Transmission Development Plan 2016-2026

EIRGRID

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DOCUMENT STRUCTURE

This document contains:

- an Abbreviations and Glossary of Terms section,
- an Executive Summary,
- seven main sections, and
- five appendices.

The structure of the document is as follows:

The **Abbreviations and Glossary of Terms** provides a glossary of terms used in the document.

The **Executive Summary** gives an overview of the main highlights of the document and presents the plan in summary terms.

Section 1: Introduction: our statutory and legal obligations are introduced. The purpose and context of the Transmission Development Plan (TDP) is outlined.

Section 2: Approach and Methodology: describes our approach to the network planning process and our strategies.

Section 3: Investment Needs: the drivers of network development are introduced and discussed, as are the needs of the network which result from these drivers. The needs are identified through the application of the transmission development approach discussed in section 2.

Section 4: Changes to the Plan since 2015: provides information on the changes to the plan between TDP 2015 and TDP 2016.

Section 5: Planned Network Developments: summarises the development projects that are currently in progress. These are the transmission projects which solve the network needs identified and discussed in section 3.

Section 6: Regional Perspective of the Plan: summarises and categorises the development projects that are currently in progress by location.

Section 7: Summary of Environmental Appraisal Report (EAR): summarises the EAR of TDP 2016.

Appendix A: Project Terms

Appendix B: Changes since TDP 2015

Appendix C: Planned Network Developments

Appendix D: Irish Projects in European Plans

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ABBREVIATIONS and GLOSSARY OF TERMS

Abbreviations

AA	Appropriate Assessment
ABP	An Bord Pleanála
ATR	Associated Transmission Reinforcement(s)
CER	Commission for Energy Regulation
CP No.	Capital Project Identification Number
CPP	Committed Project Parameters
DSO	Distribution System Operator
EAR	Environmental Appraisal Report
EC	European Commission
ECD	Estimated Completion Date
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ENTSO-E	European Network of Transmission System Operators for Electricity
ER	Environmental Report
ESB	Electricity Supply Board
EU	European Union
EWIC	East West Interconnector
GCS	Generation Capacity Statement
GIS	Gas Insulated Switchgear
GW	Gigawatt
HV	High Voltage

HVDC	High Voltage Direct Current
IA	Infrastructure Agreement
IP	Implementation Programme
LPA	Local Planning Authority
MEC	Maximum Export Capacity
MIC	Maximum Import Capacity
MW	Megawatt
NIS	Natura Impact Statement
PA	Project Agreement
RegIP	Regional Investment Plan
RES	Renewable Energy Sources
RGNS	Regional Group North Sea
RIDP	Renewable Integration Development Project
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SI60	Statutory Instrument No. 60 of 2005
SI147	Statutory Instrument No. 147 of 2011
SI445	Statutory Instrument No. 445 of 2000
SONI	System Operator Northern Ireland
SPA	Special Protection Areas
TAO	Transmission Asset Owner
TDP	Transmission Development Plan
TSO	Transmission System Operator

TSSPS	Transmission System Security and Planning Standards
TYNDP	Ten-Year Network Development Plan
TYTFS	Ten Year Transmission Forecast Statement

Glossary of Terms

Bay	A bay is a connection point to a busbar, and comprises switchgear and measurement equipment.
Busbar	An electrical conductor located in a station that makes a common connection between several circuits.
Capacitor	An item of plant normally used on the electrical network to supply reactive power to loads (generally locally) and thereby support the local area voltage.
Circuit	A line or cable, including associated switchgear, which carries electrical power.
Circuit Breaker	A device used to open a circuit that is carrying electrical current.
Constraint	A change in the output of generators from the market schedule due to transmission network limitations - specifically the overloading of transmission lines, cables and transformers.
Contingency	An unexpected failure or outage of a network component, such as a generation unit, transmission line, transformer or other electrical element.
Coupler	This is a device which can be used to either connect or disconnect sections of busbars. A coupler increases security of supply and flexibility under both fault and maintenance conditions. A coupler can also be known as a

	Sectionalising Circuit Breaker.
Deep Reinforcement	Refers to network reinforcement additional to the shallow connection that is required to allow a new generator or demand to operate at maximum export or import capacity respectively.
Demand	The amount of electrical power that is consumed by a customer and is measured in Megawatts (MW). In a general sense, the amount of power that must be transported from transmission network connected generation stations to meet all customers' electricity requirements.
Demand-Side Management	The modification of normal demand patterns usually through the use of financial incentives.
Deterministic	The deterministic methodology is often referred to as the N-1 criterion. This means that the system must have sufficient capacity so that in the eventuality of a probable system outage, there are no resulting system problems such as overloading, under-voltage, over-voltage or instability.
Distribution System Operator	In the electrical power business, a distribution system operator is the licensed entity responsible for: • operating and ensuring the maintenance and development of the distribution system in a given area (and its interconnections), if necessary and where applicable; and • ensuring the long term ability of the system to meet

	reasonable demands for electrical power.
EirGrid	The independent statutory electricity Transmission System Operator in Ireland.
Embedded Generation	Refers to generation that is connected to the distribution network or at a customer's site.
Gas Insulated Switchgear (GIS)	A compact form of switchgear where the conductors and circuit breakers are insulated by an inert gas (that is, SF_6).
Gate	A group processing mechanism to efficiently process large volumes of connection applications from renewable and conventional generators wishing to connect to the transmission or distribution systems. This is a CER approved and directed approach.
Generation Dispatch	The configuration of outputs from the connected generation units.
Grid	A network of high voltage lines and cables (400 kV, 275 kV, 220 kV and 110 kV) used to transmit bulk electricity supplies around Ireland. The terms grid, electricity transmission network, and transmission system are used interchangeably in this Development Plan.
Intact Network	The transmission network with no network element removed for maintenance, replacement or repair.
Interconnector	The electrical link, facilities and equipment that connect

	the transmission network of one EU member state to another.
Maintenance trip conditions	This condition occurs when a network component (generation unit, transmission line, transformer or other electrical element) is out of service for maintenance, and there is an unexpected failure or outage of another network component
Maximum Export Capacity (MEC)	The maximum export value (MW) provided in accordance with a generator's connection agreement. The MEC is a contract value which the generator chooses as its maximum output.
Maximum Import Capacity (MIC)	The maximum import value (MW) provided in accordance with a customer's connection agreement. The MIC is a contract value which a customer chooses to cater for maximum demand at their site.
Network Development Driver	A factor, based on national and European energy policy objectives, that influences or "drives" the investment in the transmission network.
Network Development Need	A deficiency or problem on the network which arises as a result of one or a number of network development drivers. Network reinforcement is required to solve a network development need.
Power Flow	The physical flow of electrical power. It is typically measured in Megavolt-Amperes (MVA) which is the product of both 'active' and 'reactive' electrical power. The flow of

