rose from 920,637 hits in 2015 to 1,443,644 hits in 2016, as well as other forms of communication such as social media and web channels. While our call volume reduced by 7% in 2016 compared to 2015, our PowerCheck App rose by 57% in the same year. This helps our customer agent staff to offer the extremely high quality customer service levels which can be seen in our overall customer satisfaction levels of 80.7%.

¹ Note both sets of figures are inclusive of storms, which has the effect of reducing the percentage of calls handled and increasing the percentage of calls dropped.

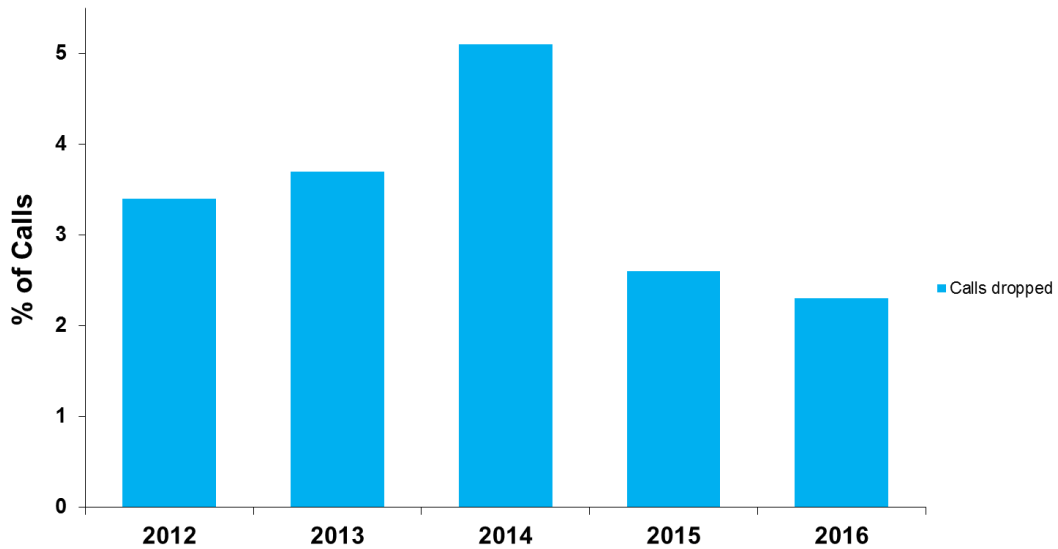
² Where the customer has terminated the call without waiting for a response.

³ The exact number of calls relating to ESB Networks issues are identified.

Call Handling Response 2012 to 2016



Call Handling Response 2012 to 2016



Call handling response performance in 2016 continued the improvement seen in 2015, with a 1.5% improvement in calls answered within 20 seconds and a 0.3% improvement in the call drop rate.

3.1 Customer Service

The distribution system Customer Service Code, Complaints Handling Procedure and Disconnection Code of Practice have been submitted to and approved by the CRU. These procedures are published by ESB Networks on our website as follows:

- Distribution System Customer Service Code
<https://www.esbnetworks.ie/docs/default-source/publications/esb-networks-customer-charter.pdf?sfvrsn=8>
- Complaints Handling Procedure
<https://www.esbnetworks.ie/tns/contact-us/feedback-and-complaints>
- Disconnection Code of Practice
<https://www.esbnetworks.ie/docs/default-source/publications/de-energisation-code-of-practice.pdf?sfvrsn=4>

3.2 Customer Service Code

ESB Networks strives to provide high quality services in a timely fashion to meet customer requirements. It is committed to service excellence in all customer dealings, in particular in the areas of telephone response, restoration of supply outages and meeting the 12 service performance guarantees in our Customer Charter⁴.

This drive to meet our 12 service performance guarantees for our customers is reflected in a reduction of Customer Charter payments in 2016. The volume of Customer Charter payments in 2016 was 1,966 - a decrease of 177 from the 2,143 in 2015. This reduction in charter payments can be attributed to improvements in the quotation process which saw quotation related payments reduce by 151 payments against 2015 figures.

More timely delivery of new connections saw connection-related payments reduce by 60 payments against 2015 figures. This reduction can also be attributed to a stronger management focus on jobs approaching charter limits.

⁴ <https://www.esbnetworks.ie/who-we-are/customer-service/customer-charter>

While there was an overall decrease in charter payments in 2016, there was an increase in charter payments related to planned supply interruptions, with a marked increase in interruptions due to planned maintenance and timber planned maintenance in 2016.

Our commitment to protect the interests of customers who are more vulnerable to loss of electricity supply⁵ is on-going. These customers can avail of priority telephone access to ESB Networks, by registering with their suppliers. A ‘vulnerable customer’ means a household customer who is:

- Critically dependent on electrically powered equipment, which shall include but is not limited to life protecting devices, assistive technologies to support independent living and medical equipment, or
- Particularly vulnerable to disconnection during winter months for reasons of advanced age or physical, sensory, intellectual or mental health.

3.3 Complaints Handling Procedure

ESB Networks employs a simple and effective complaints handling procedure to support quick and efficient resolution of problems.

The complaints procedure encourages initial complaints to be submitted via three channels:

- a) A dedicated phone line in our National Customer Contact Centre⁶,
- b) By email to a dedicated email address⁷,
- c) In writing to our Customer Relations Team⁸.

Staff in our National Customer Contact Centre (“NCCC”), and local management, are empowered to resolve complaints promptly. The ESB Networks’ complaints facilitator produces a monthly management report, to monitor both the volume of complaints received and our response performance in relation to these complaints.

Table 2 gives a breakdown of the complaints received during 2016 as well and a comparison against the PR3 average (2011 – 2015).

⁵ <https://www.esbnetworks.ie/who-we-are/customer-service/vulnerable-customer-policy>

⁶ You can phone our National Customer Care Centre on 1850 372 757 or +353 21 2386555 (outside of Ireland)

⁷ esbnetworks.complaints@esb.ie

⁸ Customer Relations, ESB Networks, Sarsfield Road, Wilton, Cork Ireland

Table 2 – Number of Complaints⁹ Received

Description of Criteria	2015	PR3 Average	2016
Complaints received	Number	Number	Number
Concerning low voltage	51	55.0	26
For frequent outages	890	974	1,066
Time to connect customers	23	17.6	31
Operation delays and overruns	77	52.6	117
From suppliers	0	0	0
On connection costs and budget quotations	35	32.8	21
On meter reading and estimated reads	235	356.4	356
Damage to Property	212		226
Staff/Contractor Performance	277		299
Communications – Customer Service Issues	165		165
Others	236	798.6 ¹⁰	454
Total complaints received	2,201	2,286.80	2,761

As shown above a total of 2,761 complaints were received in 2016 compared to 2,201 in 2015, which was an increase of around 25%. However though the volume of complaints received increased, ESB Networks achieved successfully responded to 95% of complaints within 5 working days, against a target of 92%. Complaints relating to low voltage have decreased significantly in recent years due to the network improvement programmes carried out, which can be seen in 2016 levels dropping further from the 2015 figure.

