



NETWORKS



Delivering a cleaner energy future



Annual Electricity Transmission Performance 2019

Annual EirGrid and ESB Networks'
Electricity Transmission Performance Report

Table of Contents

Welcome	Page 1
How to Contact Us	Page 1
How to use this document	Page 1
What is the Electricity Transmission System?	Page 2
How we plan, deliver and use the network	Page 3
Summary of Highlights from 2019	Page 4
Key Performance Summary Matrix	Page 5
Development of the Celtic Interconnector	Page 7
How we performed against transmission delivery incentives	Page 8
TAO Incentives Performance in 2018	Page 8
TAO Incentive Performance in 2019	Page 10
TSO Transmission Delivery Incentive	Page 10
How EirGrid performed against Strategic Incentives	Page 12
How EirGrid manage system performance	Page 14
System Frequency	Page 14
System Minutes Lost	Page 14
How we ensure network resilience	Page 15
Network resilience in an ever changing system	Page 16
Network resilience in Action	Page 16
How we manage Network Constraints	Page 17
Information on 2019 Curtailment Volumes	Page 17
How we manage constraint costs	Page 18
2018/19 Main constraint changes and TSO Initiatives	Page 19
2018-19 TSO initiatives to reduce constraint costs	Page 20
How we minimise the Financial Impact of Transmission Losses on Consumers	Page 21
How EirGrid supports market operation	Page 22
Capacity Auctions	Page 23
How we manage new connections	Page 24
Connecting Generators and Interconnectors	Page 24
Connecting Demand Customers	Page 25
Demand Side Units	Page 25
Contestable Construction	Page 25
Innovation	Page 26
Innovation Focus Areas	Page 26
2019 Highlights	Page 27

Engaging with Stakeholders	Page 30
EirGrid Stakeholder Engagement	Page 30
ESB Networks Stakeholder Engagement	Page 31
How we monitor expenditure against PR4 allowances	Page 32
Network Development Costs	Page 34
How we ensure safety	Page 35
EirGrid Safety Statement	Page 35
Electric and Magnetic Fields (EMFs)	Page 35
ESB Networks Safety	Page 35
External Validation of Safety Management System	Page 35
Safety, Health & Environment Strategy	Page 35
Public and Staff Safety	Page 35
Stakeholder Education and Awareness	Page 36
How we manage our environmental footprint	Page 37
ESB Networks Environmental Management System	Page 37
Enduring Environmental monitoring	Page 37
How we manage our environmental impact when planning the network	Page 38
How we manage our Environmental Footprint	Page 38
Acronyms	Page 40



Welcome

Welcome to the third annual EirGrid and ESB Networks' Electricity Transmission Performance Report. This report seeks to provide customers, industry and stakeholders with clear and accessible reporting on our operation, development and maintenance of the transmission system. 2019 was pivotal year in terms of the significant increase in society's recognition of the scale of the challenges posed by climate change and the decarbonisation agenda. Against this backdrop, the Irish Government published its Climate Action Plan in June 2019. EirGrid and ESB Networks are central to facilitating the implementation of government policy on climate action as outlined in the plan. The Climate Action Plan requires that renewable energy provides 70% of all electricity by 2030. This electricity will be generated from renewable sources such as offshore and onshore wind, solar power. In 2019, EirGrid launched its [Strategy 2020-25](#), the aim of which is to *Transform the Power System for Future Generations*. The strategy recognises the imperative for action on the decarbonisation of society and the impending transformation of the electricity sector. It also identifies the scale of shared ambition required to meet our 2030 Climate Action Plan targets, in addition to developing a robust and secure grid which meets the requirements of our economy and society into the future.

ESB Networks strongly supports and is fully committed to the delivery of the Climate Action Plan and Ireland's energy targets. ESB Networks develops and maintains our infrastructure with full appreciation of the customer and system needs that are evident today, and those needs which will emerge as a result of the Climate Action Plan and beyond. As a measure to facilitate this, a new department called Networks Projects was established in ESB Networks to efficiently develop and deliver major transmission projects. Throughout 2019, Networks Projects put in place all the necessary resources and processes and by year-end the department was fully operational with a team of c. 60 people managing development, design and delivery of 69 major transmission projects, with a total project value of approximately €1.25 billion, complementing the existing delivery teams in ESB Networks. EirGrid and ESB Networks are pleased to report good progress in our introduction of innovative measures, our development of the transmission grid and connecting new customers, plus our work in delivering a reliable network to meet these challenges, as well as our performance against incentive targets. This booklet shows some examples of how we have performed during the year. We hope that you find this document of use and we look forward to working together with you to further develop our plans.

How to Contact Us

We welcome all feedback in regard to the information set out in this booklet and any additional information you might wish to see included in future versions. Please see how you can get in touch below.



The current. The future.

Please contact our
Customer Relations Team at:
info@eirgrid.com



Please contact us at
esbnetworks@esb.ie

How to use this document

This booklet will take you through our main activities during calendar year 2019, including:

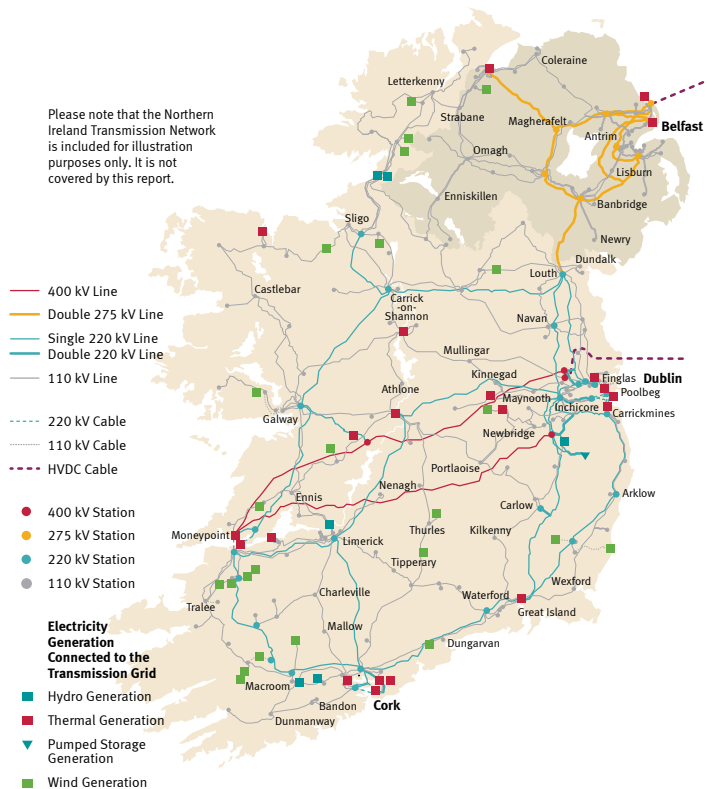
- developing the grid;
- facilitating new connections;
- innovation;
- safety and environment;
- ensuring high levels of transmission system performance;
- making sure the electricity supply is resilient even in extreme weather events;
- tools for managing constraints;
- curtailment volumes and costs;
- how we plan outages to ensure robust security of supply and carry out critical maintenance works; and
- supporting the operation of the all island electricity market.

We also provide links to other documents and data sources where further information can be found.

This booklet is aimed at anyone with an interest in the electricity transmission system, including customers, stakeholders or consumers. In this document we extensively refer to our customers. A typical transmission connected customer could be a power station, an electricity supplier, or large data centre.

This booklet should be read in conjunction with its companion document the Investment Planning and Delivery Report 2019.

What is the Electricity Transmission System?



164
Electrical
Substations

7,390km
Circuits

7,000km
of overhead line

390km
of underground
cable

Electricity transmission encompasses the operation, planning and development of the high-voltage network in Ireland, predominately assets that operate at 110 kV, 220 kV or 400 kV, ensuring that supply and demand is balanced on a minute-by-minute basis¹.

EirGrid is the Transmission System Operator (TSO), and ESB is the Transmission Asset Owner (TAO) and its business unit ESB Networks carries out the licensed TAO functions. The transmission system moves power around the country. It brings power directly to industry and businesses that use large amounts of electricity and also powers the distribution network. The transmission system supplies the electricity used every day in your homes, businesses, schools, hospitals and farms. For further information on the TSO's and TAO's activities in the delivery of the network, please see the 2019 Annual Investment Planning and Delivery report published on the EirGrid and ESB Networks websites.

Working closely together, we develop and build energy infrastructure when it is needed. Through our operation and maintenance of the transmission system, we ensure a safe, secure and reliable supply of electricity.

How we work together is governed by TSO and TAO licences granted by the Commission for Regulation of Utilities (CRU) and by an [Infrastructure Agreement](#) which is a contract between EirGrid and ESB Networks on how to develop and maintain the transmission system. Efficient operation of TSO/TAO working arrangements is essential and we can report satisfactory operation of these arrangements during 2019. The operation of a Joint Programme Management Office (JPMO) and other agreed processes are important aspects of TSO/TAO co-operation. EirGrid and ESB Networks continued to effectively operate, review and develop these arrangements throughout 2019.

1. Please note the Northern Ireland transmission system is included for illustrative purposes only. It is not covered by this report.

How we plan, deliver and use the network

EirGrid's approach to grid development uses a six-step process which explains why and how we develop the grid. More importantly, it also explains how the general public and stakeholders can influence the decisions we make. Since October 2017, all our projects go through this improved process. The joint EirGrid and ESB Networks' Investment Planning and Delivery Report which accompanies this report highlights the work carried out and project progress in 2019.

In 2019, EirGrid launched its [Strategy 2020-25](#) the aim of which is to *Transform the Power System for Future Generations*. It identifies the scale of shared ambition required to meet our 2030 Climate Action Plan targets, in addition to developing a robust and secure grid which meets the requirements of our economy and society into the future.

Central to Strategy 2020-25 is EirGrid's six-step approach for grid development which sets out how the general public and stakeholders can influence the decisions that EirGrid makes on grid development projects. EirGrid's focus has been to increase its value position to consumers and stakeholders while improving efficiencies in grid development.

During 2019, EirGrid and ESB Networks continued to partner with some of the biggest companies in the world, to foster jobs and prosperity across the country. In particular, we have worked together to develop and build the transmission infrastructure and systems needed to supply power to a number of large energy users, such as new data centers. We continued to upgrade and strengthen the transmission grid where necessary. A total of 11 projects were completed in 2019 (against 40 in 2018 and 31 in 2017) including new and upgraded transmission stations and circuits. Further details are set out in our Investment Planning and Delivery Report 2019.

In June 2019, the Irish Government published its Climate Action Plan (CAP). EirGrid and ESB Networks are central to facilitating the implementation of government policy on climate change as outlined in the CAP. As noted in the CAP, offshore wind will be a key component of our future clean electricity system. We need to ensure that offshore wind is developed to suit the context of the electricity system. To achieve this, during 2019, we commenced an objective assessment of offshore grid delivery models around the world.

Step 1

How do we identify the future needs of the electricity grid?

Step 2

What technologies can meet these needs?

Step 3

What's the best option and what area may be affected?

Step 4

Where exactly should we build?

Step 5

The planning process

Step 6

Construction, energisation and benefit sharing

Summary of Highlights from 2019:

It was a positive year for the transmission capital programme. A significant number of new generation customers and a new demand customer were connected to the transmission system in 2019. In 2019 twenty-one new EirGrid approved projects were added to the PR4 programme² in addition to the 234 projects set out at the start of 2019. This compares to 17 projects added in 2018 and 16 projects added in 2017.

EirGrid and ESB Networks undertook a substantial review of the approach to scoping of asset refurbishment and replacement of transmission overhead line projects. A pilot on one refurbishment project in 2019 saved €17.5m. This new approach will now be rolled out to future projects.

The following eleven projects were energised and completed in 2019:

- Five projects which facilitated the future connection of 547 MW transmission and distribution connected renewable generation capacity, including the connection of the largest renewable grid connection in Ireland to date, at Coomataggart 110 kV Station, facilitating 178.4 MW.
- A 220 kV station extension at Clonee enabling a demand customer with a data centre to increase their demand connection by 37 MVA.
- A project to replace two transformers at Cloghran 110 kV station to increase capacity for another data centre.
- Two Associated Transmission Reinforcements (ATR) line uprate projects, one in the South East and one in the West. The completion of these ATRs alleviates constraints and strengthens the transmission network in those areas.
- The replacement of a 110/10 kV transformer at Middleton 110 kV station.
- A protection upgrade project at Bandon 110 kV station.