	'active' power is measured in Megawatts (MW); the flow of 'reactive power' is measured in Megavars (Mvar).
Phase Shifting Transformer (PST)	A type of plant employed on the electrical network to control the flow of active power.
Reactive Compensation	The process of supplying reactive power to the network to compensate for reactive power usage at a point in time.
Reactive Power	Reactive power is that portion of electricity that establishes and sustains the electric and magnetic fields of alternating current equipment. Reactive power is measured in Megavars (Mvar).
Reactor	An item of plant comprising a coil of electrical wire. It is typically employed on the electrical network to either: • limit short circuit levels; or • prevent voltage rise depending on its installation and configuration.
Series Compensation	Series compensation is a technology that boosts flows on very long transmission lines. There have been recent advances in this technology and its control systems. This allows for greater flexibility and more benefits when using series compensation.
Shallow Connection	Shallow Connection means the local connection assets required to connect a customer, or customers, to the transmission network. These types of connections are

	typically for the specific benefit of that particular customer or group of customers.
Single contingency conditions	This condition occurs when the transmission network is intact and there is an unexpected failure or outage of one network component (generation unit, transmission line, transformer or other electrical element).
Summer Valley	The annual minimum electrical demand that usually occurs in August. Annual minimum demand is typically 35 % of the winter peak.
Summer Peak	The week-day peak electrical demand value between March and September, inclusive, which is typically 80 % of the winter peak.
Switchgear	A combination of electrical equipment such as disconnects and/ or circuit breakers used to isolate equipment in or near an electrical station.
Transformer	An item of electrical equipment that allows electrical power to flow between typically two different voltage levels in an alternating current (AC) power system.
Transmission Losses	A small proportion of energy is lost as heat or light whilst transporting electricity on the transmission network. These losses are known as transmission losses.
Transmission Peak	The peak demand that is transported on the transmission network. The transmission peak includes an estimate of

	transmission losses.
Transmission System Security and Planning Standards	The set of standards that the transmission system is designed to meet. The criteria are deterministic as is the norm throughout the world. They set out objective standards which have been found to deliver an acceptable compromise between the cost of development and the transmission service provided. The Transmission System Security and Planning Standards were previously referred to as the Transmission Planning Criteria
Transmission System Operator	In the electrical power business, a transmission system operator is the licensed entity that is responsible for: • operating and ensuring the maintenance and development of the transmission system in a given area (and its interconnections), if necessary and where applicable; and • ensuring the long term ability of the system to transmit electrical power from generation plants to transmission connected demand and regional or local electricity distribution operators.
Uprate	To increase the capacity or rating of electrical equipment.
Winter Peak	This is the maximum annual system demand. It occurs in the period October to February of the following year, inclusive. Thus, for transmission planning purposes the winter peak in 2016, the first year of this plan, may occur in early 2017. The winter peak figures take account of the impact of projected Demand-Side Management initiatives.

EXECUTIVE SUMMARY

The Transmission Development Plan[1] (TDP) 2016-2026 is the plan for the development of the Irish transmission network and interconnection over the ten years from 2016. The TDP 2016-2026 supersedes the TDP 2015-2025. This ten year plan presents projects that are needed for the operation of the transmission network. In addition, future needs that may drive future potential projects are also discussed.

This report has been prepared in accordance with Regulation 8(6) of Statutory Instrument No. 445 of 2000, European Communities (Internal Market in Electricity) Regulations and Condition 8 of the TSO Licence.

Drivers of Transmission Network Development

The development of the Irish electricity sector is guided by a number of national and European Union (EU) rules and strategic objectives. These objectives guide investment in the Irish transmission network and are summarised as follows:

- Ensuring the security of electricity supply;
- Ensuring the competitiveness of the national economy; and
- Ensuring the long-term sustainability of electricity supply in the country.

In order to achieve these strategic objectives, we must invest in the development and maintenance of the electricity transmission network. Drivers of investment include:

- Securing transmission network supplies;
- Promoting market integration; and
- Promoting the integration of Renewable Energy Sources (RES) and complementary thermal generation.

As demand or generation changes, or as the transmission network becomes more interconnected with neighbouring transmission networks[2], the flow of electrical energy

[1] Please note that this is not an all-island TDP, it does not include Northern Ireland developments.

[2] The European electric power transmission networks are interconnected, so as to be able to transmit energy from one country to the other.

throughout the transmission network changes. To accommodate these changes in power flows it is often necessary to modify or strengthen the transmission network to ensure performance and reliability levels are upheld.

In addition, the condition of transmission network assets is a factor. The timely maintenance or replacement of assets is required to provide the necessary level of security of supply.

It is possible to separate the resulting reinforcement needs into a number of categories:

- Reinforcements required to support changes in, or connection of new demand;
- Reinforcements required to support changes in, or connection of new generation;
- Reinforcements related to interconnection;
- Reinforcements to facilitate inter-regional power flows; and
- Reinforcements to address the condition of existing assets.

Transmission Network Reinforcements

This development plan considers the 116 projects that are underway.

Projects by Planning Area					
Project Category	**Border, Midlands, West Planning Area**	**South-West, Mid-West Planning Area**	**South-East, Mid-East, Dublin Planning Area**	**National Projects[3]**	**TOTAL**
New Build	10	16	8	0	34
Uprate/ Modify	27	17	16	0	60
Refurbish/ Replace	2	5	8	5	20
Other	0	0	1	1	2
TOTAL	39	38	33	6	116

Table E-1: Summary of Number of Projects in Progress by Region and Project Category

Capital Expenditure

The 116 transmission development projects need funding for the timeframe addressed by this TDP (2016-2026) and beyond.

The Commission for Energy Regulation's (CER) approved allowable transmission revenues for the current price review period (2016-2020, CER/15/296)[4] allows for a spend of €984 million on network projects.

The CER and EirGrid have a framework in place for the ongoing monitoring of transmission capital expenditure. This framework provides flexibility to respond to the

[3] These involve multiple individual projects at various locations across the country.

[4] http://www.cer.ie/docs/001043/CER15296%20Decision%20on%20TSO%20and%20TAO%20Transmission%20Revenue%20for%202016%20to%202020%20(1).pdf

identified needs which are influenced by external factors; including new generation and demand levels, amongst others. Expenditure beyond 2020 will be considered and approved in future price reviews.

Data Management

Transmission network development is ever evolving. To allow for comparison of network development projects on a year-on-year basis, data is represented at a fixed point in time – the data freeze date. The data freeze date of TDP 2016 is 31 March 2016.

1 INTRODUCTION

The transmission system is a network of 400 kV, 275 kV, 220 kV and 110 kV high voltage lines and cables. It is the backbone of the power system; efficiently delivering large amounts of power from where it is generated to where it is needed, safely and reliably.

Electricity supply is essential, and a reliable electricity network is the means by which we move electricity around the country. The development of transmission network infrastructure is therefore, of national strategic importance.

This TDP outlines the:

- Drivers of network development;
- Network investment needs; and
- Projects required to address these needs.