Increases for 2016 in ‘time to connect customers’, and ‘operation delays / overruns’ can be associated with the increasing volume of new connections. These were 18.2% higher in 2016 than in 2015 – or an additional 20,110 new connections. There were also higher numbers of line diversions, which increased by 18.3% in 2016 against 2015 levels.

⁹ Please note, complaints specifically relate to queries which cannot be resolved in the area in which they have arisen, but instead have to be referred to another party – either within ESB Networks, or an outside party.

¹⁰ As ‘damage to property’, ‘staff/contractor performance’, and ‘communications - customer service issues’ were previously combined together into the grouping ‘others’ in the first 4 years of PR3 (2011 – 2014) we have grouped these together into the grouping ‘others’ again in the table for the purposes of showing the PR3 average.

Table 3 – Number of Terminations and De-energisations

Description of Criteria	2015	2016
Connection points terminated¹¹¹²	15,095	18,601
Connection points de-energised¹³	8,066	7,312

11 This includes connection points in vacant premises that have been terminated following previous de-energisation and de-registration, it also includes MPRN's associated with housing scheme quotations that have not progressed.

12 We have revised our terminations figure for 2015 due to the discovery of an anomaly in the method of calculation of terminations data.

13 De-energisation for non-payment ONLY.

4. Cost Performance

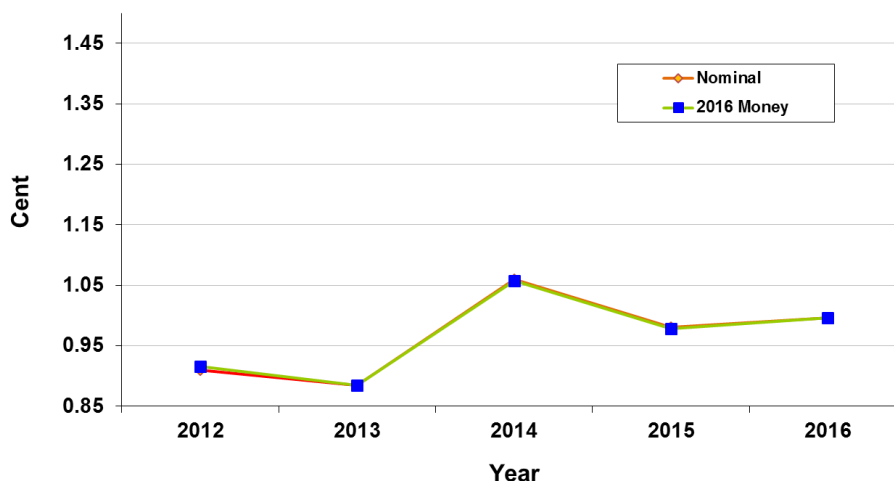
The CRU set targets for ESB Networks to efficiently manage its operating expenditure, which it aims to achieve and where possible improve on. Table 4 summarises ESB Networks' performance in 2016 in relation to two key cost criteria.

Table 4 – Cost Performance

Description of criteria	2015	2016
Controllable Costs		
Controllable Operating Cost per Unit Distributed	0.98c / kWh	0.996598 / kWh
Controllable Operating Cost per Customer	€98.61 / Customer	€101.77 / Customer

The aim is to keep these controllable costs as low as possible, without compromising the operational integrity and efficiency of the networks. Graphs 3 and 4 below show the real and nominal values of Controllable Operating Costs per Unit Distributed and per Customer.

**Controllable Operating Cost per Unit Distributed
2012 to 2016**

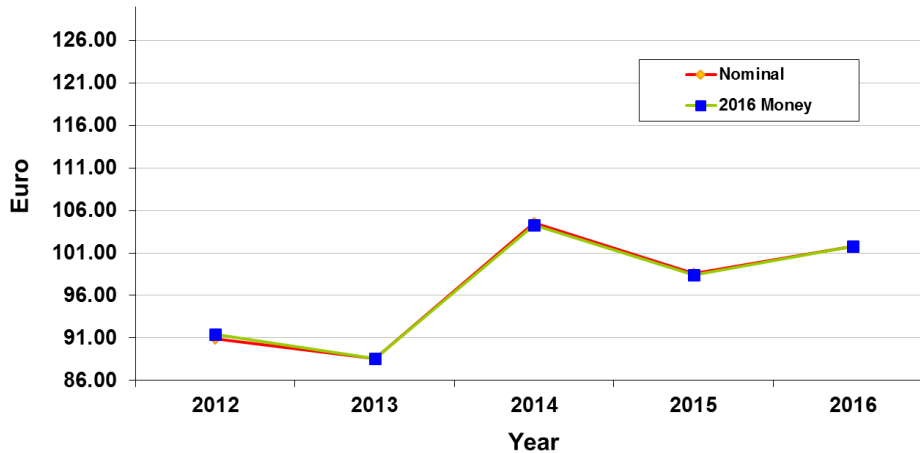


Graph 3

As can be seen from Graph 3, the Controllable Operating Cost per Unit Distributed increased marginally in both real terms and nominal terms in 2016, when compared to 2015. The years 2012 and

2013 are not comparable years, as they represent a period of stringent financial expenditure restrictions at a period of severe economic pressure in Ireland.

Controllable Operating Cost per Customer 2012 to 2016



Graph 4

Graph 4 shows that in 2016 the Controllable Operating Cost per Customer increased in both nominal and real terms. Operating cost per customer increased in 2016 when compared to 2015 but did not return to the high levels seen in 2014, where high levels of fault repair work was required in the wake of Storm Darwin. The slight increase is a result of increased hazard patrolling, and in fault maintenance costs as a result of €3.2m spent repairing a fault on a subsea cable between the Aran Islands. This includes the cost of maintaining a temporary supply to the islands for a 2-3 month period until the full repair could be completed. Additionally, €2m of operational expenditure was spent on the unforeseen replacement of 27,000 Ampy meters which were at risk of failure. However these increases were offset somewhat by lower volumes of timber cutting.

4.1 Transmission OPEX

Transmission operating costs totalled €55.7m against an allowance of €53.3m in 2016. The largest areas of expenditure in this category come from transmission network rates at €21.7m and planned maintenance at €15.8m. Planned maintenance is made up of station, line and cable maintenance, which is completed by ESB Networks as TAO, in line with maintenance policies determined by the TSO.

Across all areas of expenditure, ESB Networks has introduced new governance and cost management processes for PR4. Individual managers have been appointed “allowance owners”, responsible for monitoring allowance spends on a monthly basis to ensure that spend versus allowance is tightly controlled.

5. Achievement of Capital Programme

ESB Networks has agreed an extensive capital programme with the CRU for completion over the 5 year PR4 period 2016-2020. Our investment activities in 2016 focused on renewing and extending the distribution and transmission systems to provide Ireland and our customers with an improved electricity network.