The following works were also carried out in 2019 as part of the scope of ongoing projects which will be completed in future years:

- The new Clashavoon - Macroom 110 kV cable (8 km) was energised in December 2019. This is the first new Network to be completed as a transmission reinforcement in a number of years.
- The Moneypoint - Prospect 220 kV cable was transferred to the new GIS station at Moneypoint 220 kV station.
- The Finglas 110 kV station project continues and in 2019 the existing transformers T141 and T142 were transferred to the new 110 kV GIS station. The Finglas-Huntstown cable sealing ends were replaced on the 220 kV cable.

2. Further detail on these twenty-one projects can be found in section 7 of the Investment Planning and Delivery Report 2019 on EirGrid's website.

Key Performance Summary Matrix

Metric	Section of report	2019 Target	2019 Performance	2019 Incentive outturn	2018 Performance ³	2017 Performance ⁴
TAO Management of planned outages	<i>"How we performed against transmission delivery incentives"</i> Page 8	No more than 8,240 transmission outage days	7,590 actual transmission outage days	€0.49m	Target: 5,410 scheduled outage days Performance: 5,201 outage days Incentive: €0.49m	Target: 9,291 scheduled outage days Performance: 9,024 outage days Incentive: €0.47m
TSO Strategic Incentives	<i>"How EirGrid performed against strategic incentives"</i> Page 12	5 incentive metrics with a total incentive available €1.675m	60% success	€1.009m	Target: 3 incentive metrics with a total incentive pot available of €0.4m. Performance: 63% success Incentive: €0.25m	Target: 6 incentives metrics with a total incentive pot available of €1.25m Performance: 82% success Incentive: €1.023m
TSO Transmission System Performance (SF and SML ⁵)	<i>"How EirGrid manage system performance"</i> Page 14	SF: 94%	SF: 99.66%	€0.238m – Incentive	Target: 94% Performance: 99.6% Incentive: €0.33m	Target: 94% Performance: 99.5% Incentive: €0.33m
		SML: 1.5-3	SML: 0.176	€0.238m – Full Incentive	Target: 1.5 – 3 Performance: 0.411 Incentive: €0.33m	Target: 1.5 – 3 Performance: 0.3 Incentive: €0.33m
TSO management of curtailment	<i>"How we manage network constraints"</i> Page 17	N/A	710,591 MWh or 6.9% of the total available wind energy (10,293,287 MWh) was dispatched down. Of that 44.93% was related to curtailment volumes which amounted to 319,252 MWh.	N/A	5% of the total wind energy available i.e. 9,184,961 MWh was dispatched down. Of that, 66.2% was related to curtailment volumes.	3.7% of the total wind energy available i.e. 7,532,359 MWh was dispatched down. Of that, 71.6% was related to curtailment volumes.
TSOs' Imperfections savings for participants	<i>"How we manage constraint costs"</i> Page 18	No Incentive was applied in this period	N/A	N/A	Performance: The outturn imperfection costs were €12.6m lower than the adjusted baseline in tariff year 2017/18. Incentive: €0 ⁶	Performance: The outturn imperfection costs were €15.3m lower than the adjusted baseline in tariff year 2016/17 Incentive: €0.46m ⁷

3. 2018 [APR](#) and [IPD](#) paper

4. 2017 [APR](#) and [IPD](#) paper

5. SF – System Frequency and SML- System Minutes Lost

6. In the SEMC's decision, SEM-19-040, the RAs decided that the adjustments to the ex-ante 2017/18 Imperfections revenue of €177.7m, resulted in an ex-post 2017/18 Imperfections baseline of €203.1m. Also, the RAs decided that the actual Imperfections revenue collected by the TSOs during tariff year 2017/18 equalled an amount of €190.5m. Therefore, the savings made by the TSOs were (203.1 – 190.5) = €12.6m, being entitled to an incentive payment of €0.

7. [Further detail in SEM-18-047](#)

Metric	Section of report	2019 Target	2019 Performance	2019 Incentive outturn	2018 Performance ³	2017 Performance ⁴
TSO management of new connections (wind)	<i>"How we manage new connections"</i> Page 23	300 MW ⁸	450 MW	N/A	Target: 340 MW Performance: 350MW Incentive: N/A	Target:300 ⁹ Performance: 500 MW Incentive: N/A
TSO's Stakeholder Engagement	<i>"Engaging with stakeholders"</i> Page 29	Improved Stakeholder Engagement	Score of 7.5 (out of 10)	€0.254m	Target: 10 Performance: Score of 7.14 (out of 10) Incentive: €0.23m	N/A
TAO Completion of the Transmission Maintenance Work Programme	<i>"How we ensure network resilience"</i> Page 15	100%	81%	N/A	Target: 100 Performance: 84% Incentive: N/A	Target: 100 Performance: 75% Incentive: N/A
TAO Capital Expenditure	<i>"Network Development"</i> Page 33	CRU Capex Monitoring Process	€154m	N/A ¹⁰	Target: CRU Capex Monitoring Process Performance: €196m Incentive: N/A ¹⁰	Target: CRU Capex Monitoring Process Performance: €180m Incentive: N/A
TAO Operational Expenditure	<i>"Network Development"</i> Page 33	CRU Opex Monitoring Process	€63m	N/A	Target: CRU Opex Monitoring Process Performance: €60m Incentive: N/A	Target: CRU Opex Monitoring Process Performance: €57m Incentive: N/A
TAO/TSO Transmission Capital Outage Programme Delivery	<i>"How we ensure Network Resilience"</i> Page 15	100%	72%	N/A	Target: 100% Performance: 83% Incentive: N/A	Target: 100% Performance: 80% Incentive: N/A
TAO Project Delivery Incentive	<i>"How we performed against transmission delivery incentives"</i> Page 8	4 Incentive Metrics [total incentive available 4.15% TAO Opex]	Final Report awaiting audit	TBC	Target: 4 Incentive Metrics [total incentive available 4.15% TAO Opex] Performance & Incentive: Full incentive of 4.15% of TAO Opex awarded	Not applicable for 2017

8. As stated in our [2018-2026 All-Ireland capacity statement](#) (p39) average amounts predicted per year needed to reach 2020 targets stated in 2018.

9. As stated in our [2017-2025 All Ireland capacity statement](#) (p35) average amount predicted per year need to reach 2020 targets stated in 2017.

10. There is no direct incentive related to TAO Capital Expenditure. There is a related incentive to project delivery in section 6.

Development of the Celtic Interconnector

EirGrid, along with our French counterpart Réseau de Transport d'Électricité (RTÉ) are continuing the development of the Celtic Interconnector project, a planned subsea High Voltage Direct Current (HVDC) electricity link between Ireland and France.

A significant milestone was reached in December 2019 when the European Commission, through the Connecting Europe Facility (CEF) Energy Programme, awarded the project grant funding of €530 million. This decision followed the submission in June 2019 of an application for funding by EirGrid and RTE.

This potential project, identified by the EU as a Project of Common Interest (PCI), will drive down electricity prices for end users, increase security of supply and offer increased options for market participants in terms of where to buy and sell electricity.

In April 2019, we launched an eight-week consultation on the Celtic Interconnector project. All stakeholders and communities were encouraged to submit feedback on three proposed landfill locations on the coast of East Cork and six proposed location zones for a converter station in East Cork. Feedback from the local community is an important part of the decision making process. We have now prepared the following:

- **Step 3 Consultation Report:** Summarising all responses received and issues raised by stakeholders.
- **Step 3 Consultation Response Document:** Answering questions that were raised.
- **Step 3 Preferred Options Report:** Summarising the consultation process and providing an overview of how new information provided by stakeholders has been considered.

We thank everyone who participated in the consultation process on Step 3. The feedback provided has been very useful, and will inform the development of the project into the future.

For up to date information please see our website that is updated regularly [here](#).

Project Benefits



Competition

Apply downward pressure on the cost of electricity to consumers in Ireland and France



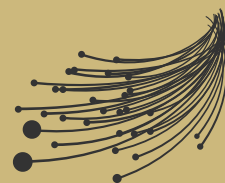
Sustainability

Help facilitate Ireland's transition to a low carbon energy future



Security of Supply

Enhanced security of supply for Irish electricity consumers



Fibre Optics

Provide a direct telecommunications link between Ireland and France (and continental Europe)

Key Facts



Le réseau de transport d'électricité



2

project promoters
(working in partnership)



575km

length of the interconnection
(500km subsea)



700 MW

capacity
(450,000 homes)

How we performed against transmission delivery incentives

EirGrid and ESB Networks are incentivised against targets set by the CRU for the delivery of the transmission network as detailed in [CER/18/087](#). These incentive arrangements apply from 2018 to 2020.

TAO Incentives Performance in 2018

At the time of publication of the 2018 Electricity Transmission Performance Report, the new incentive arrangements for the period 2018-2020 had not been finalised and the incentive report and assessment was not complete. The 2018 incentive performance has since been assessed and is therefore being reported as part of this 2019 report.

In May 2018, a new TAO Project Delivery incentive arrangement for TAO was introduced, as detailed in CER/18/087 (Decision 6), outlining the new Investment Delivery TAO performance metrics to apply in the period 2018 to 2020. The TAO Project Delivery incentive includes both qualitative and quantitative targets. The performance against the scorecard is assessed each year by independent auditors and the audit results assist the CRU in determining the incentive outturn. ESB Networks submitted final proposals on the new incentive arrangements in July 2019. CRU approved the new arrangements in September 2019.

An independent audit of the TAO 2018 incentive performance was conducted in October 2019. The auditors recommended a “Strong” TAO incentive performance for 2018. The final 2018 incentive performance report was submitted to CRU in March 2020 and received CRU approval in July 2020, resulting in full incentive outturn for this incentive for 2018. The existing incentive on the TAO’s management of outages was retained in CER/18/087 (Decision 8).

The following table outlines the breakdown of the various elements of the TAO incentives and the TAO performance in each category in the years 2016-2019. It also illustrates how the breakdown of incentives changed in 2018, due to the changes introduced by CER/18/087:

TAO Incentive Performance 2016-2019

TAO Incentives	2016	2017	2018	2019
Outage Management Performance	0.85%	0.85%	0.85%	0.85%
Project Implementation Plans (PIP’s) Issued	0.40%	0.40%	N/A	N/A
Construction and Energisation Completed	3.75%	3.75%	N/A	N/A
Project Delivery - 4 Incentive Metrics	N/A	N/A	4.15%	Pending
1. PIP’s Issued	N/A	N/A	2018 Audit Complete	
2. Customer Projects Energised	N/A	N/A		
3. Capex spend against target	N/A	N/A	2019 Audit Pending	
4. Project Delivery Process Improvements	N/A	N/A		
Confirmed Incentive Payment (as a % of TAO Opex)	5%	5%	5%	0.85%

Notes:

1. N/A indicates that this incentive line item is not applicable in that year.
2. A penalty would be indicated as a minus figure. There are no penalties in this period.
3. A full incentive payment of 5% of TAO Opex = €3m approx.

The new incentive arrangements for 2018-2020 include the established Outage Management Incentive and a new Project Delivery Incentive. The new Project Delivery Incentive replaces the previous Project Implementation Plan (PIP) and Construction/Energisation incentives. As proposed by ESB Networks and approved by CRU, the new Project Delivery Incentive is made up of four components which include both quantitative and qualitative elements. The four components of the Project Delivery Incentive are assessed and independently audited.

The four incentive metrics making up the new Project Delivery incentive are:

1. Project Implementation Plans

Project Implementation Plans (PIPs) are the committed programme of work for a new project. The PIP is the baseline schedule against which the work is planned and progress is monitored. The TAO performance is measured by the actual percentage of the target PIPs issued during the calendar year. TAO issued 16 Project Implementation Plans in 2018 meeting the full incentive target.

2. Customer Project Energisation/ Connection

The TAO performance is measured by the actual percentage of the target Customer Projects energised/ connected in the calendar year. TAO energised 8 customer projects in 2018 meeting the full incentive target.

3. Transmission Capex Spend

The TAO performance is measured by the actual percentage of the Budgeted Annual CAPEX spend delivered in calendar year. TAO spent €213.5m on Transmission Capital Projects in 2018 meeting the full incentive target.