1.1 Statutory and Legal Requirements

National and European regulations that are relevant to planning the transmission network include:

National Requirements	European Requirements
Statutory Instrument (SI) No. 445 of 2000[5] as amended	Regulation (EC) No 714/ 2009
Statutory Instrument (SI) No. 60 of 2005[6]	Directive 2009/ 72/ EC
Statutory Instrument (SI) No. 147 of 2011[7]	Directive 2009/ 28/ EC
EirGrid's TSO Licence	Directive 2012/ 27/ EC

Table 1-1 National and European regulations relevant to the TDP

[5] SI No. 445 of 2000, European Communities (Internal Market in Electricity) Regulations

[6] SI No. 60 of 2005, European Communities (Internal Market in Electricity) Regulations 2005

[7] SI No. 147 of 2011, European Communities (Renewable Energy) Regulations 2011

1.1.1 National Statutory and Licence Requirements

- Statutory Instrument (SI) No. 445 of 2000[8] as amended
    - Regulation 8(1)(i);
    - Regulation 8(1)(a) ;
    - Regulation 8(1)(c);
    - Regulation 8(3); Regulation 8(6); Regulation 8(8);
    - Regulation 19; Regulation 19(a), subject to the provisions of Regulation 18(3)
- Statutory Instrument (SI) No. 147 of 2011[9]
    - Regulation 4(1) of SI147/ 2011
- EirGrid's TSO Licence
    - Condition 3; Condition 8

1.1.2 European Statutory Requirements

- Regulation (EC) No 714/ 2009
    - Article 4; Article 8 paragraph 3(b); Article 12
- Directive 2009/ 72/ EC
    - Paragraphs 1 and 4 of Article 22
- Directive 2009/ 28/ EC
    - Paragraph 2 of Article 16
- Directive 2012/ 27/ EC
    - Paragraph 5 of Article 15

[8] Statutory Instrument No. 445 of 2000, European Communities (Internal Market in Electricity) Regulations

[9] Statutory Instrument No. 147 of 2011, European Communities (Renewable Energy) Regulations 2011

We are responsible for the operation and development of the transmission network within Ireland. We have both statutory and licence obligations to produce a TDP annually and contribute to a European Ten-Year Network Development Plan (TYNDP) every two years.

1.2 Transmission Development Plan (TDP)

This TDP covers a period of ten years which is in line with the European Network of Transmission System Operators for Electricity's (ENTSO-E) TYNDP. As part of the preparation of the TDP, we consult with System Operator Northern Ireland (SONI) to ensure that the information in the TDP is accurate. A public consultation on the draft TDP is held by the Commission for Energy Regulation (CER). Following feedback received from the public consultation we update the TDP, as required, and provide a report to the CER on feedback received. We prepare the final version of the TDP and submit it to the CER for approval.

The Transmission Asset Owner (TAO), ESB Networks Limited, is responsible for the construction of projects. This document provides them with our future plans to develop the network, which they can use to plan construction and maintenance on the network.

1.3 Context of the Plan

The development of the transmission network involves forecasting future needs. Solutions to address these needs must strike a balance between network reliability, costs and environmental impacts. The process is flexible to enable the long-term development of the network.

Considerations that shape the medium and long-term development of the transmission network are outlined below.

1.3.1 All-Island and European Context

Our TSO licence obliges us to carry out transmission planning on a coordinated all-island basis in conjunction with SONI. This requirement is met by the System Operator Agreement in place between EirGrid and SONI. Together we now publish All-Island Generation Capacity and Transmission Forecast Statements. The aim of coordinated

planning is to ensure, as far as possible, that projects developed, particularly in border areas, will benefit the entire island.

European legislation requires all European TSOs to cooperate through ENTSO-E. ENTSO-E has six regional groups that co-ordinate network planning and development at regional level. We are members of the Regional Group North Sea (RGNS), which also includes SONI and the TSOs of Belgium, Denmark, France, Germany, Great Britain, Luxembourg, Netherlands and Norway. One of the duties of RGNS is to produce a Regional Investment Plan (RegIP) every two years. This RegIP together with the other five RegIPs feed into ENTSO-E's TYNDP.

A number of projects of pan-European and regional significance[10] are identified in this TDP, using the following labels: "TYNDP/ TYNDP_Project_No" or "RegIP/ RegIP_Project_No". These projects are also included in the TYNDP[11] and RGNS RegIP[12] documents issued in 2016 and 2015 respectively, and are listed in Appendix D.

1.3.2 United Kingdom's referendum on EU membership

The United Kingdom's June 2016 referendum on EU membership has presented undoubted challenges and uncertainties for the Irish energy market. However, most issues covered by our grid development strategy and this development plan relate to Ireland only, and are unaffected.

Regardless of the UK leaving the EU, there will always be many shared benefits of working closely with our nearest neighbours. We aim to maintain a strong relationship between Ireland, Northern Ireland and Great Britain on energy matters.

1.4 Grid Development Strategy

In 2008 we published Grid25, our long-term strategy to develop Ireland's electricity grid.

[10] Please see Appendix D for information on what qualifies a project to be of pan-European significance.

[11] Please note TYNDP 2016 is currently in draft version - the draft TYNDP 2016 was recently published for consultation and the finalised version of the document is expected imminently. See https://www.entsoe.eu/major-projects/ten-year-network-development-plan/ten%20year%20network%20development%20plan%202016/Pages/default.aspx for latest information.

[12] https://www.entsoe.eu/Documents/TYNDP%20documents/TYNDP%202016/rgips/Regional%20Investment%20Plan%202015%20-%20RG%20NS%20-%20Final.pdf

Following our first major review in 2011, we reduced the cost of Grid25 from €4 bn to €3.2 bn. This was possible due primarily to lower forecasts for electricity demand in the recessionary period, and through the use of new technologies.

In March 2015, we published a first draft of our second major review, entitled Your Grid, Your Views, Your Tomorrow. That review responded to feedback received from the public over recent years. It also reflected an updated economic context, and our growing experience of new technologies.

Our updated grid development strategy was published in January 2017. It reflects the Government's Energy White Paper, published in December 2015. We were further guided by the Action Plan for Jobs and the IDA's 2015-2019 strategy, which includes ambitious regional targets.

Our updated grid development strategy is based on all available information at the time of publication, and is an informed view of our needs in the coming years.

We will continue to review it on a regular basis. This is to ensure that our strategy continues to be up to date, and fit for purpose in a changing Ireland.

1.5 TDP 2016

TDP 2016 presents our view of future transmission needs and our plan to develop the network through specific projects, to meet these needs over the next ten years.

It is possible that changes will occur in the need for, scope of, and timing of the listed developments. Similarly, it is likely, given the continuously changing nature of electricity requirements, that new developments will emerge that could impact the plan as presented. These changes will be identified in future studies and accommodated in future TDPs. As such, the long-term development of the network is under review on an on-going basis.

This TDP presents the projects which are currently being advanced to solve the needs of the transmission network. In addition, future needs that drive future potential projects are also discussed.

1.6 Data Management

Transmission network development is continuously evolving. To help the comparison of network development projects year-on-year, and in the interest of routine reporting, data is represented at a fixed point in time – the data freeze date.

The TDP summarises transmission projects and the changes that have happened since the last TDP, with data applicable as at the data freeze date, 31 March 2016.

The estimated completion dates (ECDs) for some transmission projects are available and updated on an on-going basis at the following two websites:

- Associated Transmission Reinforcements (ATRs) (available here[13])
- On the CER website[14], Transmission Capital Expenditure Monitoring

1.7 Planning Area Categorisation

Power flows on the transmission network are not contained within specific counties. Therefore, from a transmission planning viewpoint, it is more appropriate to represent groups of counties as natural planning areas. There are three planning areas that best reflect the conditions and power flows on the transmission network:

- The Border, Midlands and West;
- The Mid-West and South-West; and
- The South-East, Mid-East and Dublin.

These three planning areas can be sub-divided into eight regions which allow for more descriptive regional analyses to be carried out. These eight regions are also used by government agencies in Ireland, including IDA Ireland and the Central Statistics Office. However, these regions do not reflect the Government's reform of local government.[15]

[13] http://www.eirgridgroup.com/customer-and-industry/general-customer-information/operational-constraints/

[14] http://www.cer.ie/

[15] The new assemblies were established with effect from 1 January 2015 by the Local Government Act 1991 (Regional Assemblies) (Establishment) Order 2014 (SI 573 of 2014). The existing 8 regional authorities and 2 regional assemblies were replaced by 3 new regional assemblies.