The major programmes of work undertaken over the past year include:

- Continued renewal of the urban low voltage system, with 14,700 spans of overhead networks refurbished in 2016.
- The commencement of a “pole inventory programme”, to develop a detailed, evidence based profile of the health and risk of our overhead network assets. This saw 60,000 poles inspected in a trial phase in 2016.
- An MV substation replacement programme focused on a small volume of substations with obsolete components which no longer perform to the expected standard.
- An extensive network development programme, to reinforce existing networks and improve the capacity of the distribution system was continued in 2016. Some examples of stations where capacity was increased include Cashel 38kV station, which had its load capacity doubled through the uprate of its transformers. In addition to this the MV AIS busbar was retired and a new MV Module was installed, and the control room was replaced.
- Other ways of reinforcing the system include overhead line uprates, for example on the Middleton-Kilbarry 38kV overhead circuit, on which 9.5km of network was either built or uprated.
- Continued conversion of the 10kV network to 20kV operation, with 701 km being completed within the year 2016. This brings the total 20kV network to 51% of the entire medium voltage system.
- 13 new generation connections continued to progress to energisation, consisting of 12 wind generation projects, and the Dublin Waste to Energy project.
- Two new 220k V stations were completed in the South West at Knockanure and Ballnahulla. Both were energised during 2016 and were looped into what was originally the existing Tarbert-Clashavoon 220kV line. This then created the Knockanure-Tarbert and Ballynahulla-Knockanure 220kV lines.
- The Kilpaddoge – Money point 220kV cable progressed nearer to completion.
- A large volume of refurbishment and uprating works on transmission assets is on-going in existing stations including busbar uprates, bay uprates and asset replacement. Stations affected include Finglas, Carrickmines, Ardnacrusha and Moneypoint.

The table below reports on ESB Networks’ delivery of the transmission and distribution capital programmes.

Table 5 – Progress of Capital Programmes

Description of Criteria	Value	Comment
Total Planned Capital Investment Programme¹⁴		
Distribution Capital Investment Programme achieved to date (%) (i.e. percentage of allowed capital spent)	17.8	Distribution CapEx completed in 2016 was 17.8%, and the allowed target was 21%
Transmission Capital Investment Programme achieved to date (%)	16.3	Transmission CapEx completed in 2016 was 16.3%, and the allowed target was 24%
LV Rural Refurbishment Programme		
LV Groups completed (no.)	223	
LV Urban Refurbishment Programme		
Spans completed (no.)	4125	
MV Overhead Line Refurbishment		
km completed (no.)	30,897	
HV Cable Replacement Programme		
38kV pre-1945 paper insulated cable (km)	0	
Distribution Capacity added		
Increase in 110kV/38kV capacity (MVA)	94.5	
Increase in 110kV/MV capacity (MVA)	0	
Increase in 38kV/MV capacity (MVA)	55	
Increase in 220kV/110kV	250	

¹⁴ Based on HICP (Harmonised Indices of Consumer Prices)

Description of Criteria	Value	Comment
Transmission New Build		
220kV Stations (no.)	2	Two new 220kV stations in the South West at Knocknanure and Ballnahulla were completed.
110kV Stations (no.)	6	Six new 110kV stations were completed. Three were non-contestably built (Knockranny, Cloghar, Sliabh Bawn), and three were contestably built (Ugool, Mulreavy, Clahane).
Busbar Uprates		
Full Bus-Bar Uprates (no.)	1	This was completed in Butlerstown station.
220kV Overhead Line Uprates/Refurbishment		
Line Uprates/Refurbishment (km)	16.2	Uprate complete of the Clashavoon-Ballyvouskill 220 kV Line
110kV Overhead Line Uprates/Refurbishment		
Line Uprates/Refurbishment (km)	18.7	Uprate complete of the Arva-Shankill No.1 110kv line
220kV Cable Uprates/Refurbishment		
Cable Uprates/Refurbishment (km)	0.6	Ballynahulla 220kV Station – Clashavoon-Tarbert 220kV Cable (loop-in)
110kV Cables Uprates/Refurbishment		
Cable Uprates/Refurbishment (km)	15.47	This includes the Ardnacrusha 110kV Station- Ardnacrusha-

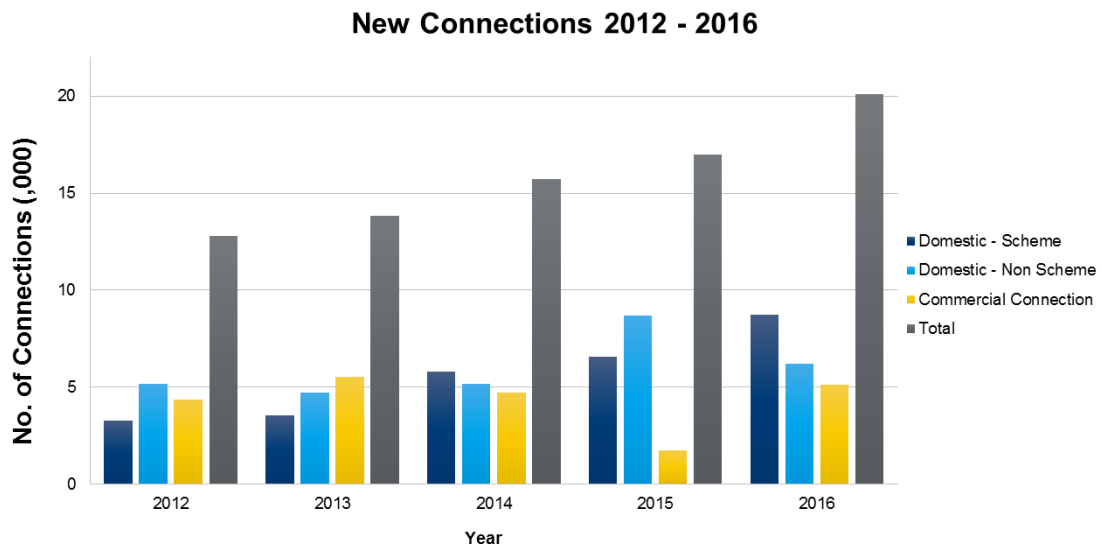
Description of Criteria	Value	Comment
		Ennis 110kV Cable, the contestable Ballyvouskill–Garrow 110kV Cable, the Cloghran-Corduff 110kV Cable, and the contestable Clogher-Mulreavy 110kV Cable.

Description of Criteria	Value
38kV Overhead Line Refurbishment	
Overhead Line Refurbishment (km)	216
MV Substations Asset Replacement	
1. Oil-filled Switchgear Subs (no.)	7
2. Cast Resin Kiosks (RGB12 and Magnefix) (no.)	22
3. Open Cubicle Switchgear (no.)	8
20kV Conversion	
20kV Conversion (km)	701

Description of Criteria	Value	Comment
Embedded Wind Generation Connected to the Distribution System in 2016		
Wind Farms Connected	12 WFPS	Projects progressing in light of extension to REFIT 2019
Total MW Connected	113.089 MW	Projects progressing in light of extension to REFIT 2019

5.1 New Connections

In 2016, a total of 20,110 new connections to the distribution system were completed by ESB Networks. This equates to an overall increase of 18.2% in the volume of new connections when compared with the total of 17,012 in 2015. This reflects a continuing upturn in construction activity over the past number of years.