4. Project Delivery Process Improvement

This element is qualitatively audited by independent external auditors and examines the TAO's performance on the quality and rigor of its processes for identifying and implementing efficiencies and improving processes in project delivery. In 2018, the two process improvements implemented in the business and submitted by TAO were:

4A. Transmission Project Stage Reporting

A formal process for project reporting at Project Agreement stage and at Project Close stage was developed and implemented during 2018. Standard success criteria have been defined for the project reports as part of this process and an overall Project Success rating is decided by the Project Governance Board.

4B. Tower Line Foundation QRA Process

ESB Networks and EirGrid agreed and implemented a new risk-based design approach to the assessment of Steel Transmission Tower foundations. The new approach saves considerable costs in foundation assessment and site works and optimises the amount of remedial work required to extend the life of a steel tower and avoid replacing it. This initiative is projected to save tens of millions of Euro every year.

The auditors recommended a 'strong' score for the Project Delivery Process Improvement aspect of the TAO Project Delivery incentive.

TAO Incentive Performance in 2019

The potential incentive performance payment to TAO available under the Project Delivery incentive for 2019 is 4.15% of TAO Opex. However, due to the Covid-19 Pandemic, it was not possible to have the independent audit. Therefore, the final submission on the 2019 TAO Incentives remains outstanding and CRU assessment of this incentive for 2019 will take place once the audit is completed and report submitted.

The Outage Management Incentive for 2019 was submitted and approved. Outage targets are designed to improve the availability of the network by reducing outage durations and providing greater certainty to all affected parties on expected start and finish dates. In 2019 there were a total of 7,848 scheduled transmission outage days. The incentive requirement is not to exceed scheduled days by more than 5% or 8,240 days. Total actual outage days reached 7,590 by year end. The incentive available to the TAO is 0.85% TAO Opex (€0.49m) for its management of planned outages in 2019. ESB Networks delivered on all of its targets relating to these outages, and was granted the full incentive.

TSO Transmission Delivery Incentive

As per CER/18/087, from 2018 onwards a new network delivery incentive has been put in place for the TSO. Within this CRU's decision, a "Balanced Scorecard" was to be agreed between the TSO and the CRU which would put in place performance measures for the incentive.

Following extensive engagement throughout 2019, a final proposal was submitted by EirGrid and approved by the CRU in February 2020 (CRU/20/039). The new Balanced Scorecard framework has moved away from the former mechanistic approach, which focused on project milestones, to a more outcome and qualitative-based approach. Under this framework, the TSO's performance against the scorecard will be audited by an independent external auditor on an annual basis and graded as either "Strong" (full incentive), "Acceptable" (no incentive) or "Below Acceptable" (full penalty). The audit results assist the CRU in determining the incentive outturn.

There are five incentive metrics, split into two main areas: Investment Planning (50%) and Delivery (50%), aligned with EirGrid's 6 Step Process:

PR4 Balance Scorecard Framework

Area	Metric number/ type	%	Steps of the 6-step process	(Strong) Full assurance: 2% payment	(Acceptable) Satisfactory assurance: 0% payment + recovery of reasonable audit cost	(Below Acceptable) Limited/ Unsatisfactory assurance: -2% penalty
Investment Planning (50%)	Metric 1 Qualitative	10%	Step 1	Audit Full Assurance	Audit Satisfactory Assurance	Audit Limited/ Unsatisfactory Assurance
	Metric 2 Qualitative	10%	Step 2			
	Metric 3 Qualitative	30%	Step 3			
Delivery (50%)	Metric 4 Qualitative	20%	Step 4-5	Greater than or equal to 75%	61-74%	Less than 60%
	Metric 5 Quantitative	30%	Step 6			

Further details on the metrics can be found in the CRU information paper [CRU/20/039](#) and EirGrid's submission paper [CRU/20/039a](#) which are published on the CRU's website.

The actual performance of the TSO in a calendar year will be assessed by an Independent Auditor and the CRU in the following year. However due to the Covid-19 Pandemic, EirGrid was unable to arrange for the external audits for both calendar year 2018 and 2019 to be carried out. These audits will be undertaken as soon as practicable and the audit reports provided to the CRU for their consideration. The outturn performance and CRU approved incentive payment/penalty for 2018 and 2019 will be documented and included in future reports.



How EirGrid performed against Strategic Incentives

We are in a time of unprecedented change on the electricity system as we move to a low carbon future. EirGrid is at the forefront of guaranteeing that this change is brought about in a timely and cost effective manner while realising a broad range of benefits for end users and market participants.

We do this by maintaining a safe, secure and reliable transmission system while integrating an ever increasing number of renewables. This is supported by our development of a wide variety of innovative projects and the roll out of new system services.

In May 2018, the CRU published its Decision on Reporting and Incentives Framework under PR4, [CER/18/087](#). The Framework sets out twenty decisions for improving the previous reporting and incentives arrangements.

Decision ten of CER/18/087 invites the TSO to propose metrics for its strategic incentives annually, under two broad headings;

- i. delivering the energy transition to a low carbon future, and
- ii. managing the costs and risks of the energy transition.

These are the metrics/criteria against which the TSO's performance over 2019 was assessed. The 2019 indicators were consulted upon by the TSO before being submitted to the CRU for approval. The approved indicators, targets and our outturn performance is summarised in the table below.

Target	Description of work	Incentive Value (€m)	Achieved	Incentive Received (€m)
Increase SNSP:	RoCoF setting changes completed for all TSO & DSO connected generators in Ireland by end of 2019.	€0.235m	No	€0
	Three "Decision Making Tools" introduced in the Control Centre by end of 2019	€0.235m	No	€0
The 2018/19 Qualification Trial Process	The trial is designed to be bespoke with a focus on innovative technologies and strategy. The 2018/19 Qualification Trial Process will include Proven ability, Distribution Impact and Standard & Compliance trials to demonstrate capability in the reserve, ramping and fast-acting services. The trials will be concluded in December 2019.	€0.268m	Yes	€0.268m
Delivery of Fixed Contracts DS3 System Services	Targeted delivery of contracts by Q4 2019.	€0.301m	Yes	€0.301m

Target	Description of work	Incentive Value (€m)	Achieved	Incentive Received (€m)
DSR deployment for distributed power flow control	1. Complete the public procurement phase and award the contract by Q3 2019.	€0.318m	Partial (88%)	€0.280m
	2. Complete a reduced Line Project Assessment Report for the circuit by Q3 2019.			
	3. Identify and confirm circuit for deployment of DSR and achieve capital approval by Q4 2019.			
Innovative Solutions	1. Tower Voltage Uprate for project CP1017: Achieve planning consent for installation of new towers by Q3 2019.	€0.318m	Partial (50%)	€0.159m
	2. Tower Voltage Uprate for project CP1017: Achieve Project Agreement with ESB Networks to enter into the construction phase by Q4 2019.			
Total		€1.675m		€1.009m

A total of €1.009m strategic incentives allowance relating to 2019 was approved by CRU against a total possible incentive allowance for 2019 of €1.675m. This compares to an incentive allowance of €0.25m in 2018 (against a total possible allowance of €0.4m) and an incentive allowance of €1.023m in 2017 (against a total possible allowances €1.25m).

In terms of partially received incentives, regarding deployment of Distributed Series Reactors (DSR), the TSO achieved two of the three measures i.e. 66%. Regarding the third measure, the TSO had three months to achieve it but was one month late. The CRU has approved 2/3 of this measure i.e. 22%. The total performance approved by the CRU is 66% + 22% = 88%. With regard to Innovative Solutions, the planning consent and installation of the new towers was achieved but unfortunately the project agreement for the construction was not complete and only 50% of the incentive was awarded.

The TSO has a responsibility to enable increased levels of renewable energy generation on the power system while making sure that the system is operated safely and securely. In 2010 our analysis identified 50% as the then maximum allowable level of renewable generation on the power system, referred to as the System Non Synchronous Penetration (SNSP) limit.

The DS3 programme has now enabled SNSP to be increased to 65%, on a permanent basis from 9 April 2018. EirGrid is working with SONI to increase the All-Island SNSP limit to 75% in 2020. In 2019, EirGrid worked towards completing the change of Rate of Change of Frequency (RoCoF) settings for all TSO and DSO connected parties in Ireland and introducing a number of Decision Making Tools to the National Control Centre. At the end of 2019, overall RoCoF settings changes were 90% complete, with 10,471MW of 11,634MW being changed and tested. The incentive called for a completion of RoCoF programme coordination in Ireland, including conventional generation studies and testing for all TSO & DSO units in Ireland by end of 2019. Unfortunately, this was not complete in the timeline and the incentive was not awarded.

How EirGrid manage system performance

In a highly competitive global marketplace, continuity of supply is crucial to attracting inward investment and ensuring economic growth, especially in the technology sector. A changing generation portfolio with increased penetration of variable renewable generation makes it more difficult to maintain current high levels of security of supply.

As an island with limited interconnection Ireland is leading the way in resolving the complex technical challenges that the integration of high levels of renewable generation presents. Operational policies and procedures are reviewed on a continuous basis.

Two of the primary metrics by which a transmission system's performance is measured are System Frequency and System Minutes Lost. These measures are a recognised, robust way of measuring the reliability and quality of supply delivered by an electricity transmission system. Given their importance EirGrid is incentivised to maintain certain levels for each of these.

System Frequency

Frequency must be maintained at the standard level in order to support the stability of the system. If the frequency is not maintained within defined limits, the system will collapse leading to wide-scale power outages. For the Irish transmission grid, the standard for frequency is 50 Hz. This means that at this level load and generation are perfectly balanced. If the system becomes significantly unbalanced, transmission equipment can be damaged. Household devices are also designed to only handle a certain range of frequencies and can be damaged if this range is not maintained. Ensuring control of the system frequency is critical and challenging as EirGrid seeks to further increase the level of renewable generation connected to the grid. EirGrid continues to be incentivised to maintain system frequency within prescribed limits. In 2019 the system frequency was operated within the target operating limits of 49.9 Hz and 50.1 Hz for 99.66% of the time. In 2019 EirGrid achieved its full incentive amount of €0.238m in this regard. Also, EirGrid achieved the full incentive payments relating to 2018 and 2017 (€0.33m each year)

System Minutes Lost

System Minutes Lost (SML) is an internationally recognised measure of transmission system performance. It measures the severity of each system disturbance relative to the size of the system. By measuring SML EirGrid's performance can be compared against other TSOs. EirGrid is incentivised to ensure SML remain low. EirGrid has maintained downward pressure on SML through diligent frequency management, developments in generator performance incentivisation and monitoring, and through the transmission system protection upgrade programme. In 2019, there were 0.176 System Minutes lost on the transmission system. In 2019, there were a number of instances where we were required to manage interruptions to the network and maintain its resilience, ensuring that a constant, safe and secure supply of electricity was available at all times. There were no under-frequency load shedding (UFLS) disturbances in 2019 which resulted in shedding of normal tariff load customers. In 2019, EirGrid achieved its full incentive amount of €0.238m in this regard. Also, EirGrid achieved the full incentive payments relating to 2018 and 2017 (€0.33m each year).

For further information see the [All Island Transmission System Performance Report 2019](#)

99.66%
EirGrid maintained system frequency in line with target 94% of the time.

In 2019, there were **0.176** System Minutes Lost (SML) on the transmission system, significantly below the target level of 'less than 1.5 SML'.

How we ensure network resilience

EirGrid designs, plans and operates the network in accordance with the transmission system security and planning standards while ESB Networks constructs and maintains the network on the ground. As the transmission network is vital to the supply of electricity for all customers and end users, these standards are critical to ensuring that the network is designed in a way which guarantees this in a safe, secure and robust manner. The operation of the network once in place is supported and underpinned by robust policies and procedures both in our control centres and on the ground.

Ongoing transmission system maintenance is crucial to ensuring the resilience of the network. The Asset Maintenance Policy is kept under review to ensure that it continues to meet the requirements of the system and best international practice. The most up to date guide to Transmission Equipment Maintenance can be found on the EirGrid website [here](#).