The regions and planning areas that best reflect the conditions and power flows on the transmission network are illustrated in Figure 1-1 below.

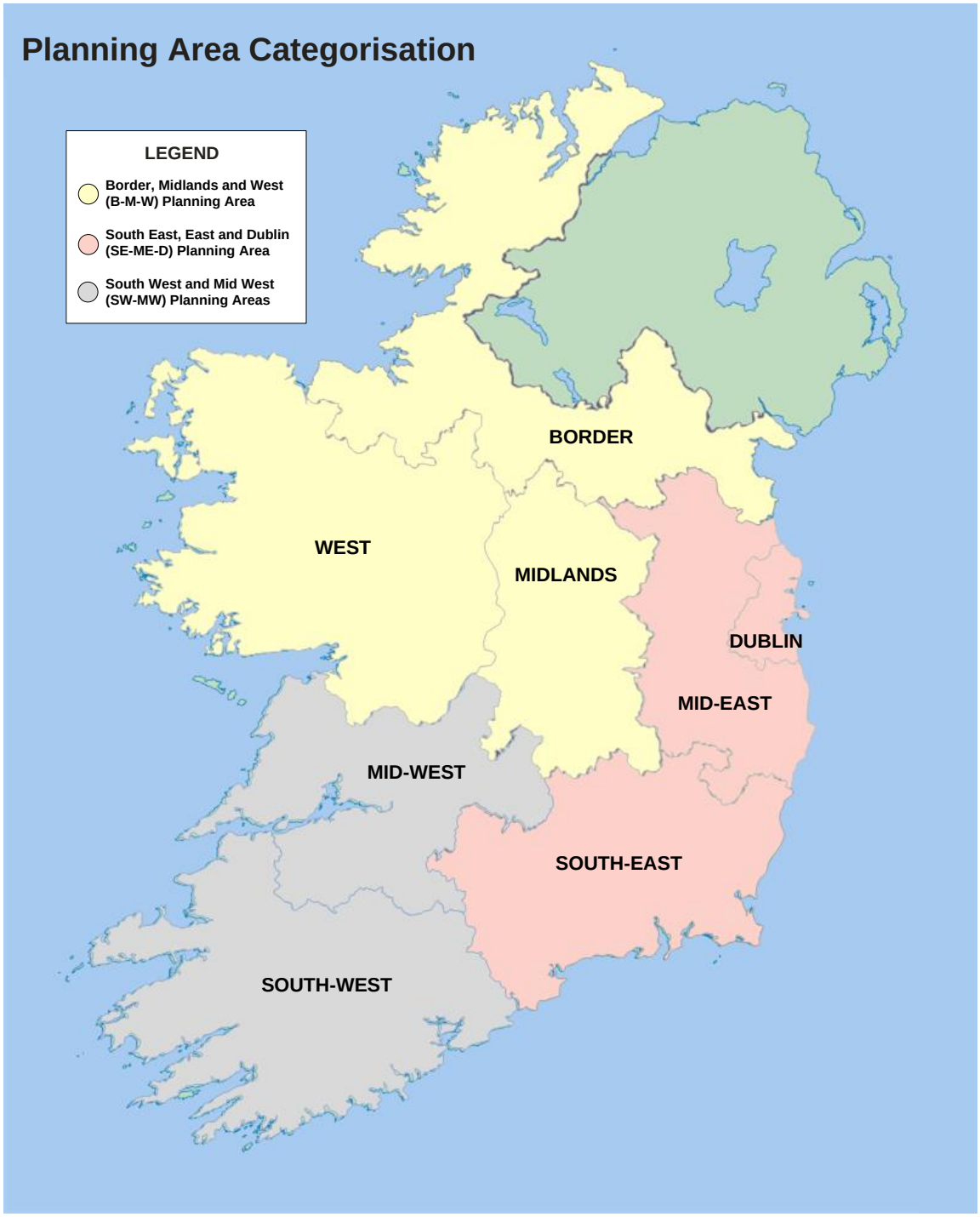


Figure 1-1 Illustration of the eight regions and three planning areas

Planned projects are categorised in Chapter 6 “Regional Perspective of the Plan” on a planning area basis, as defined above.

2 APPROACH AND METHODOLOGY

2.1 Development Objectives and Strategies

As TSO, we are obliged to develop a safe, secure, reliable, economical, and efficient transmission network to meet all reasonable demands for electricity, in accordance with legal obligations.

We plan the development of the transmission network taking account of the long-term needs and the economics of various development options. The need for development is determined by assessing long-term future network performance against technical standards. These technical standards are embodied in the Transmission System Security and Planning Standards[16] (TSSPS). When it is established that changes on the network cannot be accommodated without violating the performance criteria outlined in the TSSPS, a range of issues are considered when selecting a transmission reinforcement strategy.

When assessing development options to address future potential network needs, we consider the impacts of each possible option on other potential development needs. Sometimes by making more effective use of the existing network, we can delay large investment or avoid the need for additional circuits.

In some cases a proposed project may meet more than one development requirement and prove more economic and have less impact on the environment than multiple projects. Where possible, we seek to find single development projects to meet multiple network requirements.

[16] http://www.eirgridgroup.com/site-files/library/EirGrid/EirGrid-Transmission-System-Security-and-Planning-Standards-TSSPS-Final-May-2016-APPROVED.pdf

2.2 The Transmission System Security and Planning Standards (TSSPS)[17,18]

The requirement for network development is identified when the simulation of future conditions indicates that the TSSPS would be breached. These standards are in line with international standards.

The standards are deterministic[19] – as are those generally used throughout the world in transmission planning. They set out an objective standard which delivers an acceptable compromise between the cost of development and service delivered. Rather than conducting subjective benefit analysis in each case, it is preferable to plan to meet an objective standard and carry out analysis of the options available to meet the standard.

2.3 Public Planning and Environmental Considerations

2.3.1 A Dynamic Process

In October 2008 we published our grid development strategy Grid25[20]. The resultant TDP 2008-2012 marked the beginning of a series of updates that describe current plans to implement that strategy. The TDP is a continuously evolving document, made up of reinforcement projects required in the short, medium and longer-term.

Strategic Environmental Assessment (SEA) is a systematic process of predicting and evaluating the environmental effects of a proposed plan or programme, in order to ensure that these effects are adequately addressed at the earliest stage. In 2011, we prepared and adopted a SEA in respect of the Grid25 Implementation Programme (IP) (2011-2016). The IP outlines how the early stages of Grid25 were to be implemented. A Natura Impact Report in support of the Appropriate Assessment of the Grid25 IP accompanied the SEA. The purpose of the SEA is to anticipate and avoid, where possible,

[17] Previously referred to as the Transmission Planning Criteria

[18] http://www.eirgridgroup.com/site-files/library/EirGrid/EirGrid-Transmission-System-Security-and-Planning-Standards-TSSPS-Final-May-2016-APPROVED.pdf

[19] The deterministic methodology is often referred to as the N-1 criterion. The system must have sufficient capacity so that in the eventuality of a probable system outage, there are no resulting system problems such as overloading, under-voltage, over-voltage or instability.