Graph 5

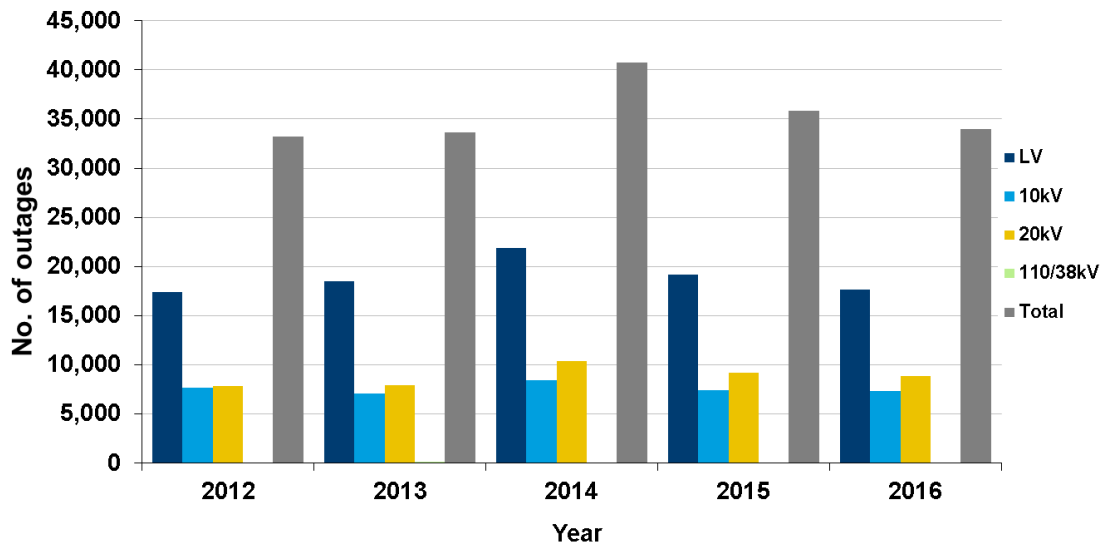
6. Supply Quality and Reliability

Supply reliability is an essential aspect of distribution system performance. The number of interruptions of supply is given in Table 6 while Graph 6 shows the trend over the past 5 years.

Table 6 – Number of Outages¹⁵ by Connection Voltage

Description of criteria	Value		
	Unplanned	Planned	Total
Voltage			
LV	16,161	1,476	17,637
10kV	3,799	3,557	7,356
20kV	5,981	2,894	8,875
110kV/38kV	80	0	80
Unknown	4	7	11
Total (excl. Storm Days and Major Renewable Programmes)	26,025	7,934	33,959

Number of Outages 2012 - 2016



Graph 6

¹⁵ Short interruptions lasting less than three minutes are not included. In some fault situations, there can be a number of temporary supply restorations followed by an interruption before supply is permanently restored. One interruption per customer affected is recorded in these situations. The figures do not include customer outages which resulted from problems on the transmission system, e.g. operation of under-frequency relays.

The impact of outages on customers across the entire distribution system is measured by two parameters; average number of interruptions per customer connected in the year (CI) and the average number of minutes without supply per customer connected in the year (CML). As the effects of severe weather can cause wide variations in these measures beyond ESB Networks' control, the figures below are adjusted to remove storms days so that the underlying reliability performance is clearer.

Table 6a – Continuity Performance¹⁶¹⁷

Performance	2012	2013	2014	2015	2016
CML	97.91	128.85	147.45	155.69	142.62
CI	0.92	1.30	1.42	1.28	1.27

In 2016 the number of customer interruptions per single customer was consistent with performance in 2015. The introduction of stringent safety controls to mitigate the risks arising of accelerated pole degradation in Scantrepo poles has impacted on average outage volumes and durations, with more works and conditions requiring outages than was previously the case.

¹⁶ Due to a new storm treatment threshold introduced in 2018, these historic figures have been updated in line with the new storm treatments criteria.

¹⁷ These are expressed as per single customer.

Table 7 – Customer Minutes Lost (CML) and Customer Interruptions (CI)

Description of	Value		
	Unplanned Actual	Planned Actual	Total Actual
Customer Minutes Lost			
Total (including Major Renewal Programmes)	79.05	63.57	142.62
Major Renewal Programmes		16	16
Total (excluding Major Renewal Programmes)	79.05	47.57	126.62
Customer Interruptions			
Total (including Major Renewal Programmes)	1.04	0.23	1.27
Major Renewal Programmes		0.05	0.05
Total (excluding Major Renewal Programmes)	1.04	0.18	1.22

Table 7 shows CML and CI for 2016 broken down between unplanned and planned, as well as major Renewal Programmes which are programmes such as LV overhead network refurbishment, where planned outages are required to carry out the work. The planned CI and CML arising from these programmes in a given year depends on the nature and volumes of renewal works carried out in that year. It is useful to show the performance excluding Major Renewal Programmes as that reflects the underlying trend in continuity performance.

Table 8 shows the number of storm days in 2016 and details of the weather on those days.

Table 8 – Storm Days

Description of criteria	
Storms and exceptional events	
Number of storm days: 5	
Description of storm days	
27-May-16	
Loss of Kilkenny 110kV and Morrinstown - Edenderry 38kV stations.	
02-Mar-16	
Storm Jake – An orange wind alert was declared affecting the mid-west mainly, though Met Eireann issued four warnings, for snow, ice and wind. Met Eireann reported that the highest 10-minute mean wind speed and highest gust were both recorded at Mace Head, at 98 km/h and 133 km/h respectively. These were both the highest wind speeds measured at this weather station in March since 2007. In total 47,738 electricity customers were interrupted during Storm Jake.	
09-Feb-16	
Shoulder Day following Storm Imogen	
08-Feb-16	
Storm Imogen – An orange wind alert was issued for Cork and Kerry. In total 47,829 electricity customers were interrupted during Storm Imogen. The joint highest gust speed of the 2015-2016 storm season was recorded, at 135 km/h.	
29-Jan-16	
Storm Gertrude - An orange wind alert was issued. In total 42,166 electricity customers were interrupted during Storm Gertrude. The worst affected areas were in the northwest – Donegal, Mayo and Sligo.	
Total number of customers affected by storm days in 2016:	221,900

Table 9 – Faults Exceeding 4 Hours Duration and Voltage Quality Problems

Description of criteria	2015	2016
Additional items		
Percentage of faults exceeding 4 hours restoration time	27%	23%
Customer reports of problems relating to Voltage Quality	1,285	1300
Verified problems relating to Voltage Quality	397	407

The percentage of faults exceeding 4 hours restoration time was 23% in 2016. This was a decrease from 2015.

The number of customers that reported problems relating to voltage quality was 1300. These requests are requests for a technical investigation of possible voltage problems.

The number of verified problems relating to supply quality was 407. These are situations where the voltage at the customer's location was verified to be outside the standard levels.

6.1 Operations

During 2016, SCADA (Supervisory Control and Data Acquisition) installation was completed in two 220kV stations, and ten 110kV stations, along with a further eleven 38kV stations and seven windfarms across the country.

105 distribution automation devices were built on the SCADA system in 2016. These are devices installed across the medium and high voltage system, for remote and automatic network monitoring, control and restoration.

77 Operational Incidents occurred while operating the network, compared to 103 in 2015. This decrease in incidents can be attributed to improved processes driven by a new IT safety management system, which has brought an improved focus on safety performance in Operations.