The transmission network contains a large amount of overhead lines, cables and substations distributed across the country and at customer's installations. Transmission maintenance work requires a wide range and high volume of complex maintenance tasks to be undertaken annually. EirGrid and ESB Networks agree an annual maintenance programme based on the applicable Transmission Maintenance policies and standards. ESB Networks delivers the transmission maintenance programme utilising teams of highly skilled technicians and specialists distributed nationally. The maintenance expenditure in 2019 was €22m. ESB Networks delivers transmission maintenance efficiently and to a high standard contributing to the health, performance, life and resilience of the transmission system. There is some flexibility in scheduling maintenance within the year, or from year to year. EirGrid and ESB Networks report and manage the programme actively and dynamically, based on criticality, on an on-going basis. The ability to deliver the full maintenance work programme is affected by the availability of outages; interdependencies with capital project works; weather and other unplanned maintenance or faults arising; additional work or materials requirements identified following inspection; and a wide range of other issues. The performance in completing the scheduled transmission maintenance programme in the period 2016 to 2019 is shown in the table below:

Transmission Maintenance - % Completion

2016	2017	2018	2019
78%	75%	84%	81%

Co-ordinated outage planning is another core requirement to ensuring network reliance on a day-to-day and week-to-week basis. The ability of the system to meet demand, even where generation or system assets are unavailable, is carefully monitored and planned for. The All-Island Generation Outage Plan ensures co-ordination of planned outages when power stations will not be available due to maintenance or other reasons. The plan takes into account security of supply in Ireland, as well as economic operation of the power system, and the maintenance/resource needs of generators.

The All-Island Generation Outage Plan is published in September each year. During the year, the plan for that year is updated on a monthly basis, or as necessary. The 2019 All-Island Generation Outage Plan can be found on the EirGrid website [here](#). Generators can send outage requests to EirGrid using the Generator Outage request form on EirGrid's website [here](#).

Transmission Outages involve planned times when lines, cables and substations will be maintained and not in service. It also involves times when plant testing, connection of new plant and decommissioning of old plant is carried out. The annual Transmission Outage Programme includes all outages of transmission infrastructure which are planned to occur in the year. The 2019 Transmission Outage Programme can be found in the library section of the EirGrid website by searching for 'Transmission Outage Programme 2019'.

In 2017, EirGrid developed a dashboard which monitors the percentage of the Transmission Outage Programme delivered in terms of capital projects. The 2019 percentage was 72% (compared to 83% in 2018 and 80% in 2017). 100% delivery was not achieved in 2019 for a large variety of reasons, including;

- Land access issues
- Weather delays
- Additional works being identified on site
- Cable resourcing
- Outage availability
- Material/design delays

Network resilience in an ever changing system

One of our biggest challenges is maintaining network resilience in an increasingly diverse and complex power system with ever increasing levels of renewable generation.

EirGrid's Delivering a Secure Sustainable Power System (DS3) programme seeks to address this issue. In April 2018, the power system moved to permanent system operation at 65% System Non-Synchronous Penetration (SNSP). This means we can securely operate the power system with up to 65% of the energy coming from newer forms of variable, renewable generation. In 2019, the system was operated above 60% SNSP for 720 hours.

Network resilience in Action

In 2019 there were a number of instances where we were required to manage interruptions to the network and maintain its resilience, ensuring that a constant, safe and secure supply of electricity was available at all times.

We are pleased to report that during these events, the protection equipment on the network ensured that the faults were resolved with minimal impact to customers.

There were two adverse weather events which caused faults on the transmission system in 2019; however, there were no power supply interruptions on the transmission system:

- On 8 December 2019, there were six faults on the 110kV transmission system during Storm Atiyah. The faults were caused by wind and lightning. Fault clearing times were between 49 ms and 89 ms.
- On 18 December 2019, there were four faults on the 110 kV transmission system during Storm Elsa. All faults were caused by high winds. There was an orange weather warning in place at the time of the faults. All faults were cleared in less than 90 ms. Two circuits were automatically reclosed and two circuits tripped, reclosed and tripped again.



How we manage Network Constraints

EirGrid implements system operational constraints, in conjunction with SONI the TSO of Northern Ireland, in order to maintain acceptable levels of system stability and voltage levels to enable efficient operation of the system. More information can be found in the [Operational Constraints Update](#) published in Dec 2019, which covers all the operational constraints in place at the end of 2019.

More information can be found in the [Operational Constraints Update](#) published

A review is carried out on all operational constraints annually. A review of operational constraints is also carried out if there have been significant network changes made to a particular area of the transmission system, connection of significant generation in an area of the transmission system, or closure of significant generation in an area of the transmission system. The TSO publishes updates to the Operational Constraints monthly and as required if any changes are made. EirGrid can report that all reports for 2019 were published in a timely manner and are available on EirGrid's website.

Ensuring efficient operation of the system is critical to maintaining a safe, secure and robust supply of electricity for end users and market participants. Scheduling operational constraints well in advance also ensures that they are accounted for in the market schedule, reducing the imperfections charge for market participants.

In terms of short term management of network constraints, this is carried out in the control centre through the use of a specialist software tool. Using this specialist software tool means short term constraints are identified and information is provided to EirGrid staff which allows them to take the most cost effective action. The most effective measure of performance in managing constraints is action taken to reduce constraint costs. This is discussed further on the next page.

Information on 2019 Curtailment Volumes

Curtailment refers to the dispatch-down of wind for system-wide reasons. There are different types of system security limits that necessitate curtailment:

1. System stability requirements (synchronous inertia, dynamic and transient stability)
2. Operating reserve requirements, including negative reserve
3. Voltage control requirements
4. System Non-Synchronous Penetration (SNSP) limit

In 2019, 710,591 MWh or 6.9% of the Total Available wind energy (10,293,287 MWh) in Ireland was dispatched down. Of that 44.93% was related to curtailment volumes which amounted to 319,252 MWh. This compares to 303,110 MWh in 2018 and 198,291 MWh in 2017. The Annual renewable Constraints and Curtailment Report capturing this information in detail can be found located [here](#).

Curtailment levels are affected by a number of factors which vary year to year. The amount of wind installed on the system will have a significant impact on curtailment. In 2019, an excess of 450 MW was added to the wind installed capacity in Ireland. This is higher than the average annual wind connection level of about 350 MW over the previous 5 years. The total wind capacity installed in Ireland at the end of 2019 was 4113 MW.

450 MW
of Wind installed
in 2019

How we manage constraint costs

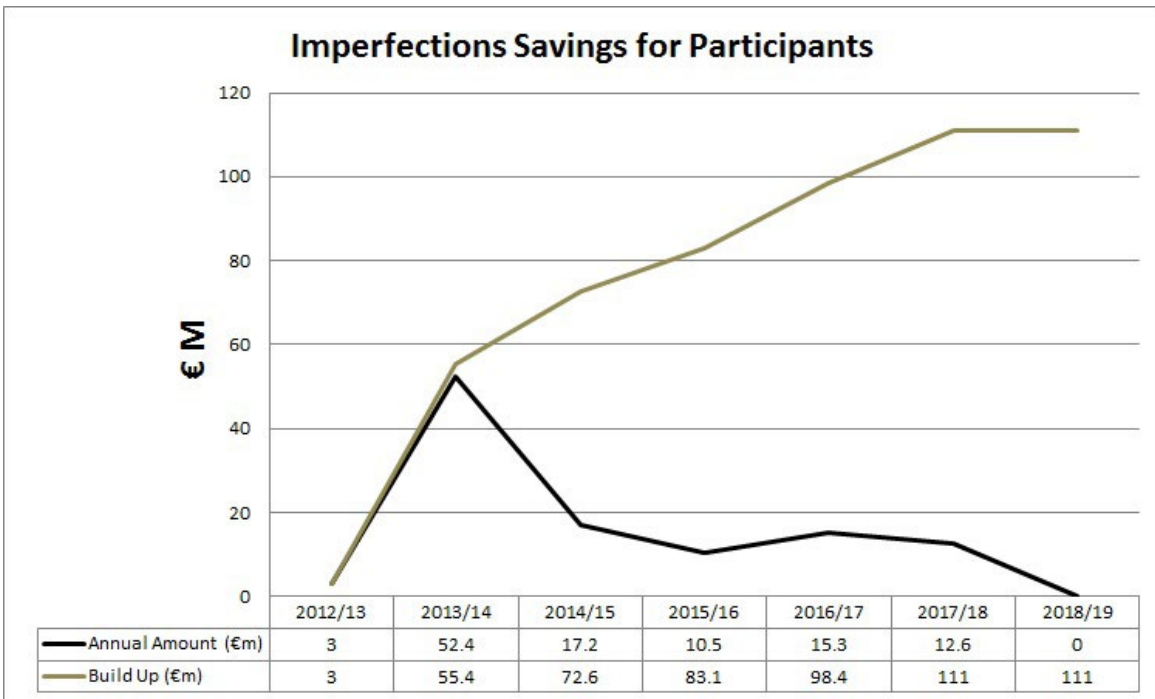
Sometimes we will have to dispatch or call in some power generators differently from the market schedule, in order to ensure security of supply to end users and market participants. This is because of the technical realities of operating a dynamic and fast-changing power system, such as preventing overloads or maintaining enough generation reserve. Where power stations are run differently from the market schedule, it is termed “constraint”. Generators are kept financially neutral with the original market schedule and the cost associated with doing this is the constraint cost.

Constraint costs are the most significant part of dispatch balancing costs. Dispatch means the sending of instructions from the EirGrid control centre to power generators, demand side units, interconnectors or pumped storage plant about their times, fuel, manner of operation or output. Dispatch balancing costs are a suite of payments that relate to how generators are instructed.

In addition to constraint costs, dispatch balancing costs also include uninstructed imbalance payments and generator testing charges. Constraint costs are an inherent feature of the Single Electricity Market (SEM) design. These costs are levied on suppliers through the Imperfections Charge. EirGrid, working with SONI, the TSO in Northern Ireland, is responsible for forecasting and managing dispatch balancing costs. They form part of the imperfections charge which is paid for by market participants.

Within the period 2012-2018, the TSOs have been incentivised to reduce imperfection costs. The incentive mechanism took into account the structure of industry and the degree of control which the TSOs have on the imperfection costs drivers. The TSOs have implemented measures in the operation of the transmission system that have resulted in cumulative imperfections savings for participants totaling €111m.

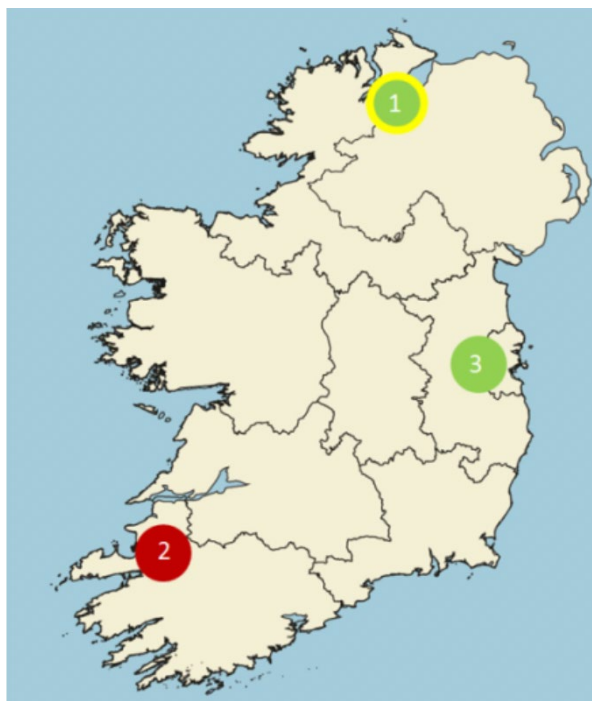
Please see [2018/19 Imperfections Costs Reforecast](#) issued in July



The new Integrated Single Electricity Market Arrangements went live in October 2018. It was recognised that the first number of months of the revised arrangements cannot be held as a true representation of the market operation for a variety of reasons, including, but not limited to: code and system defects, changes in participant bidding strategy and general settling in of the revised market arrangements and as a result comparison of actual imperfection costs, to a reforecast model (as would normally be prepared by the TSOs¹¹), would not provide meaningful data. In this context, it was determined by the RAs that no incentive arrangements would apply for the first year of the revised SEM arrangements (tariff year 2018/19). Regarding the tariff year 2018/19, the TSOs provided a Reforecast report to the RAs, where they compared the ex-ante imperfections allowance with the ex-post adjusted baseline and the outturn costs; however the ex-post adjusted baseline was not validated by the RAs given no incentive arrangement applied to this tariff year. Further detail on this can be located in the 2018/19 Imperfection Costs Reforecast located [here](#).