[20] We published a review of our grid development strategy in March 2015. Our updated grid development strategy was published in January 2017.

potential adverse environmental impacts arising from the IP. These documents are available at www.eirgridgroup.com.

The IP and associated SEA have a five year lifespan, with review and drafting processes for the next IP and SEA beginning in the final year. In this regard, the preparation of the next IP and associated SEA has commenced. The updated and revised IP and associated environmental documents will be available for public consultation in early 2017. These are being prepared in the context of the new grid strategy, and will cover the next five year period up to 2022.

An Environmental Appraisal Report (EAR) has been prepared to ensure that the TDP 2016-2026 is in accordance with the provisions of the Strategic Environmental Objectives as detailed in the SEA for the current IP. A summary of the results of this appraisal is presented in Section 7 of this report. This relationship between the grid development strategy, SEA, TDP and EAR is set out graphically in Figure 2-1 below.

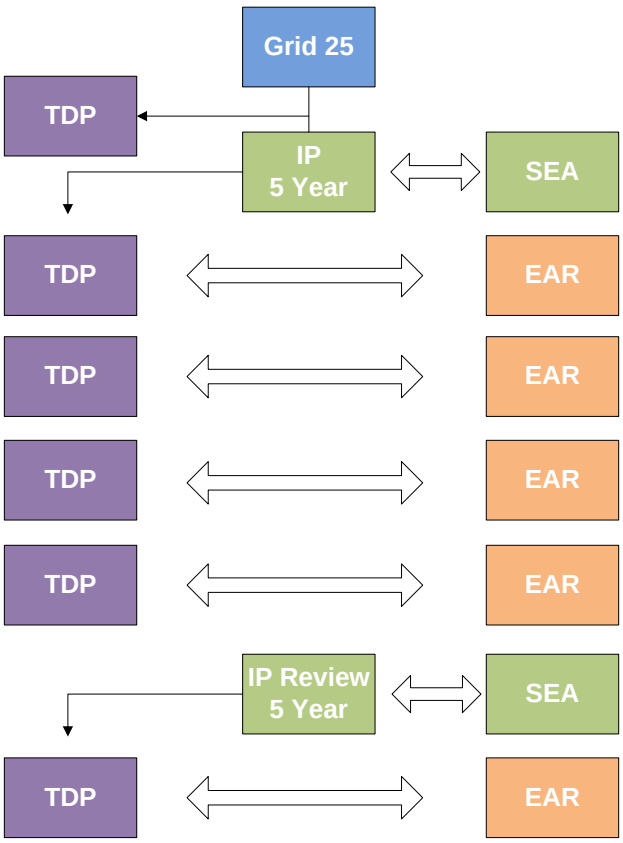


Figure 2-1 Structure for Grid25 strategy and associated IP, SEA, TDP and associated EAR (extract from our Grid25 IP 2011-2016)

2.3.2 Public Planning Considerations

Our Programme Management Office includes experienced professional planning and ecological consultants. These consultants assist in the development of transmission infrastructure projects, and in other aspects of network development, from a planning and environmental perspective.

Statutory consent for transmission projects is sought on a project-by-project basis, as required under the Planning and Development Acts. At the outset, our public planning specialists determine whether permission is needed for a proposed development, or whether, under the current Planning and Development legislation, such works may comprise exempted development – development which does not require a prior grant of approval or permission. These in particular might include uprate, refurbishment and maintenance works.

We currently undertake a process to confirm our consideration of the exempted status of such works. This process also involves a Screening for Appropriate Assessment (AA), which is a statutory obligation under the European Communities[21] Regulations 2011. This can also be formally confirmed by way of a Statutory Declaration of Exempted Development from the relevant planning authority, in accordance with the provisions of Section 5 of the Planning and Development Act 2000 (as amended).

Where it is determined that permission is required, we engage with An Bord Pleanála (ABP) which determines if a proposed development falls within the scope of Section 182A of the Planning and Development Acts 2000 to 2014, which relates to Strategic Infrastructure Development (SID). If it does fall within Section 182A, an application for approval is made directly to the Strategic Infrastructure Division of ABP. If ABP determines that the proposal does not fall within Section 182A, it directs us to make an application for permission to the relevant Local Planning Authority (LPA).

[21] Birds and Natural Habitats

The decision-making authority (ABP or LPA) will determine whether the application for development is in accordance with the principles of proper planning and sustainable development. Considerations in this regard include:

- EU directives and governing Statutory and Strategic Policy;
- Conformity with the provisions of key documents such as relevant Development Plans and Regional Planning Guidelines;
- Input from Prescribed Bodies, such as the:
    - Relevant LPA (if the decision-maker is ABP);
    - Department of Communications, Climate Action and Environment;
    - Department of Housing, Planning, Community and Local Government; and
    - National Parks and Wildlife Service of the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.
- Requirements to protect designated areas on account of their ecological, cultural, archaeological, visual, or other sensitivity and / or significance.

2.3.3 Environmental Considerations

The requirements for Environmental Impact Assessment (EIA) and Appropriate Assessment (AA) (see below) are transposed into Irish law in the Planning and Development Acts and associated Regulations.

Where necessary, applications for statutory consent are accompanied by an Environmental Report (ER) or Environmental Impact Statement (EIS) - the need for a statutory EIS is informed by way of an EIA Screening report.

Similarly, screening for the need for AA for impacts on sites specifically designated for nature conservation is routinely undertaken for all our grid projects.

Environmental Impact Assessment (EIA)

EIA is the process of examining the environmental effects of projects, from consideration of environmental aspects at design stage, to preparation of a non-statutory ER, through to preparation of an EIS. Projects where an EIS is mandatory are identified in Annex I of the EIA Directive. This includes transmission of electricity by overhead lines where:

- The voltage is 220 kV or more; and
- The cable length is more than 15 km.

An EIS may be required for sub-threshold development where likely significant impacts on the environment are identified by the relevant LPA or ABP.

The content and scope of the EIS is defined by the EIA Directive; however, detail varies between projects depending on local environmental sensitivities.

Appropriate Assessment (AA)

In accordance with the provisions of the EU Habitats Directive, any plan or project not directly connected to a Natura 2000 site (Special Area of Conservation (SAC) or Special Protection Area (SPA)), that is likely to have a significant effect on the site is subject to Appropriate Assessment (AA) of its implications on the site.

The requirements for AA are set out in:

- Article 6 of the EU Habitats Directive (92/ 43/ EEC),
- The European Communities (Birds and Natural Habitats) Regulations 2011; and
- Part XAB of the Planning and Development Act.

European Sites include:

- Special Areas of Conservation (SAC) designated under the Habitats Directive;
- Special Protection Areas (SPA) designated under the Birds Directive (2009/ 147/ EEC); and
- Candidate SACs or proposed SPAs, all of which are given the same level of protection as fully adopted sites.

Both the Habitats and Birds Directives have been fully transposed into Irish law. The provisions of Part XAB of the Planning and Development Act require, among other things, that an AA "shall include a determination by the competent authority under Article 6.3 of the Habitats Directive as to whether or not a proposed development would adversely affect the integrity of a European site."

The overall AA process is different from EIA as it is only focused on the conservation objectives of European sites. The process is made up of separate stages of assessment, the results of each stage determining the need for the next.