Also in 2016 re-insulation has continued on the Gurrane medium voltage network to provide for medium voltage arc suppression. No new medium voltage arc suppression systems energised on the network.

7. Safety

7.1 Overview

Managing the safety of our networks is ESBN's highest priority, we ensure the safety of our customers and our staff through the use of a variety of public engagement programmes and initiatives, and through increased health & safety protocols for staff in the workplace and when out on site.

7.2 Public Safety Programmes 2016

Throughout 2016, ESB Networks continued to meet its obligations and responsibilities for public safety through its delivery of PR4 network maintenance and renewal work programmes, along with on-going public awareness campaigns across TV, radio and social media. Stakeholder engagement initiatives targeted key stakeholders such as farming organisations, construction, schools, farm colleges, leisure interests, and national and local media.

7.3 PR4 Work Programmes

Delivery of the network refurbishment programmes continued to have a significant and beneficial impact on public safety with particular emphasis on hazard patrolling and maintenance.

7.4 Schools Safety Campaign

Education campaigns included a sponsorship partnership with the Road Safety Authority to deliver 85,000 high visibility vests to Junior Infants in all national schools. The educational programme – 'Stay Safe Stay Clear' involved providing education resource materials and running a national colouring competition to encourage pupils to actively engage with the topic of electricity safety.

The winning entries were included in a calendar which was distributed to all schools. As well as this our collaboration with AgriAware, in partnership with FBD and IFA, resulted in the production and distribution of a new Farm Safety DVD to all primary schools.

7.5 Other Educational Initiatives

Safety talks were delivered to all Teagasc colleges, UCD and WIT as part of the FBD 'Champions for Change' initiative, in association with the H.S.A. Winning entries of the Safety Essay competition were recognised at the National Ploughing event with presentation of awards by the Minister for Agriculture.

7.6 Irish Farmers Journal Partnership

2016 marked the start of a new partnership with the Irish Farmers Journal, called 'Safe Family Farms', which delivered strongly throughout the year with weekly safety tips on 'Farming Safely with Electricity' and seasonal safety message ads. ESB Networks also participated at the FTMA national 'Grass and Muck' event in May and delivered a number of practical demonstrations of how to farm safely when working in the vicinity of overhead electricity wires.

7.8 Public Safety Information Campaign

In January 2016, ESB Networks launched its major new TV Public Safety Advertising Campaign, with the tag lines called 'Are You Sure It's Safe?' and "Stay Safe, Stay Clear", reminding the public of the need to be aware of the dangers electricity can pose and that everyone has an individual responsibility to stay safe around electricity.

The campaign ran over the 4 quarters throughout the year, with awareness figures of 75%, which is very significant for the first year of a campaign. Radio ads ran as part of an integrated media strategy and covered overhead wires, fallen wires, underground cables, gardening and bunting.

Sponsorship of the 'weather forecast' on RTE Radio 1 continued and provided a very relevant and engaging platform for raising public awareness in relation to the electricity infrastructure.

7.9 National Ploughing Championships

The National Ploughing Championships in September was a strong point of contact for farm families and the wider rural community to engage with ESB Networks staff, and receive important information in relation to public safety and the electricity network.

7.10 Other Public safety Initiatives

In response to specific public safety incidents and near misses involving electricity, information was provided to organisations such as the GAA, and representative bodies for sailing, fishing and gun clubs. A new look public safety website went live and provided easy access to public safety information and resources. Initial engagement took place with the construction sector with presentation to CIF and their representative Safety Committee. It is planned to significantly expand on this initiative in the coming years in anticipation of increased construction activity.

7.11 PowerCheck App

There were 1.4 million hits on the PowerCheck app which as well as providing up-to-date supply interruption information to all electricity customers, also delivers a timely safety message on keeping clear of electricity wires. The levels of engagement with this app continued to grow , more than doubling from 540,000 hits in 2015.

7.12 Involvement with the HSA

ESB Networks continued their support of the “Keep Safe” programme for 5th and 6th class primary school children in association with the Health and Safety Authority and other national bodies, coordinated by Junior Achievement Ireland.

7.13 Fatalities

There was one electrical fatality, involving a member of the public, due to contact with ESB Networks electricity infrastructure during 2016. There were no fatalities resulting from contact with electricity on the customers’ side of the meter during 2016. The total number of electrical fatalities for the 10 year period from 2007-2016 was 21, with 11 of these occurring on the ESB Networks side of the meter and 10 on the customer’s side.

7.14 Dangerous Occurrences

Table 10 reports on the number of dangerous occurrences associated with ESB Networks' infrastructure during 2016. These figures are broken down as third party damages¹⁸ and non-third party notifiable fault incidents¹⁹ and are similar to previous years.

Table 10. Dangerous Occurrences (2016)

Description of criteria	Value
Number of safety incidents (to be updated	
3 rd Party plant damages (excluding underground cable dig-ins)	1,086
3 rd Party plant damages caused by underground cable dig-ins	994
Non 3 rd party – MV and 38kV notifiable fault incidents (line drops & reduced clearances)	183
Non 3 rd party – LV notifiable fault incidents (line drops & reduced clearances)	969

¹⁸ Third party damages are incidents where third parties cause damage to the networks infrastructure. These are broken down into incidents that involve damage to underground electricity cables termed 'dig-ins' and incidents that cause damage to other plant such as overhead lines, minipillars and substations.

¹⁹ Non-third party notifiable fault incidents are principally incidents on the overhead lines networks where an overhead line conductor / wire falls e.g. in stormy conditions or due to corrosion or other plant item failure.

8. Sustainability

8.1 R&D Projects

In 2016, ESB Networks continued to progress its wide range of R&D projects. These projects included RealValue and EVOLVE DSO –which are funded by the European Commission under the Horizon 2020 framework. While approaching final stages of completion, all have scored extremely well at an EU level.

The €12m 'RealValue' project is in the process of implementing an end-to-end domestic Demand Response solution and ESB Networks has been able to assess the impact of Demand Response on the low and medium voltage networks and utilise a software tool - SERVVO - to minimise any detrimental impact on our networks.

Evolve DSO has identified and developed 12 tools and systems which help DSOs maintain and operate their assets in the most economic fashion possible. ESB Networks continues to engage in beneficial collaborative R&D projects to further its understanding of new load technologies, renewable technologies and ICT requirements for the future grid in Projects such as FlexiGrid (customer sited battery storage) and Winterpeak (monitoring equipment for LV networks). ESB Networks is also currently inputting into the development of a strategy for the future role of a Distribution System Operator (DSO) in the European context.

8.2 Systems Development Projects

In 2016, ESB Networks took part in a number of thought leadership and R&D activities both at home and internationally. 2016 saw the continued progression of the Nodal Controller project, which will enable generation connected to the distribution system to participate in grid ancillary services.

In January 2016 ESB Networks participated in a number of activities and events including participation in and attendance of 'CENELEC TC8x' activities, participation in 'Reactive Power TSO-DSO' activities in Brussels, and participation in and attendance of Eurelectric's Working Group on 'Active Distribution System Management' activities. ESB Networks also initiated the Collaborative Energy Programme (CEP) with Energy Networks Association (ENA) in order to replace STP activities with EA Technology.