2018/19 Main constraint changes and TSO Initiatives

The map below shows some main constraints that were introduced/changed over 2018/19 which influenced imperfections costs; red indicates a change that increased costs, green indicates a change that reduced costs. The green constraint (highlighted in yellow) is a TSO initiative, which is an operational improvement that lowered costs for 2018-19 and continually beyond.



Transmission constraint group introduced in 2018/2019

1	In February 2019, the constraint related to Coolkeeragh running was relaxed. This was an initiative for TSO.
2	In May 2019, a constraint to support voltages in the south west at times of very low wind was introduced. This involved the dispatch of additional generation units (TB3, TB4 or MP2).
3	In May 2019, the constraint related to replacement reserve was updated to include Poolbeg A and Poolbeg B in open cycle mode in the list of generators available to satisfy this constraint.

For a full list of changes to constraints on a monthly basis, and the full set of constraints that are currently applicable, please see operational constraints report located [here](#).

11. Please refer to the 2018 APR (pg 13) for more details on the imperfections incentive applied within the 2012 – 2018 period.



2018-19 TSO initiatives to reduce constraint costs

The level of savings to constraint costs over the last few years represents significant effort on behalf of the TSOs to reduce costs where possible. As highlighted above, the primary operational initiatives introduced by the TSOs which helped to decrease constraint costs across the island in 2018-19 are as follows:

Coolkeeragh:

Prior to Feb 2019, it was required that Coolkeeragh must be on load when the NI system demand is at or above 1,290 MW. From Feb 2019 onwards, this constraint was relaxed to: Coolkeeragh must be on load when the NI system demand is at or above 1,550 MW, Coolkeeragh Gas Turbine Unit 8 (CGT8) is unavailable and NI wind generation < 450 MW. This demand limit can be raised to 1,608 MW if CGT8 is available. For NI wind generation in excess of 450 MW there is no constraint. This change allowed for more flexible management of the all island transmission system, reducing constraint costs for end users across the island.



How we minimise the Financial Impact of Transmission Losses on Consumers

When electricity is transported through networks, there are losses, which means that not all of the power generated reaches customers and end users. This can occur either in transmission or distribution networks, although higher voltages generally reduce losses.

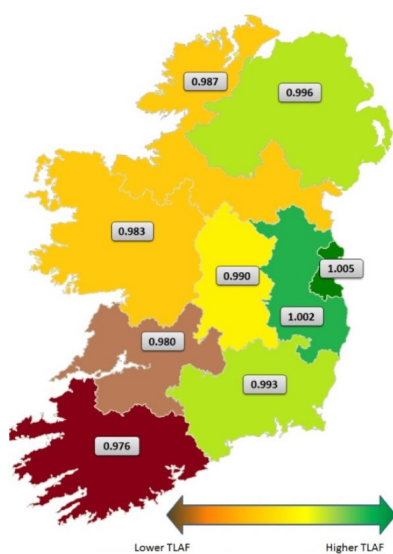
To ensure that the all-island wholesale market is settled correctly, transmission losses are allocated to generators in Ireland and Northern Ireland (including generators connected to the distribution system), using Transmission Loss Adjustment Factors (TLAFs). TLAFs are only applied to generators so the costs of transmission losses are not directly charged to end consumers.

The TLAFs for the island of Ireland are calculated annually by EirGrid, jointly with SONI in Northern Ireland, and approved jointly by the CRU in Ireland and the Utility Regulator (UR) in Northern Ireland. They effectively discount the value of the generation being produced by individual generators.

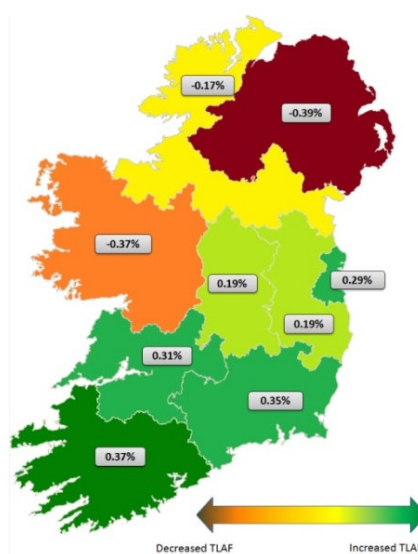
The further power has to flow through the system from where it is generated to where it is needed, the greater the potential losses. As a result TLAFs are location specific. The regional TLAFs for 2019 are shown on the map with green indicating a higher and therefore financially better TLAF. The second map indicates the change in regional TLAFs from 2018. These changes are influenced by yearly dispatch, demand and topology changes.

Such signals provide a commercial incentive for generators to make informed investment decisions concerning their use of the transmission system. Further information on TLAFs can be found on EirGrids website located [here](#).

Further information on the TLAFs and their calculation can be found in the [TLAF Methodology Explanatory Paper](#)

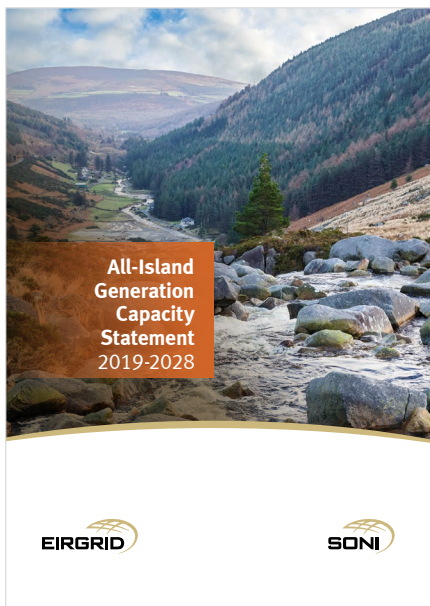


2019 Regional TLAFs



% Change from 2018 to 2019: Regional TLAFs

How EirGrid supports market operation



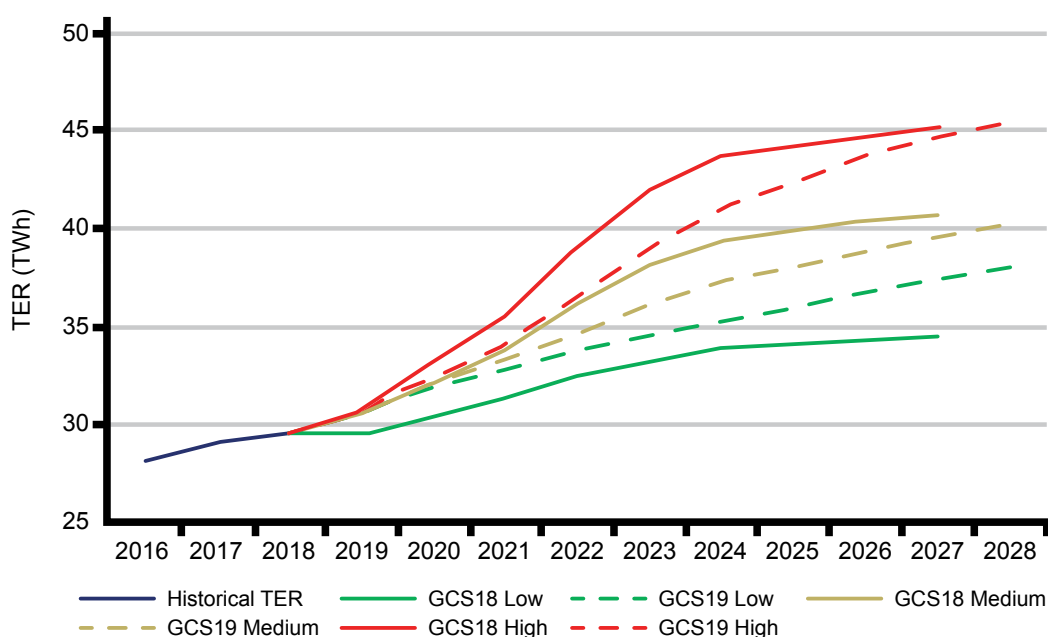
In its role as TSO, EirGrid provides critical support in the operation of the Single Electricity Market.

The market arrangements are designed to integrate the all-island electricity market with European electricity markets, making optimal use of cross-border interconnectors, enhancing security of supply, delivering increased competition and further enabling the integration of renewables onto the system.

During 2019, the new market design, implemented in October 2018, delivered improved efficiency in cross-border trading. It also opened up new opportunities for market participants and has seen trade move in response to price changes. This means that we buy electricity from neighbouring markets when they are cheaper, and sell to them when they are more expensive. This benefits both

the end customers and those investing in generation. This was the result we planned to achieve when implementing the new market.

One of our key responsibilities is providing accurate system demand forecasts. This is a crucial aspect of ensuring generation adequacy and maintaining security of supply. Using a complex modelling system which predicts electricity demand based on changes in economic parameters, and with the support of bodies such as the ESRI (Economic and Social Research Institute), we ensure that market participants can make informed decisions due to the accuracy of our demand forecasts. Further details on our work in demand forecasting in 2019 can be found in the [Generation Capacity Statement 2019-2028](#).



Ireland Total Energy Forecast 2019-2028

In Ireland, the growth in energy demand for the next ten years varies between 23% in the low demand scenarios, to 47% in the high scenarios as shown in the above graph.

The medium forecast is generally aligned with EirGrid's Tomorrow Energy Scenarios which predict an overall Energy Requirement for Ireland of approximately 41TWh by 2030.

Capacity Auctions

EirGrid, working with SONI, also has a critical role in the operation of the Capacity Market, securing generation capacity to meet the further demand needs of the All Island network. This is achieved through Capacity Auctions.

In 2019 the first T-4 auction closed on April 2nd, procuring sufficient capacity to meet security of supply for the period October 2022 to the end of September 2023. The auction secured a total of 7,412 megawatts (MW) of capacity. The auction clearing price was €46,150 per MW per year. Of the 112 generating units that qualified to take part in the auction, 93 were successful. A total of €342 million of capacity payments will be paid during the period October 2022 to September 2023.

The capacity required from the auction took into account peak demand, security of supply, as well as the reliability and performance of generators, and a range of demand forecasts and interconnection.

A total of 710 MW of new capacity was successful in the auction.

The provisional results are available at [Provisional Capacity Auction Results Report](#). EirGrid has also published the following documents on the SEMO website:

- [Capacity Market Overview & Auction Provisional Results Summary](#)
- [A Quick Guide to the Capacity Market and 2022/2023 T-4 Capacity Auction Provisional Results](#)



Total of
710 MW
of new capacity
was successful in
the auction

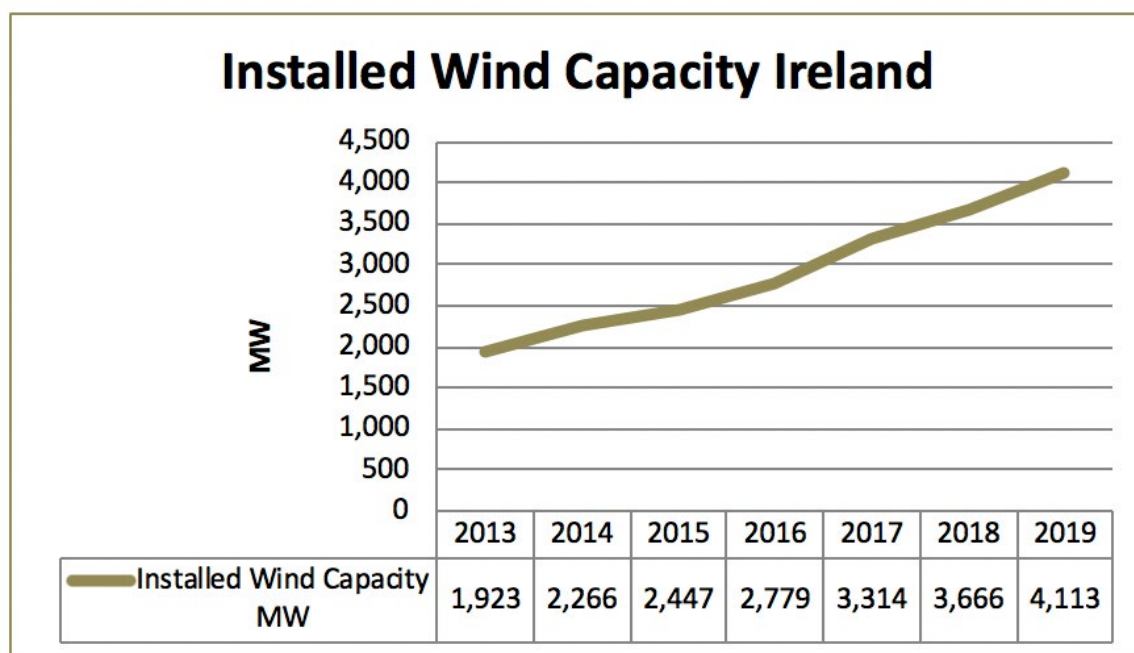
How we manage new connections

EirGrid issues connection offers to large scale generators, interconnectors and demand customers, who seek connections to the transmission system in line with connection policy and directions as issued by CRU from time to time. This section summarises the offers issued in 2019.