The AA Process

Stage 1: Screening

The purpose of the screening stage is to determine on the basis of a preliminary assessment and objective criteria, whether a plan or project could have significant effects on a Natura 2000 site.

Stage 2: AA

The need for stage two AA arises when the screening process has determined that the proposed development (alone or in combination with other plans or projects) is likely to have a significant effect on a European site. It also includes any mitigation measures necessary to avoid, reduce or offset negative effects.

Stage 3: Assessment of alternative solutions

This stage of the process arises where adverse effects on the integrity of a European site cannot be excluded. Stage three examines other ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the European site.

Stage 4: Imperative Reasons of Overriding Public Interest

This is the derogation process of Article 6(4). Stage four examines whether there are Imperative Reasons of Overriding Public Interest for allowing a project to proceed, where adverse effects on the integrity of a European site have been predicted. Compensatory measures must be proposed and assessed as part of this stage and the EU Commission must be informed of the compensatory measures.

2.4 Network Development Process

The network development process[22] is a dynamic process, as requirements for transmission services are continuously evolving. The TDP is a snapshot in time of the development needs in this process.

2.4.1 Stages in the Network Development Process

The Network development process is outlined in Figure 2-2 below. On the left hand side of Figure 2-2 are the different phases of network development that are assigned to each project in this TDP. Each stage of the Network development process outlined in Figure 2-2 is discussed below.

[22] The Network Development Process is currently under review within EirGrid

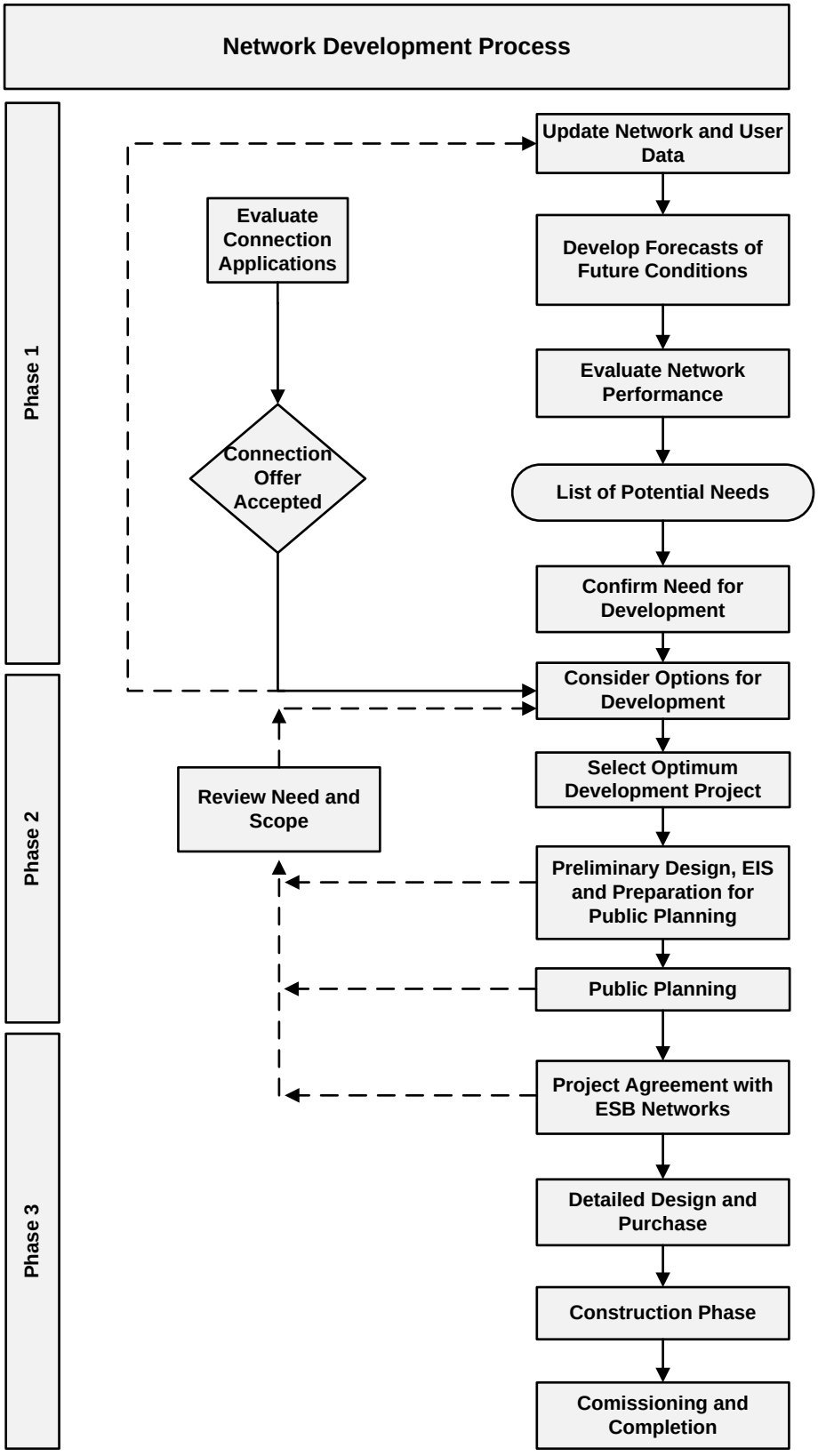


Figure 2-2 Flow Chart of Network Development Process (showing how it fits into the overall process of grid development - including construction & energisation)

Update the Network and User Data: The beginning of the process involves reviewing and updating the network and user information that defines the network model.

Develop Forecasts of Future Conditions: This involves reviewing and making projections of the main drivers as outlined in Section 3.

Evaluate Network Performance: The network models are used to assess the future long-term performance of the network against the standards set out in the TSSPS.

Evaluate Connection Applications: An analysis of shallow connection and associated deep reinforcements is carried out for generation and demand applications that are processed.

Connection Offer Accepted: If the applicant signs the connection agreement the shallow connections are progressed in accordance with contractual milestones, while the deep reinforcement options are considered for optimisation.

Confirm Need for Development: The previous stages provide a list of potential problem areas that may arise in the future. The need for development may also be identified following an assessment of existing asset condition, see section 2.5 Refurbishment Planning Process for further details. In some cases there may not be an immediate need to progress a solution. Therefore, at the appropriate time, a detailed review is carried out on each problem to determine if there is a definite requirement for development.

Consider Options for Development: Once the need is confirmed, a list of potential options will be developed. Each option will be evaluated to ensure it meets the statutory requirements.

Select Optimum Development Project: The selection of the optimum project involves the consideration of many factors including:

- Compliance with the TSSPS;
- Meeting government and EU objectives;
- Environmental and societal impacts;
- The need for an Appropriate Assessment;

- Economics of development options;
- Project lead-times and feasibility of options;
- The impact of constraints in the transmission network on generation costs;
- Flexibility in scheduling generation to support the operation of an effective market;
- Alignment with the grid development strategy;
- Robustness to accommodate other future needs;
- The impact on transmission operations, protection and maintenance;
- Co-ordination with the Distribution System Operator's (DSO) requirements;
- The impact of other development plans on distribution costs; and
- Synergy with refurbishment projects, see section 2.5 Refurbishment Planning Process for further details.

The challenge for us is to find robust solutions that deliver the best long-term value to the customer. After careful analysis and review one or more preferred options are put forward to be progressed.