In addition to these activities ESB Networks was also represented at a speaking engagement at 'The Age of the Active Distribution System Operation' event in Essen Germany in February 2016. In June ESB Networks participated in a 'Flexibility' workshop in Brussels and in the 'Distributed Intelligence for Cost-Effective and Reliable Distribution Network Operation' (DISCERN) event also in Essen. Finally

in November ESB Networks participated in the Smart Cities conference in Chicago, and in 'Universal Smart Energy Framework Working Group' in Brussels.

8.3 Carbon Reduction

There was a slight increase of 2.6% in energy usage in buildings from 2015 to 2016. The Met Éireann annual summary report for 2016 notes that the early part of the year, while mild, was exceptionally wet, with many areas reporting their wettest winter on record. Six named storms also affected the country during the 2015-2016 winter period.

ESB Networks was on the frontline during these storms and exceptional rainfall events, which resulted in an increased use of drying rooms and associated facilities in ESB buildings. In addition, the spring and autumn periods of 2016 were noted for being dry but with cooler than average temperatures, which typically results in an increased use of heating in buildings.

Fuel consumption across the vehicle fleet decreased by 2.2% from 2015 to 2016. This has been facilitated by adopting the following measures:

- Continued implementation of ESB's 'Green Fleet Plan' which is designed to improve the fuel efficiency of the fleet. This is facilitated by a Fleet Management System which enables improved vehicle maintenance and feedback on driving behaviours.
- Continued adoption of a lifecycle cost approach to new vehicle procurement, which allows for the procurement of more efficient vehicles within the limitations of the price control mechanism agreed with CRU.
- A number of new HGVs entered the fleet replacing older and less efficient vehicles.
- An overall decrease in fleet vehicle numbers.

There was a 3.2% reduction in CO₂-equivalent emissions due to SF₆ gas release. The continued implementation of targeted overhaul programmes designed to eliminate leaks on specific asset types helped reduce the leakage rate of SF₆ gas. In addition, some assets containing SF₆ gas were retired over the period.

There were also further reductions in the amount of waste and retired materials generated within ESB in 2016 with a consequent reduction in associated carbon emissions.

The energy audits of ESB buildings and fleet, which were commenced in 2015, continued throughout 2016, assessing over 70% of operational energy usage as required by SI426/2014. The register of

opportunities identified is now being used by the business to identify, prioritise and implement energy saving measures.

Overall, there has been a 1.4% reduction in carbon emissions from the end of 2015 to the end of 2016.

8.4 Environment

ESB Networks is fully committed to operating to the highest environmental standards as part of its strategy “*ESB Networks 2027 Lighting the way to a better energy future*”.

During 2016, ESB Networks successfully retained its external accreditation to the International Standard for Environment Management Systems - ISO14001:2004.

ESB’s Sustainability Strategy reflects its determination to build a successful business in the long-term as it moves to decarbonise its generation activities by 2050. ESB is focused on maintaining the highest levels of environmental management and sustainability in all aspects of its operations in order to minimise its impact on the environment and enhance the reputation of ESB as an exemplar organisation.

In addition, ESB has identified and adopted a number of the Sustainable Development Goals, which were set out by the United Nations in September 2015, that most closely align with the company’s priority issues and areas of long-standing commitment. ESB continued to pursue these goals as part of its long-term strategy throughout 2016.

8.5 Renewable Generation

In 2016, the number of Gate 3 distribution applicants accepting their offers stood at 112. This translates into 1,694 MW of acceptances and proposed customer connections to the distribution system. The reduction from 1,784 MW in 2015 is generally due to connection offer modifications. By the end of 2016, there was only one Gate 3 distribution offer remaining to be accepted, amounting to a total capacity 115.2 MW, and one Gate 3 offer has lapsed since being issued in 2016 comprising of 26.5 MW. Approximately 66% of Gate 3 developers have opted to build their shallow connections contestably.

8.6 Offers Issued Update

- **Modifications**

In addition to completing the Gate 3 offer programme, there were 56 distribution offers issued by ESB Networks to generator customers during 2016. This is an increase in productivity of 16.7% when compared to 2015 figures.

- **Non-GPA**

Furthermore under the 2009 CRU direction CER/09/099, 82 distribution offers were issued to generator customers outside the Group Processing Approach (GPA) during 2016. This is an increase in productivity of 173.3% when compared to 2015 figures. These 82 offers translate to 328 MW, and out of these 82 offers 50 have accepted translating to 198 MW.

The total amount of distribution connection offers issued during 2016 was 138, 76.9% higher than the previous year.

8.7 Energised and Connected Projects

In 2016 a total of 185 MW of generation was added to the distribution system. Of this, 113 MW was wind generation, and the Dublin Waste to Energy project contributed 72 MW. This brings the total generation added to the distribution system to 1,774 MW, at the end of 2016, of which 1,526 MW is wind generation.

9. Service Level Agreements

ESB Networks performs three market roles that are central to the operation of a fully open market; these roles are the Meter Registration System Operator (MRSO), Data Collector and Meter Operator. These functions involve delivering daily processes to support the market. The processes are detailed in a suite of documents referred to as the Market Process Documents (MPDs).

Service Level Agreements (SLA) set out the target service levels that ESB Networks will operate to in providing market roles to all market participants. The format of the SLAs, in general terms, outline the time frames within which suppliers can expect the required transactions to have been completed in response to the supplier message. These market messages and related SLA's are based on the agreed processes approved by CRU. They set out performance standards which ESB Networks must strive to achieve and report on, as laid down in condition 13 of the DSO Licence. As provided in that condition, the standards and/or targets of performance may be determined by the CRU from time to time.

9.1 SLA Report

The Service Level Agreement (SLA) Report in the following tables contain the complete set of results for 2016. The report provides a description of each SLA and the measure against which its level of performance is reported. It is inevitable that a small number of exceptional transactions will require special manual handling for a number of reasons. To accommodate such cases the performance targets are set below 100%, in most cases it is 95%. The target timeline for those transactions that do exceed the SLA timeline is set at twice the SLA timeline.

The actual performance is measured as the percentage of transactions that were completed within the agreed SLA timeline and the percentage completed within twice the SLA timeline during 2016. The target for the number of transactions to be completed within the SLA timeline for all SLAs with the exception of 14A and 14B (these SLAs relate to NQH Meter Reading) is set at 95%. The target levels for 14A and 14B are stated in the comments column of Table 13. The comments column is used to provide an explanation of the reason why the actual performance has not reached the set performance target within the SLA timeline.

9.2 Performance against SLA's

There are a total of 44 SLA's in place. The performance of each SLA is shown in Table 11, 12, 13, 14, 15 and 16 below.