Connecting Generators and Interconnectors

Large generators, typically with a capacity of more than 40 megawatts (MW), connect to the transmission system. Offers are issued to generators seeking connection in line with the regulatory framework set down by the CRU. EirGrid also provide connection offers to the Distribution System Operator (DSO) so that generators connecting to the distribution network can export power onto the transmission system. Generator types include thermal plants using fossil fuels, hydro, Combined Heat & Power (CHP) plants, wind and other newer generation types such as solar power or commercial energy storage facilities. EirGrid operates the connection process for new generators in close co-operation with ESB Networks, as DSO and in line with regulatory policy.

In 2019, EirGrid and ESB Networks as DSO facilitated the connection of c.450 MW of installed windfarm projects (against a target of 300 MW) which is made up of c.150 MW of transmission system and c.300 MW on the distribution system. A graph charting the increase of installed wind capacity can be seen below. By the end of 2019 the connection of these new windfarms resulted in the overall generation provided from wind energy sources reaching 31% of total demand.



When a connection offer is executed this means that the applicant has signed a connection agreement but has not yet energised. When an offer is issued it means that the TSO, or DSO, has issued a connection offer to an applicant. This does not mean the offer has at the time been accepted by the participant. A list of the currently contracted and connected customer to the Transmission system is located on EirGrid website [here](#).

Offers executed New and Overall Total in 2019	No.	MW
New Transmission Generator Connection Offers Executed	4	640 ¹²
Modifications to pre-existing Transmission Generator connection agreements executed	16	33 ¹³
Total	20	673

Offer issued New and overall Total in 2019	No.	MW
New Transmission Generator Connection Offers Issued	13	948.5
Modifications to pre-existing Transmission Generator connection agreements issued	17	0
Total	30	948.5

In addition we facilitate the connection of Interconnectors between the transmission system in Ireland and the transmission systems in other countries. Offers are issued to companies seeking to construct an interconnector in line with the rules set down by the CRU. One connection offer was issued and accepted for an interconnector in 2019 for 500 MW's.

Connecting Demand Customers

A demand customer is a large commercial or industrial user of power. They can apply to connect to either the transmission or the distribution system. In general, customers who require a power supply of over 20MVA connect directly to the transmission system. At the end of 2019 there were twenty demand customer sites connected directly to the transmission system. A total of five transmission demand connection agreements were executed in 2019.

	No.	MVA
Demand Connection Offers Executed	5	173
Demand connection offers issued (includes modifications to contracts)	23	215

Demand Side Units

Demand Side Units (DSUs) do not receive connection offers. A Demand Side Unit or DSU is a single demand site or group of demand sites that can reduce their electricity consumption when instructed by the National Control Centre. These are registered in the market and are offered system services contracts. In 2019, a total of four new DSU's were contracted, adding 108MW of capacity to the network. This brought the total number of contracted DSUs at the end of 2019 to 26 with a total capacity of 511MW. The table below shows the change from 2017 to 2019, this will be updated annually in future reports.

	2017	2018	2019
DSU Total Capacity (MW) - Ireland	348	403	511
Total No. of Operational DSU's - Ireland	19	22	26

Contestable Construction

Contestable construction is the arrangement whereby customers build their own connection assets required to connect to the transmission system, this has been in place for several years. This mechanism provides flexibility to customers to manage and control their costs, their programme and their risk. The ownership of the contestably constructed transmission assets transfers to ESB Networks on completion. EirGrid takes over operational control of the new assets. TSO and TAO work closely together to manage the takeover processes associated with contestable construction.

12. Includes 500MW of an Interconnector

13. New capacity in Cork

Innovation

EirGrid and ESB Networks have innovation programmes through which we research, develop and use innovative solutions which help us manage the ever-changing power system. We innovate to bring value to all users of the power system.

One of our main aims is to create flexibility in the system to adapt to the changes in the electricity industry. We are a small island with ambitious targets for renewable generation and increased energy user participation. This creates the opportunity to do things differently and deliver solutions that have real benefits for our customers and the wider community.

The Innovation Programme involves the integration of new technologies and services which work well with each other and improve the way we operate the transmission system. The programme will help facilitate a low-carbon energy future, while helping us operate and maintain a safe, secure and efficient power system. The programme focuses on the following areas;

Innovation Focus Areas

Evolving User Facilitation

As the power system becomes increasingly dynamic we must ensure we are positioned to both facilitate new types of users and manage their impact on the system. We focus on new user types that support energy efficiency and sustainability such as active demand, PV and Storage. By ensuring we are equipped to manage such users we are positioned to utilise them in managing intermittent generation and network congestion

Reduced Community & Environmental Impact

The TSO is mindful of the impact of transmission infrastructure development on the environment and we are keen to seek out innovative ways to adapt how we approach the deployment of infrastructure so we can minimise the impact on the local environment. By seeking out innovative ways to adapt existing infrastructure to meet our system needs we can minimise the impact on the local environment.

Enhanced Grid Utilisation

This area focuses on how we can identify and test devices which can be added to the network to enable the efficient use of existing infrastructure. Such technologies work by redirecting power flow from heavily loaded circuits to circuits that are less loaded. This functionality provides EirGrid with greater ability to manage system congestion and has the potential to suppress the short term need for infrastructure build, reduce constraint costs and facilitating connection to the grid.

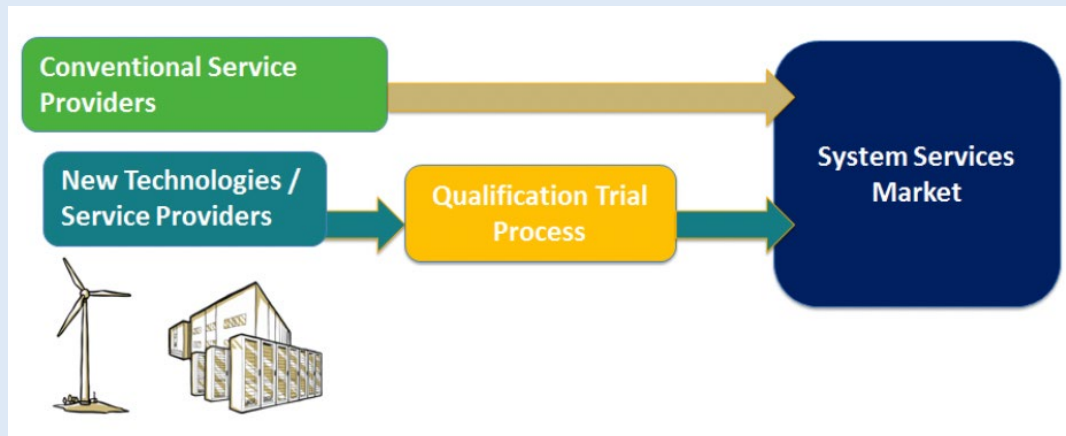
Control Centre Evolution

How we operate and manage the system will become more complex as we move towards an increasingly diverse and dynamic energy mix with new technologies on the system. It is essential that we are innovative in our development and use of sophisticated control system tools that ensure the efficient and effective operation and management of the grid and fully exploit the benefit of our innovations.

2019 Highlights

Qualifier Trial Process (QTP)

The QTP is the mechanism through which EirGrid TSO, working with SONI in Northern Ireland, manages the transition to a wider portfolio of system service providers. The aim is to identify operational complexities that may be associated with new technologies, or delivery of new System Services. In doing so, EirGrid and SONI can develop a deep understanding of these complexities and suggest solutions on how to best integrate these technologies at scale on the power system on the Island of Ireland and Europe.



The 2019 QTP includes trials to demonstrate capability in the reserve, ramping and fast-acting services. The 12 month trials will be concluded in September 2020 and the 18 month trial will be concluded in March 2021, after which the results will be compiled and published. The 2019 QTP was divided into three distinct trials. Detailed information of the trials for 2019/2020 can be found [here](#). EirGrid received an incentive for its work on this initiative – as set out in the ‘How we performed against Strategic Incentives’ section of this report.

Solar photovoltaic (PV) Trial

Solar photovoltaic (PV) generation has become a more economically viable form of electricity generation in Ireland and Northern Ireland in recent years. It is likely that large scale solar PV will connect to the system at an increasing rate from the mid-2020s without the need for a subsidy due to decreasing capital costs. EirGrid’s Tomorrow’s Energy Scenarios consider a range of installed solar PV capacities between 200 MW and 2,500 MW in 2030 due to the uncertainty of how the technology will develop.

In 2019/2020, Bann Road Solar located in Northern Ireland will demonstrate the potential of Solar photovoltaic (PV) generation’s to provide DS3 services.

Aggregated Residential Services Trial

The system operator will use the project to investigate the potential delivery of residential Demand Side Management (DSM) at scale, which has benefits in assisting Ireland to reach its renewable energy targets by providing greater flexibility in operating the power system with up to 70% renewable generation, which will require the ability to operate the power system with as much as 95% of generation from renewables at times.

In the 2019 QTP, two participants were successful; Energia and Solo Energy. As part of the trial, the two participants will use various technology forms connected to residential homes to demonstrate the capabilities of System Services.

Alternative Communication Method Trial

Due to the increasing use of renewable energy sources, TSO's worldwide are seeing a shift from operating a centralized portfolio of large conventional fossil-fuel generators to a more widely distributed network which includes small-scale generation. The current communication method was designed for larger generators, which has resulted in a communication solution that may be inflexible or expensive for small scale generation or other service providers on the system such as an aggregator. This project is to enable a two-way communication between a small scale service provider or aggregator and the system operator.

In 2019, Energia and Electricity Exchange conducted a trial on a new telecommunications method which meets the shifting needs of the industry.

FlexTech Initiative

In 2019, EirGrid and SONI launched the FlexTech Initiative, with support from ESB Networks and NIE Networks. FlexTech aims to breakdown key barriers across a wide range of technical, operational, commercial, regulatory, and market challenges in order to facilitate the integration of renewable energy in Ireland and Northern Ireland.

In doing so, the objective is to maximise the opportunity to make effective use of new and existing technologies to meet the needs of the future power system. Through collaboration, we can better understand stakeholder's perspectives and key challenges in the electricity sector, which, if resolved, will bring considerable transformation in the further integration of renewables to meet the needs of Ireland and Northern Ireland's power system. It is recognised that enhanced engagement across the sector is required to help make this happen. To maximise this potential, the FlexTech Initiative will provide a comprehensive platform through which the system operators, regulatory bodies and industry engage with each other.

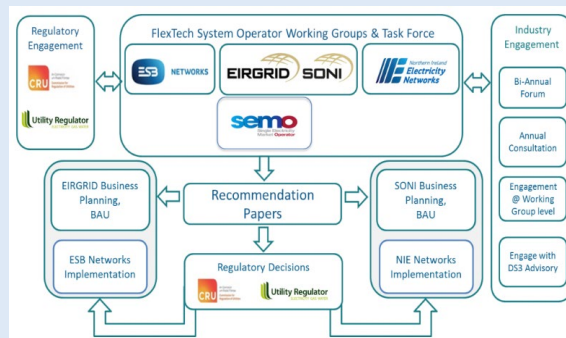


Figure 1 - FlexTech Initiative Framework

Asset Refurbishment and Replacement of Overhead Transmission Line

EirGrid and ESB Networks undertook a substantial review of the approach to scoping of Asset Refurbishment and Replacement of Overhead Transmission Line projects. A pilot on one refurbishment project in 2019 saved €17.5m. This new approach will now be rolled out to future projects.