Public Consultation: Members of the public are consulted and their input is sought throughout this process. The main goals are improving the efficiency, transparency and public participation in the proposed project. The process usually involves notification to publicise the matter to be consulted on. Consultation involves a two-way flow of information and opinion exchange as well as participation.

Preliminary Design, EIS and Preparation of Planning Applications: This phase includes a number of tasks:

- meetings with stakeholders (landowners, local representative bodies and the general public).
- preparation of preliminary designs; and
- site selection; route surveys

For developments that require planning permission this stage includes two additional tasks:

- preparation of planning applications to the relevant statutory authorities; and
- preparation of an EIS, if required to comply with environmental legislation.

Public Planning: The Strategic Infrastructure Act 2006[23] (now inserted into the Planning and Development Act 2000 (as amended)) introduced a new strategic consent process for major infrastructure of national and public importance. Persons seeking permission for electricity transmission infrastructure (110 kV and greater) apply directly to ABP for approval of the scheme. The public, the Local Authority and interested stakeholders are consulted to be given an opportunity to provide input to the application process and their views taken into account.

Some projects are not deemed strategic infrastructure, and an application will be lodged with the relevant planning authority. The planning authority decides whether or not to grant planning permission for the project. If planning permission is granted it may subsequently be appealed to ABP, subject to the appellant(s) having lodged an objection to the planning application with the relevant LPA in the first instance.

Once planning permission is secured by either of the above processes, the requirement for the project is reviewed and the project cost is re-evaluated before progressing to the next phase.

Project Agreement (PA) with ESB Networks: Under the Infrastructure Agreement (IA) between EirGrid and ESB, we conclude a PA with ESB Networks for detailed design and construction of each committed project. PA contains:

- a project description,
- the outline design and functional specification, and
- a description of the methods by which the project will be realised within the agreed timescale and budget.

[23] http://www.oireachtas.ie/documents/bills28/acts/2006/a2706.pdf

The next three stages are undertaken by ESB Networks. We have a project management and client engineering role throughout the IA phase and through to project close out.

Detailed Design and Purchase: When statutory consents are secured, where necessary, and internal approval is obtained to proceed to construction;

- the materials are procured;
- station sites are finalised where necessary; and
- construction arrangements put in place.

Construction Phase: Once the detailed design and purchase are completed, construction is carried out.

Commissioning and Completion: When the development is constructed it must undergo commissioning, testing and approval before going into operation. This is to ensure that equipment is safe, will operate as per design and that signals and controls are correctly installed.

Review Need and Scope

The process is presented above in a sequential format for explanatory purposes. It is in fact a dynamic process; there are opportunities at various stages for a review and possible change of the project scope.

For example, the process includes a review following the planning process when more accurate project costs based on an actual route are obtained. If, for example, these turn out to be significantly higher than estimated, the project justification and selection would be reviewed. If planning permission is not granted, or if there are other mitigating circumstances then it would be necessary to reassess the project. The process allows investments to be optimised and ensures that the network development plan matches network reinforcement requirements as closely as possible.

Timescales

The delivery of projects, ranging from local station works to the provision of a new circuit, through the network development process described above typically takes between 3-10 years.

These timescales are required to ensure that all the aspects of the project can be thoroughly considered, consideration of stakeholder input, consultation opportunities, the public planning process, review of project need and scope, detailed design and finally the time required to construct the project.

2.5 Refurbishment Planning Process

Asset refurbishment is work specifically undertaken to restore the condition of assets in the cases where:

- Routine maintenance[24] by itself is unable to do so; and
- The early replacement of the asset is not the least cost option.

Refurbishment projects are designed to provide additional non-routine maintenance on assets where the condition is below acceptable standards. Refurbishment works may consist of a major overhaul of equipment, to rebuild or replace parts or components of an asset to restore it to a required functional condition and extend its life.

For some equipment, replacement or uprating rather than refurbishment may be the most appropriate and optimised long term decision when all factors are considered. Examples of such factors include:

- safety and environmental considerations;
- asset age;
- asset condition;
- increasing fault frequency;
- increasing cost and complexity of maintenance;
- lack of spares;
- plant obsolescence; and
- forecast conditions.

[24] Routine maintenance activities help to realise expected life time of an asset, not increase it. Activities can include checking the operability of transmission equipment (such as operational tests and cable inspections) or work as a result of inspections or faults to repair equipment.

Where action is required on the basis of condition, age, or reliability it is referred to as a refurbishment project for simplicity, regardless of whether replacement or refurbishment is chosen.

The process of network refurbishment is illustrated in Figure 2-3 with each of the steps described below. The main inputs into the process are represented by the two blocks titled "Initial Condition Assessment" and "Performance and Technology Review".

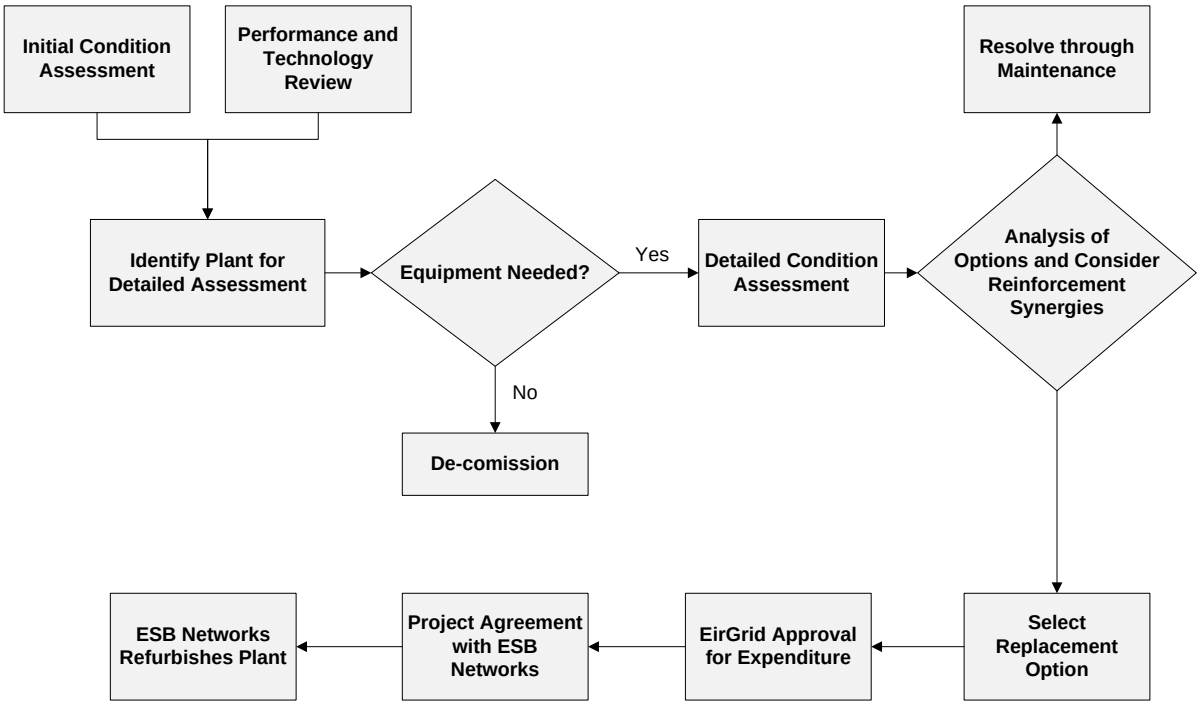


Figure 2-3 Flow Chart of Network Refurbishment Process

Initial Condition Assessment: The transmission maintenance policy combines preventative maintenance (interval based) and condition based maintenance. A refurbishment programme may be considered when signs of deterioration are identified which would otherwise require costly, special or excessive amounts of maintenance to rectify.