Table 11 – Change of Supplier

Market Processes		Standard Approval Timelines (SLA)	Actual Performance		Comments
Description	No.		Within SLA Timeline	Within Twice Timeline	
Change of Supplier (NQH)	1A	Validate within 5 days	99.98%	0.01%	0.0094% - System error which resulted in workflow stall or move-in move-out failure
	1B	Using customer read – Complete within 3 days	99.84%	0.06%	0.094% - System error which resulted in workflow stall or move-in move-out failure
	1B	Using special read – Complete within 10 days	96.23%	2.83%	0.94%- System error which resulted in workflow stall or move-in move-out failure
	1B	Using scheduled read – Complete within 3 days	98.66%	0.84%	1.50% - System error which resulted in workflow stall or move-in move-out failure
Change of Supplier (QH)	2A	Validate within 5 days	99.95%	0.05%	System error which resulted in workflow stall or move-in move-out failure
	2B	Complete within 3 days	98.98%	0.15%	0.877%- System error which resulted in workflow stall or move-in move-out failure
Change of Supplier Cancellation	3A	Validate cancellation within 5 days	99.92%	0.00%	0.0799% - System error which resulted in workflow stall or move-in move-out failure
	3B	Complete cancellation within 5 days	99.91%	0.00%	0.0937% - System error which resulted in workflow stall or move-in move-out failure

Table 12 – New Connections and Connection Agreements

Market Processes		Standard Approval Timelines (SLA)	Actual Performance		Comments
Description	No.		Within SLA Timeline	Within Twice Timeline	
New Connection and registration with supplier (NQH)	5A	Prepare Quote – Within 7 working days where no site visit required. Within 15 working days where site visit required	97.97%	100%	Calculations for these SLA's were based on records for quotations issued within customer charter guidelines.
	5B	Complete connection – Within 10 working days of receipt of ETCI certificate.	99.39%	100%	Calculations for these SLA's were based on records for quotations issued within customer charter guidelines.
	5C	Data Processing – Issue details to Supplier within 10 Days	99.25%	99.76%	0.2% outside target - delays with paper service orders not reached office in time & some refer to conflicting devices which will require another call to confirm meter details
New Connection and registration with supplier (QH)	6A	Prepare Quote – Within 7 working days where no site visit required. Within 15 working days where site visit required	97.97%	100%	Calculations for these SLA's were based on records for quotations issued within customer charter guidelines.
	6B	Complete Connection – Within 10 working days of receipt of ETCI certificate.	99.39%	100%	Calculations for these SLA's were based on records for quotations issued within customer charter guidelines.
	6C	Data Processing – Issue details to Supplier within 10 Days	99.33%	99.33%	0.7% outside target - During year some of orders for QH sites received with incorrect configurations leading to delays in processing. New training was developed for

					Engineering Officers which addressed this problem.
Change to meter point characteristics	8A	Prepare quote – Within 7 working days where no site visit required. Within 15 working days where site visit required	97.97%	100%	Calculations for these SLA's were based on records for quotations issued within customer charter guidelines.
	8B	Complete change – Within 10 working days of receipt of ETCI certificate.	99.39%	100%	Calculations for these SLA's were based on records for quotations issued within customer charter guidelines.
	8C	Process Change – Issue details to Supplier within 10 Days	97.30	98.93	1.07% outside target - delays with paper service orders not reached office in time & some refer to conflicting devices which will require another call to confirm meter details

Table 13 – Meter Works

Market Processes		Standard Approval timelines (SLA)	Actual Performance		Comments
Description	No.		Within SLA timeline	Within twice timeline	
De-energisation of Meter Point	9A	De-energise within 5 days	91.26%	95.29%	1.07% outside target - delays with paper service orders not reached office in time & some refer to conflicting devices which will require another call to confirm meter details.
	9B	Issue Meter details to Supplier within 10 Days	99.26%	99.97%	0.03% outside target - delays with paper service orders not reached office in time & some refer to conflicting devices which will require another call to confirm meter details.
Re-energisation of Meter Point	10A	Re-energise within 5 days	98.79%	99.37%	Both figures reflect very satisfactory performance ahead of target, as the SLA target for both is 95%.
	10B	Issue Meter details to Supplier within 10 Days	99.31%	99.89%	0.1% outside target - delays with paper service orders not reached office in time & some refer to conflicting devices which will require another call to confirm meter details
Change of Meter Configuration	11A	Reconfigure within 5 days after the receipt and validation of Supplier request	94.44%	97.24%	The target for both measures is 95% and was not achieved for 'Within SLA timeline' due to the high overall volume of work leading to some delays and resulting in the work order not being

					received by the Network Technicians within the appropriate timescale. Target was achieved for 'Within twice timeline'.
	11B	Process data within 10 days	99.40%	99.93%	0.1% outside target - delays with paper service orders not reached office in time & some refer to conflicting devices which will require another call to confirm meter details
Meter Problems and Reports of damage	12A	Repair or replace faulty meter within 5 days	81.98%	90.68%	Failure to achieve the 95% target is due partly to high ESN work volumes and partly due to incorrect logging of requests by Suppliers.
	12B	When a faulty meter is Repaired or Replaced – Process Meter Data within 5 days	98.84%	99.45%	0.6% outside target - delays with paper service orders not reached office in time & some refer to conflicting devices which will require another call to confirm meter details

Table 14 – Meter Data

Market Processes		Standard Approval timelines (SLA)	Actual Performance		Comments
Description	No.		Within SLA timeline	Within twice timeline	
NQH Meter Reading	14A	Scheduled Read – Distribution of Reads to Suppliers within 7 workdays	99.86%	99.90%	Within SLA timeline target of 98%
	14A	2 Scheduled reading visits per annum	100.00%	N/A	Within SLA timeline target of 100%
	14A	4 Scheduled reading visits per annum	99.07%	N/A	Within SLA timeline target of 97%
	14A	Actual reads for scheduled meter reading visits	81.34%	N/A	Within SLA timeline target 80%
	14A	Actual reads for scheduled MD meter reads	98.21%	N/A	Within SLA timeline target
		One actual read per annum	97.83%	N/A	Within SLA timeline target of 97.8%
	14B	No Consecutive Block Estimations	99.41%	N/A	Within SLA timeline target
	14B	No Consecutive MD Block Estimations	100.00%	N/A	Within SLA timeline target
	14C	Out of Cycle Customer Read – Readings processed within 3 workdays	97.23%	99.31	Within SLA timeline target
QH Data Collection	15A	D+4 QH data- Send to SEM-O / Suppliers in 1 workday	100.00%	100.00%	Within SLA timeline target
	15B	QH Actual Data			
		Send to suppliers within 4 and 10 days**	98.36%	98.75%	**SEM Timeline
	18A	Site visit by 7 days	71.28%	84.70%	Suppliers are not providing accurate

Request for Special Read					contact details for many customers
	18B	Issue of Meter details within 3 Days	74.71%	81.87%	Suppliers are not providing accurate contact details for many customers

Table 15 – Miscellaneous MRSO Processes

Market Processes		Standard Approval timelines (SLA)	Actual Performance		Comments
Description	No.		Within SLA timeline	Within twice timeline	
Data Aggregation	16	Issue of aggregated data to SEM-O/TSO/Suppliers and Generators within 5 workdays	100.00%	NA	
Change of SSAC	20	Complete process in 3 workdays	100.00%	NA	
De-registration	21	Auto Completion within 5 workdays	100.00%	NA	
		Manual Completion within 10 workdays	100.00%	NA	

Table 16 – Change of Customer

Market Processes		Standard Approval timelines (SLA)	Actual Performance		Comments
Description	No.		Within SLA timeline	Within twice timeline	
Change Customer Details	24	Complete within 5 days	99.75% ²⁰	NA	The reason for the shortfall in target is that some requests require lengthy investigations to complete and therefore would not be completed within 5 days.
Change of Legal Entity	25	Complete within 5 days	99.96%	NA	99.96% Within SLA Timeline (similar to 2015 when 99.97% was achieved). Delays occur very occasionally and are due either to delays in receiving the Connection Agreement for a Max. Demand account or, in cases where an estimated reading has been provided, an actual meter reading has to be carried out.