Engaging with Stakeholders

EirGrid Stakeholder Engagement

EirGrid's commitment to meaningful stakeholder engagement is embedded across the company and forms part of our core company strategy. The commitment to understanding the needs of stakeholders is critical to informing all EirGrid activity.

EirGrid's six-step grid development process was designed with a particular focus on engaging with the public and landowners on grid projects - more often and earlier in the decision-making process.

A key highlight of 2019 was engaging with our customers and stakeholders about our future strategy. We carried out this work as part of the development and roll-out of the EirGrid's [Strategy 2020-25](#), launched in September 2019.

As part of EirGrid strategy development process, we held executive level meetings with 35 organisations. These ranged across the spectrum of stakeholders in Ireland and Northern Ireland. In Ireland, this included ESB, the National Advisory Committee, Chambers Ireland, the Sustainable Energy Authority of Ireland, the European Commission and IBEC.

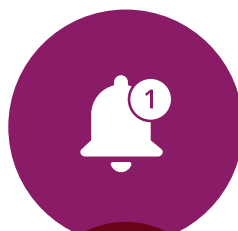
EirGrid also welcomed the creation by the CRU of the Networks Stakeholder Engagement Evaluation Panel. This panel is composed of CRU staff, industry and wider stakeholders. The panel is tasked with assessing the quality, implementation and effectiveness of the network operators, EirGrid and ESB Networks, on their respective stakeholder engagement strategies on an annual basis.

EirGrid was pleased to be awarded a score of 7.5 out of a possible 10 by the Panel for its activities in 2019, which resulted in an incentive payment of €0.254m. This compares to a score of 7.14 and an incentive payment of €0.23m relating to performance in 2018.

Our commitment to openness and transparency has been complemented by significant work in bringing forward communications material which is accessible to all. We have introduced a Plain English policy in all of our public facing documents to further this commitment.

EirGrid has also been progressive in ensuring that there is active engagement with industry to ensure that there is maximum alignment between the TSO and market participants.

Building on our efforts in 2018, EirGrid published its Stakeholder Engagement Report 2019. This report provided information on all areas of EirGrid's stakeholder engagement including continued engagement with local communities in proximity to network developments. The report can be found on EirGrid's website [here](#).



Inform

E.G. Notifications of progress/updates



Consult

E.G. Formal Consultation



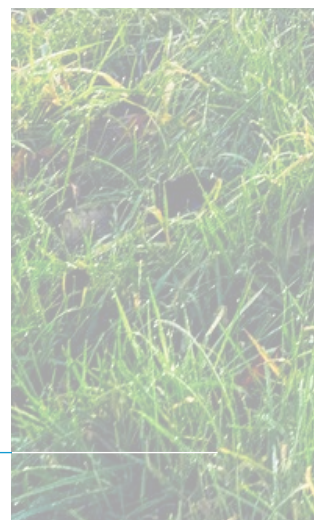
Involve

E.G. Reference Group and Industry Workshops



Collaborate

E.G. Design Workshops and Industry Advisory Councils



ESB Networks Stakeholder Engagement

ESB Networks has proudly worked with customers, communities and stakeholders across Ireland for over 90 years. We value the trust that has developed with all of our customers and as the use of the transmission network continues to evolve, we understand the importance of keeping our customers at the centre of everything we do.

Stakeholder engagement is seen as a vital activity at every level of our organisation and, as a strategic priority, is led by the Directors and the senior leadership team. Our stakeholder engagement team works closely with stakeholder leads across our business, ensuring that engagement forms a core element of our business processes, remains embedded in our business culture, and is seen as a key element of the way we work by each employee within the organisation.

In 2019, ESB Networks published for public consultation “[Strategic Stakeholder Engagement Framework](#)”, which sets out our strategy to enable an open and ongoing dialogue with all our stakeholders. This framework identifies our stakeholders and the principles that guide our engagement, together with our proposed engagement methodology and our governance and control processes.

During 2019, ESB Networks also published for consultation our “[Strategic Stakeholder Engagement Plan 2020](#)”, which sets out our proposed engagement activities for the remainder of the PR4. ESB Networks will further revise and develop our stakeholder engagement plans going forward into the next price control period (PR5) to ensure they reflect our ever-evolving business and stakeholder requirements.

As the energy sector changes and evolves and as we transition to a low carbon future, ESB Networks continues to ensure that the Irish electricity customer will remain at the centre of everything we do. Safety, the environment and our heritage are to the fore in every aspect of our work and this continued to be the case through 2019 as ESB Networks and EirGrid engaged with members of the public, landowners and relevant organisations on these key issues and issues raised by them. Throughout 2019 ESB Networks continued to interact on an ongoing basis with Landowners, Landowner Representative Organisations and EirGrid regarding land access issues and arrangements.

EirGrid have collaborated and engaged constructively with the CRU and the wider industry, particularly ESB Networks as DSO, as part of the implementation of the European Network Codes (EUNC) and Guidelines. In 2019, this included significant work on the Requirements for Generators Network Code, the Demand Connection Code (DCC) and the System Operation Guideline (SOGL). This included stakeholder engagement in the form of public consultations and the All Island EUNC Forums. Further detail on Network Codes can be located [here](#).

Through strong engagement between ESB Networks and EirGrid on an ongoing basis, we ensure that the needs of all customers and stakeholders are taken into consideration in the planning, management, operation and future development of the transmission network in Ireland.



How we monitor expenditure against PR4 allowances

Every five years the CRU determines the revenue price control for EirGrid and ESB Networks as TSO and TAO for the following five year period. The price control sets out the amount of revenues the companies are allowed to recover through tariffs. The allowances are designed to ensure that we, both EirGrid and ESB Networks, have adequate revenues to carry out our activities as TSO and TAO respectively while delivering value for all of our stakeholders.

Within the price control periods there is an opportunity each year for the companies to submit adjustments in advance of tariffs being set. This is to make sure that the most up to date information is used. The CRU publishes updated information on the approved revenues on an annual basis.

After each year EirGrid and ESB Networks carry out a review of what was actually required to carry out our functions. Updates would include any changes to costs outside of our direct control, updates for inflation rates and incentive payments. We also look back on the previous year and compare the amount the CRU approved to be recovered against the amount that was actually recovered through the tariffs in that year. Any under or over recovery of monies against those approved by the CRU is fed into future tariffs. This is done using the k factor mechanism. The k factor captures the difference between what was actually required by the TSO and TAO to carry out their responsibilities and what was recovered through the tariffs. This figure is then included as a line item in the following year's tariffs. If there was an over-recovery, meaning that the amount recovered was more than required, this figure is taken off the next year's revenue allowance. Likewise if there is an under-recovery this figure is added to the next year's revenue allowance. Please see below tables setting out the TAO and TSO's k factors for 2019, which are included in the 2021 revenue allowance.

TAO 2019 allowed outturn and resulting k-factor

2014 Prices € millions	PR4 allowance for 2019 (ex-ante)	CRU outturn allowance for 2019 (ex-post)	Adjustments (ex-post minus ex-ante)
Pass Through Costs			
Local Authority Rates	30.4	24.55	-5.85
CRU Regulatory Levy	1.2	0.93	-0.27
Incentives			
2019 Incentive allowance	2.25	5.27	3.02
Inflation Correction			
Difference in forecast and actual inflation for 2019	0	-0.26	-0.26
Uncertain Costs – Non Capitalised			
AUoS	-0.5	-0.31	0.19
Uncertain Costs - Capitalised			
Depreciation	0	0	0
Return	0	0	0
Total	33.35	30.18	-3.17
Total k-factor adjustment (pre-interest) in 2014 prices		-3.17	

TSO 2019 allowed outturn and resulting k-factor

2019 prices € millions	CRU Tariff Decision for 2019 revenues	CRU approved updated actual costs of 2019
External Costs		
CRU Regulatory Levy	1.10	0.94
DUoS Costs	3.26	2.59
Interconnector Services	0.65	1.26
Inter TSO Compensation	1.50	1.94
CORES0	0.37	0.56
Ancillary Services	3.53	2.40
DS3 System Services	128.15	88.47
TAO Charge	255.22	255.22
EWIC Charge	30.12	30.17
Dublin Security of Supply	58.65	26.25
Allowed TSO Operating Revenue		
Allowed TSO Internal Opex costs	46.28	46.24
Depreciation	8.47	8.46
Stage 1 Side RAB - Working Capital	1.87	1.96
Working Capital (Other)	5.26	6.66
Return on RAB - CapEx non-network	2.85	2.85
Approved adjustments		
Adjustments (GoO + Constraints bank fee)	0.51	0.51
PR3 Adjustment	-0.70	-0.70
Strategic project France-Ireland Interconnector	0.33	0.39
I-SEM opex	5.25	5.25
I-SEM Adjustment - Project Depreciation	14.62	14.62
I-SEM Adjustment - Project Return	3.26	3.26
DS3 System Services Implementation - depreciation	1.14	1.14
DS3 System Services Implementation - return	0.25	0.25
Incentives		
2019 Incentive allowance	0.00	1.84
k-factor Y-2	-14.08	-14.06
Total (2019 Prices)	557.87	488.44
Total CRU approved updated actual costs of 2019 (2019 prices)		
	(a) 488.44	
TUoS collected in 2019 (2019 prices)		
	(b) 519.84	
Total k-factor adjustment in 2019 prices		
	(b)-(a) = -€31.4	

Our current Price Review (PR4) runs from 2016 to 2020. The CRU Decision for 2019 Transmission Revenues, which features a breakdown of, and explanation for, the revenue requirements (CRU/18/195) can be found [here](#). Details on the approved costs for 2019 taking into account this lookback review are published by the CRU as part of the 2021 Transmission Revenues which can be found located [here](#).

Network Development Costs

As part of the revenue price control the CRU sets a revenue envelope specifically associated with the development of the national transmission grid. This is referred to as network capex under which EirGrid and ESB Networks carry out their capital works programme over a five year period. This envelope can be adjusted, if necessary, to allow for the changing needs of grid development. The costs associated with development of the national transmission grid are recovered over a 50 year period consistent with the expected network asset life.

Funding arrangements for the development of the national transmission grid (network capital works) are the responsibility of ESB Networks. Costs incurred by EirGrid as part of the development of network capital works are ultimately recovered by EirGrid from ESB Networks.

The CRU does not approve individual projects. The CRU monitors our actual spend against the overall envelope, with the monies identified by the CRU being provided via the regulated Use of System Tariffs on an annual basis. At the end of 2019, the forecast outturn programme cost for the PR4 period had decreased by €90m to €784m.

On an annual basis we jointly submit detailed reports to the CRU on our network expenditure as required under the PR4 reporting arrangements. Expenditure in relation to the network is covered in more detail in our Investment Planning and Delivery Report.

The annual investment by ESB Networks in new or refurbished Transmission assets is known as Capital Expenditure and is shown in the following table:

PR4 TAO Capital Expenditure (Nominal)	2016 €m	2017 €m	2018 €m	2019 €m
Gross Capital Expenditure	161	180	196	154
Customer Payments	(9)	(21)	(14)	(26)
Total Regulatory Spend	152	159	182	128

This capital investment less the annual depreciation of the asset gives the net value of the Transmission assets also known as the Regulated Asset Base (RAB) shown in the table below:

TAO Regulated Asset Base (RAB) (Nominal)	2016 €m	2017 €m	2018 €m	2019 €m
Closing Net Book Value	2,172	2,281	2,419	2,503

Day to day expenditure not related to building assets are referred to as Operating Expenditure or Opex. The TAO Opex is shown in the table below:

PR4 TAO Operating Expenditure (Nominal)	2016 €m	2017 €m	2018 €m	2019 €m
Transmission Operations	3	3	3	2
Planned & Fault Maintenance	19	18	19	22
Asset Management	1	1	1	1
Non-Controllable Costs	23	24	26	26
Controllable Costs	12	12	11	12
Total	57	57	60	63

How we ensure safety

EirGrid Safety Statement

EirGrid maintained an Occupational Health and Safety management system externally certified to BS OHSAS18001 Occupational Health and Safety Management Systems requirements during 2019 and was awarded ISO 45001 certification in December 2019.