²⁰ The figure provided is an estimate the figure for 2016 is not available.

10. Compliance with licence requirements

10.1 Annual Compliance Report

The Compliance Officer for ESB Networks submits a report on compliance to the CRU each year and the Compliance Report was submitted to CRU in March 2016.

10.2 Records and Reporting

The following tables serve to illustrate the sections of this report that meet the reporting requirements contained in the DSO and TAO Licences.

Table 17 – DSO Licence Compliance Matrix

Clause in DSO Licence		Requirement	Performance Report Reference
Title	No.		Section
Relevant Assets	5.1	Submit a register of all relevant assets to CRU annually	10
Performance of DSO's Business	13.4	Report annually on performance	Entire report
	13.5	Publication of criteria	2
Records and Reporting	17.1	Maintain a record of its general operation under Conditions 7, 8, 9, 13, 14 and 15:	
		7. Theft of Electricity	
		8. Meter Point Registration Service	10
		9. Provision of Metering and Data Services	10
		13. Performance Reporting	10
		14. Access to Land or Premises	Entire Report
		15. Customer Service Code and Complaints Handling Procedure	10
			3.2

Clause in DSO Licence		Requirement	Performance Report Reference
Title	No.		Section
			3.3
	17.3	Report annually on performance	Entire report
	17.4	Publication of report	2.1
	17.5	Presented in a standard form to be approved by the CRU	Entire Report

Table 18 – TAO Licence Compliance Matrix

Clause in TAO Licence		Requirement	Performance Report Reference
Title	No.		Section
Performance of TAO's Business	11	Report annually on performance	Entire report

10.3 Market Services

Condition 17 of the DSO Licence states that the Licensee shall keep a record of its general operation of the arrangements mentioned in Conditions 7, 8, 9, 13, 14 and 15 and, if the CRU so directs in writing, of its operation of any particular cases specified, or of classes specified, by the CRU. Condition 7, 8 and 9 relate to Market Services and the records of their general operation that are kept by ESB Networks are as follows:

10.4 Detection and Prevention of Theft of Electricity

In compliance with licence Condition 7 records were kept in respect of incidents where theft of electricity was suspected or where there was interference with metering equipment and that these incidents were reported to the supplier.

10.5 Meter Point Registration Service

In compliance with licence Condition 8 records were kept in respect of the Meter Point Registration Service i.e. of MPRN, identity of the supplier, meter class, premises address and other information required for change of supplier.

10.6 Provision of Metering and Data Services

Salient business and transaction data were maintained on the services provided under Condition 9 of DSO Licence Provision of Metering and Data Services. These services include, provision of metering equipment, installation, commissioning, testing, repair and maintenance of metering equipment and data collection.

10.7 Access to Land and/or Premises

Pursuant to Condition 14 of the DSO Licence and as required in Condition 17, the following are the general principles and procedures that ESB Networks will follow in respect of any person acting on its behalf who requires access to land and/or premises for the purposes set out in this licence:

- All such employees or representatives acting on behalf of ESB Networks will possess the skills necessary to perform the duties for which access is required and will be appropriate persons to visit and enter the land and/or premises;
- Both employees and representatives of ESB Networks will be in possession of identity cards that clearly identify them as such. These identifications will be available to the persons occupying the land and/or premises. All vehicles arriving on these sites will either carry the full ESB Networks livery or be clearly identified as working on behalf of ESB Networks;
- ESB Networks will ensure that any person visiting land and/or premises on its behalf will be able to inform final customers connected to the Electricity System, on request, of a contact point for help and advice they may require in relation to the distribution of electricity.

Records are maintained of individual training, levels of approval to carry out work and the issue of ID cards. The contact number of the customer contact centre is available via briefing material to all team members and is printed on ESB Networks vehicles.

10.8 Register of Assets

Table 19. Register of Distribution System Assets at end of 2016

Asset	Units	Volume
220kV		
220kV Substations	Sub	3
220/110kV Transformer Capacity	MVA	2,500
110kV		
110kV Overhead Lines	km	354
110kV Underground Cable	km	174
110/38kV Substations	Sub	84
110kV/MV Substations	Sub	31
110/38kV Transformer Capacity	MVA	6,482
110kV/MV Transformer Capacity	MVA	1,405
38kV		
38kV Overhead Lines	km	5,717
38kV Underground Cable	km	988
38kV Substations	Sub	432
38kV Transformer Capacity	MVA	5,245
MV		
20kV 3-ph Overhead Lines	km	15,546
20kV 1-ph Overhead Lines	km	30,936
10kV 3-ph Overhead Lines	km	12,265
10kV 1-ph Overhead Lines	km	24,407
20kV Underground Cable	km	800
10kV Underground Cable	km	8,905
3-ph Pole mounted Transformers	Trafo	20,484
1-ph Pole mounted Transformers	Trafo	216,203
MV Ground Mounted Substations	Sub	21,468
LV		
LV 3-ph Overhead Lines	km	4,136
LV 1-ph Overhead Lines	km	54,860
LV Underground Cable	km	12,611
Mini-Pillars	MP	165,588

Table 20. Register of Transmission System Assets at end of 2016

Asset	Units	Volume
<i>Overhead lines</i>		
<i>400kV</i>		
single circuit	km	437.83
double circuit	km	0
<i>275kV</i>		
single circuit	km	0
double circuit	km	21.46
<i>220kV</i>		
single circuit	km	1,481.2
double circuit	km	319.7
<i>110kV</i>		
single circuit	km	4,132
double circuit	km	71.12
<i>Underground Cables</i>		
<i>400kV</i>		
underground cables	km	2.28
<i>275kV</i>		
underground cables	km	0.19
<i>220kV</i>		
underground cables	km	125.41
<i>110kV</i>		
underground cables	km	153.086
<i>Submarine Cables</i>		
<i>400kV</i>		
Submarine Cables	km	0

275kV		
Submarine Cables	km	0
220kV		
Submarine Cables	km	16
110kV		
Submarine Cables	km	0
Switchgear		
400kV		
400kV substation bays	sub	30
275kV		
275kV substation bays	sub	3
220kV		
220kV substation bays	sub	273
110kV		
110kV substation bays	sub	1467
Transformers - incl. tap changers & reactors		
400kV		
400/220kV transformers	Trafo	7
275kV		
275/220kV transformers	Trafo	3
220kV		
220/110kV transformers	Trafo	63
110kV		
110/38kV transformers	Trafo	263
Oil Filled Reactors		
400kV	Reactor	2
220kV	Reactor	1