With active support of the executive team and senior management ongoing dialogue with staff, consultants, contractors and other relevant parties, EirGrid maintains the highest standards of occupational health and safety.

There were no HSA reportable accidents in 2019.

Electric and Magnetic Fields (EMFs)

Electric and Magnetic Fields are produced when electric current flows. EMFs are created from electrical appliances and power lines which produce extremely low frequency in the electro-magnetic spectrum. Following research, measurement and monitoring the consensus from health and regulatory authorities is EMFs do not present a health risk. However, some people have genuine concerns about the electric and magnetic fields (EMFs) found near electricity lines and cables. Information on the EirGrid website explains the facts about EMF, based on current information from health and scientific agencies.

ESB Networks Safety

Within ESB Networks, safety, health and wellbeing is at the centre of everything we do. We are committed to protecting the safety, health and wellbeing of our employees, contractors, customers, members of the public and others who may be affected by our work activities.

External Validation of Safety Management System

Throughout 2019, ESB Networks continued to further improve and develop our capability and performance levels in Safety, Health and Wellbeing including the implementation of our 'Safe and Sound' safety culture transformation programme. We successfully retained ISO 18001 accreditation with independent validation of the effectiveness of our continuous improvement approach to safety, health and wellbeing.

Safety, Health & Environment Strategy

Work was completed on the development of the new ESB Networks Safety Strategy. It is based on five fundamental building blocks of Safe People- Safe Workplace- Safe Tools / Equipment / Vehicles- Safe systems of Work - Safe Behaviours.

Public and Staff Safety

The delivery of our public safety work programmes including the cyclical hazard patrol and maintenance of overhead & underground networks, and timber cutting continued to be prioritised to ensure public safety. The delivery of these programmes is monitored and reviewed regularly to ensure delivery within agreed cycles. Our incident recording system which records, and actions all public safety incidents provided important information that led to various initiatives and campaign targeting key 'at risk' groups.



The monthly safety briefing was further improved with the use of video content to more effectively communicate significant public safety incidents to staff so as to continually reinforce the priority of public safety. We continued to implement critical public safety interventions by serving 'stop work notices' where we become aware of unsafe construction work near electricity networks. The remote disconnection of the electricity network in the event of low or fallen electricity wires was fully implemented to protect the public and first responders. The 'dial before you dig' service provided maps of the overhead and electricity networks to construction companies to support compliance with HSA Codes of Practice.

Where we become aware of equipment failures that may have safety implications, we prioritise that work. An example in 2019 was the full replacement of a particular type of cable sealing end, the failure of which may have had safety implications. An exceptional effort was put into planning the work and the outages and the full replacement of 19 sets of cable sealing ends across four locations was completed in November 2019.

Stakeholder Education and Awareness

In 2019 ESB Networks continued to implement the Public safety Strategy and action Plan (2017 – 2020), including engagement initiatives across the farm, construction, leisure and DIY sectors. Our Safe Family Farms partnership with the Irish Farmers Journal continued into its fifth year, with further additions to the library of general farm safety videos as well as the regular safety pages and full-page public safety advertorials to raise awareness of electrical safety on farms. We also participated in the 3-day National Ploughing and Tullamore Show where we engaged with large numbers of the public in relation to electricity safety.

A revised and updated Code of Practice for Overhead Electricity Lines was completed in consultation with the HSA and was approved by their Board and published in 2019. ESB Networks continued to participate in the CIF-led Construction Safety Partnership Advisory Committee, with a strong focus on electricity safety as one of the main construction risks for CIF's Construction Safety Week. This was supported by our partners in the ESB Networks-led Joint Utility Forum, including Gas Networks Ireland and Irish Water.



How we manage our environmental footprint

The Irish Government has set a target of an energy efficiency improvement of 33% by 2020 across the public sector, under the National Energy Efficient Action Plan 2014 and SI 426/2014: 'Energy Efficiency Regulations'. These regulations and targets apply to EirGrid and ESB Networks. We are committed to playing a leading role in enabling Ireland's transition to a low carbon future.

In 2019, EirGrid consumed 3,355 MWh of energy in our Dublin offices and business continuity centre. The latter is an off-site location with a fully functional backup of the national control centre. This energy use can be broken down as follows:

- 2,787 MWh of electricity, and
- 568 MWh of fossil fuels.

Year-on-year, we have achieved an energy reduction of 3% for our Dublin sites. We continue to find ways to reduce our energy use. This totals a 42% reduction since 2009, exceeding the 2020 reduction target of 33% set for public bodies. Our sources of energy usage across the group are from electricity and natural gas. We continue to find ways to reduce our own energy use. In 2019, this included installing LED lighting in our second Dublin site.

We also installed LED lights in certain locations at our Dublin and Belfast offices. In 2020 we will continue to refurbish our headquarters to further improve energy efficiency and increase capacity. Thanks to all our energy saving initiatives, we are on target to achieve the 2020 public-sector target.

ESB Networks Environmental Management System

ESB Networks operates an Environmental Management System (EMS) which is externally certified to ISO 14001 Standard. The EMS provides a framework for the operational control of risk, performance management and continuous improvement and is independently audited against the ISO14001 standard each year. ESB Networks had a full re-certification audit for ISO 14001 during 2019 and we successfully retained this certification.

Enduring Environmental monitoring

In 2019, ESB Networks had one Local Authority notifiable leak on the Transmission fluid-filled cables Network which was repaired in 2019 also. You will find details on our repairs on our website www.esbnetworks.ie/acting-responsibly/environmental-information.

In 2019, approximately 316.9kgs of sulphur hexafluoride (SF6) was emitted due to equipment faults on transmission and distribution switchgear, of which 279.56kgs related to transmission switchgear. Overall emissions from both transmission and distribution switchgear represented 0.18% of the total inventory of SF6 employed (versus 0.32% in 2018). The objective is to maintain leak rates at less than 0.5% per annum. SF6 is used in most of ESB Networks' high-voltage switch gear on the Transmission and Distribution networks. It is used because of its very high electrical insulating properties and it allows the switch gear to work efficiently and safely. There has been a 5-year trend of consistent leakage reduction, as we replace and repair our older switch gear. This is included in the national SF6 emission figure submitted by ESB Networks to the Environmental Protection Agency (EPA) annually.

In February 2019, a number of environmental issues were raised by a staff member as part of a Protected Disclosure made to the Minister. These disclosures were the subject of an Oireachtas Joint Committee on Communications, Climate Action and Environment hearing.

Some of the issues raised by the Protected Disclosure were already being dealt with as part of ESB Networks' risk-based programme for environmental issues. Action plans have been put in place and ESB Networks is engaging with the relevant statutory authorities with regard to the specific issues raised in the Protected Disclosure.

How we manage our environmental impact when planning the network

Respect for the environment is a key part of the development and operation of the transmission system. Electricity transmission infrastructure (overhead lines, underground cables, substations) interacts with many environmental factors including natural habitats, wildlife - especially birds, landscape and cultural heritage.

In accordance with European and National law, we undertake Strategic Environmental Assessments (SEA) of our grid implementation plans every five years. Our current plan and SEA covers the period 2017-2022. The plan integrates [Ireland's Grid Development Strategy](#), the approved [Transmission Development Plan](#) and the Grid Implementation Plan 2017-2022 which includes policies and objectives that guide sustainable grid development. EirGrid adopted the Grid Implementation Plan 2017-2022 and associated Strategic Environmental Assessment (SEA) documents in 2019.

Individual projects are all subject to environmental assessment outside of the SEA process. Some projects fall under a class of development requiring an Environmental Impact Assessment (EIA). In these situations, we submit an Environmental Impact Statement to the relevant planning authority.

EirGrid has obligations as a public authority under the European Communities (Birds and Natural Habitats) Regulations 2011 and carries out screening for appropriate assessment of all projects. Further information on EirGrid's approach to the environment can be found on our website: www.eirgridgroup.ie.

How we manage our Environmental Footprint

ESB Networks has unparalleled experience in overseeing and delivering construction projects in a wide range of physical environments. Over the course of recent years the mainstreaming of environmental protection into project delivery has ensured that all ESB Networks projects are informed by our past experience and also prevailing and emerging best practice in all stages – from project planning and consenting through to the final construction and commissioning stages.

ESB Networks has adapted to the increasingly challenging environment of project planning and consenting while maintaining a focus on timely and cost-effective delivery of projects. At a planning stage, multi-disciplinary technical teams work to develop construction methodologies appropriate to the receiving environment. We ensure these – and any additional requirements of consents, are reflected in construction documents provided to external contractors who are increasingly important to project delivery through EPC contracts. We inform on-site works through document review processes (e.g. inputs to Construction Environment Management Plans, Traffic Management Plans, Waste Management Plans, etc.).

We support construction teams on site providing oversight through appointment of specialists – such as Project Ecologists, Ecological Clerks of Works, Project Archaeologists etc. and capture feedback through site audits. Within ESB Networks significant resources have been put in place to support these efforts. All of these inputs happen in the context of the company-wide Environmental Management System (EMS) – and are key tools in promoting environmental protection.

The progress made promoting environmental protection in ESB Networks construction activities will continue in the years ahead to the benefit of the environment and the customer. We always seek to improve the way we work to ensure we can anticipate and address issues at the earliest possible stage in project development. We have developed better ways of working that benefit planned projects and significantly improve our ability to respond to issues as they arrive. These are invaluable tools to support the company in the delivery of our network development plans for the benefit of all.



Acronyms

- (ATR) Associated Transmission Reinforcements
- (CAP) Climate Action Plan
- (CEF) Connecting Europe Facility
- (CGT8) Coolkeeragh Gas Turbine Unit 8
- (CIF) Construction Industry Federation
- (CORESO) Coordination of electricity system operators
- (CHP) Combined Heat & Power
- (CRU) Commission for Regulation of Utilities
- (CRU) Commission for Regulation of Utilities
- (DCC) Demand Connection Code
- (DSUs) Demand Side Units
- (DAO) Distribution Asset Owner
- (DSO) Distribution System Operator
- (DSR) Deploy Distribution Reactance
- (DUoS) Distribution Use of System
- (ECP) Engineer Procure Construct
- (EWIC) East West Interconnector
- (ESRI) Economic and Social Research Institute
- (EMFs) Electric and magnetic fields
- (EIA) Environmental Impact Assessment
- (EMS) Environmental Management System
- (EPA) Environmental Protection Agency
- (EUNC) European Network Codes
- (FFR) Firm Frequency Response
- (HSA) Health and Safety Authority
- (HVDC) High Voltage Direct Current
- (JPMO) Joint Programme Management Office
- (MIC) Maximum Import Capacity
- (MW) Megawatts
- (NSAI) National Standards Authority Ireland
- (NSEE) Network Stakeholder Engagement Evaluation
- (OHSAS) Occupational Health and Safety Assessment Series
- (PR3) Price Review
- (PR4) Price Review



- (PA) Project Agreement
- (PIP) Project Implementation Plans
- (PCI) Project of Common Interest
- (RAB) Regulatory asset Base
- (RoCof) Rate of Change of Frequency
- (RES-E) Renewable energy sources for electricity
- (RTE) Réseau de Transport d'Électricité
- (RCUC) Reserve constrained unit commitment
- (I-SEM) Single Electricity Market
- (SPS) Special Protection Schemes
- (SEA) Strategic Environmental Assessments
- (SF) System Frequency
- (SF6) Sulphur Hexafluoride
- (SML) System Minutes Lost
- (SNSP) System Non-Synchronous Penetration
- (SONI) System Operator Northern Ireland
- (SOGL) System Operation Guideline
- (TES) Tomorrow's Energy Scenarios
- (TEN-E) Trans-European Network Energy
- (TCG) Transmission constraint group
- (TLAFs) Transmission Loss Adjustment Factors
- (TSO) Transmission System Operator
- (TUoS) Transmission Use of System
- (UFLS) Under-Frequency Load Shedding
- (UR) Utility Regulator
- (VAR) Volt-Ampere reactive





How to Contact Us

We welcome all feedback in regard to the information set out in this booklet and any additional information you might wish to see included in future versions.

Please contact the below:



The current. The future.

Please contact our Customer Relations Team at:

info@eirgrid.com



NETWORKS

Please contact us at:
esbnetworks@esb.ie