Performance and Technology Review: The performance reviews are undertaken on an on-going basis. The results are used to identify if a particular asset or a family of equipment type is not performing as well as expected. Technology reviews determine if:

- any of the installed equipment is obsolete; or
- it is still adequate to provide the necessary performance and able to interact with the rest of the network.

Identify Plant for Detailed Assessment: Input from the first two activities result in the creation of a list of plant requiring a detailed assessment of their condition.

Equipment Needed: Before embarking on a detailed assessment programme the continued need for the equipment is established.

De-commission: If the equipment is no longer required, it may be permanently isolated from the network and/ or removed completely.

Detailed Condition Assessment: A detailed condition assessment is carried out on assets that are showing increased signs of deterioration and/ or a notable reduction in performance. The detailed assessment of the condition of the relevant asset or plant will identify which individual components of the asset, if any, need to be replaced.

The condition assessment report will also give a best estimate of the remaining useful life of the existing equipment based on set criteria (history of issues, reliability, maintainability and age of the asset). In the case of overhead lines, a Line Condition Assessment (LCA) and subsequently a Line Project Assessment Report (LPAR) are carried out to identify the individual components of the asset which require refurbishment. For example:

- the replacement of individual pole-sets, insulators and hardware at selected locations; and
- the replacement or strengthening of selected angle tower foundations.

In the case of stations, a Station Condition Assessment report will identify the requirement for the replacement of selected items of high voltage plant. Such items include:

- circuit breakers,
- disconnects,
- instrument transformers,

- batteries,
- protection and control equipment,
- steelwork and
- vintage civil works.

Analysis of Options and Consider Reinforcement Synergies: Based on the detailed condition assessment report, the economic merits of a full replacement project versus a refurbishment project will then be considered. Feasibility analysis is carried out to investigate the merits of refurbishment versus replacement. This analysis includes consideration of potential planning permission requirements as this can have a significant effect on project costs and lead-times.

As per the stages defined in section 2.3.3, options are screened to determine the need for an Appropriate Assessment. Options could include for example; the like-for-like replacement of old switchgear; or the use of more modern switchgear; or the construction of a new station to replace the old one.

Following the analysis, a decision is made to resolve the problem either through a refurbishment or a replacement project. The "do nothing option" is also considered which generally means the asset will remain in service and may require more extensive monitoring and maintenance activities.

Having identified the refurbishment options, we then carry out analysis to determine if synergies exist between the refurbishment and potential reinforcement projects. In the case of overhead line projects for example, the refurbishment project may provide the opportunity to uprate the line to meet future power flow requirements.

The decision is based on an economic appraisal. This compares the option of uprating the line at the same time the refurbishment is undertaken with the option of uprating later as a stand-alone project. Likewise in station refurbishment projects, the opportunity may be taken to uprate busbars and switchgear or upgrade protection equipment or reconfigure the busbar, if economic to do so.

Resolve through Maintenance: Increased monitoring and maintenance of the existing assets may be the optimal decision to ensure the asset lives out its expected lifecycle. If

this is the case and it is the most cost effective option, maintenance can normally be carried out and the asset returned to service relatively quickly.

Select Replacement Option: The chosen option is determined by factors such as

- cost;
- whether a solution can solve multiple needs;
- economic trade-off;
- remaining useful life of the asset;
- environmental considerations;
- system safety;
- security; and
- reliability.

A high level scope of work for the selected option is developed and an estimated cost prepared.

EirGrid Approval of Expenditure: The final scope or works with estimated costs for the refurbishment project is submitted for internal approval.

Project Agreement (PA) with ESB Networks: Under the Infrastructure Agreement (IA), between EirGrid and ESB, we conclude a PA with ESB Networks for detailed design and construction of each committed project. PA contains:

- a project description,
- the outline design and functional specification, and
- a description of the methods by which the project will be realised within the agreed timescale and budget.

The next stage is undertaken by ESB Networks. We have a project management and client engineering role throughout the IA phase and through to project close out.

ESB Networks Refurbishes Plant: Following PA, ESB Networks carries out the refurbishment works in timelines agreed by EirGrid and ESB Networks. Our client engineering role ensures the assets are refurbished in line with our requirements during this phase of the project.

2.6 Approach and Methodology going forward

The approach and methodology outlined above has been applied to the network development projects included in this TDP and recent TDPs.

However, this approach and methodology is currently under review, with a view to enhancing our network development and consultation processes. This review is primarily a result of feedback received from the public, and is focused on how we can encourage and enable greater involvement in our decision-making process. Once finalised and approved, these processes will replace the network development approach and methodology described above.

Since the data freeze date, we have published the following documents:

- An updated Grid Development Strategy[25];
- A consultation on Tomorrow's Energy Scenarios[26] ; and
- Have Your Say[27].

The updated approach and methodology will be reflected in future TDPs.

[25] http://www.eirgridgroup.com/the-grid/irelands-strategy/

[26] http://www.eirgridgroup.com/customer-and-industry/energy-future/

[27] http://www.eirgridgroup.com/the-grid/have-your-say/

3 INVESTMENT NEEDS

The Government Energy White Paper [28] released in December 2015 sets out Ireland's energy future. Investment in the transmission system is necessary to enable Ireland's transition to a low carbon energy future. In this regard, the TDP is developed to support Government objectives and enable this energy transition.

3.1 Strategic Context of Transmission Network Investment

The ability to provide all customers with a secure, efficient, reliable and stable electricity supply is essential for Irish society and to enabling economic activity and economic growth.

The Irish electricity industry and its development take direction from a number of broad national[29] and European[30] strategic objectives. These objectives guide investment in the Irish transmission network and are summarised as follows:

- Ensuring the security of electricity supply;
- Ensuring the competitiveness of the national economy; and
- Ensuring the long-term sustainability of electricity supply in the country.

To ensure these objectives are met we must provide on-going and timely reinforcement of the Irish transmission network.

As the TSO for Ireland, we have a statutory duty to support the development of the Irish economy and society by ensuring the transmission network is able to support all reasonable demands for electricity. In addition, we are required to enter into agreement for connection with parties seeking to connect to the network under such terms approved by the CER.

[28] http://www.dcenr.gov.ie/energy/SiteCollectionDocuments/Energy-Initiatives/Energy%20White%20Paper%20-%20Dec%202015.pdf

[29] http://www.dcenr.gov.ie/energy/SiteCollectionDocuments/Energy-Initiatives/Energy%20White%20Paper%20-%20Dec%202015.pdf

[30] http://ec.europa.eu/energy/en/topics/energy-strategy/2030-energy-strategy

Changes to demand, generation, or to interconnection with neighbouring transmission networks may alter the flow of electrical power throughout the Irish transmission network. To accommodate these changes in power flows it is often necessary to reinforce the transmission network to ensure adequate performance and reliability levels are maintained.

National and EU policies are the basis of our grid development strategy. Figure 3-1 outlines how national and EU policies and network investment drivers relate to the resultant needs and projects in this TDP.

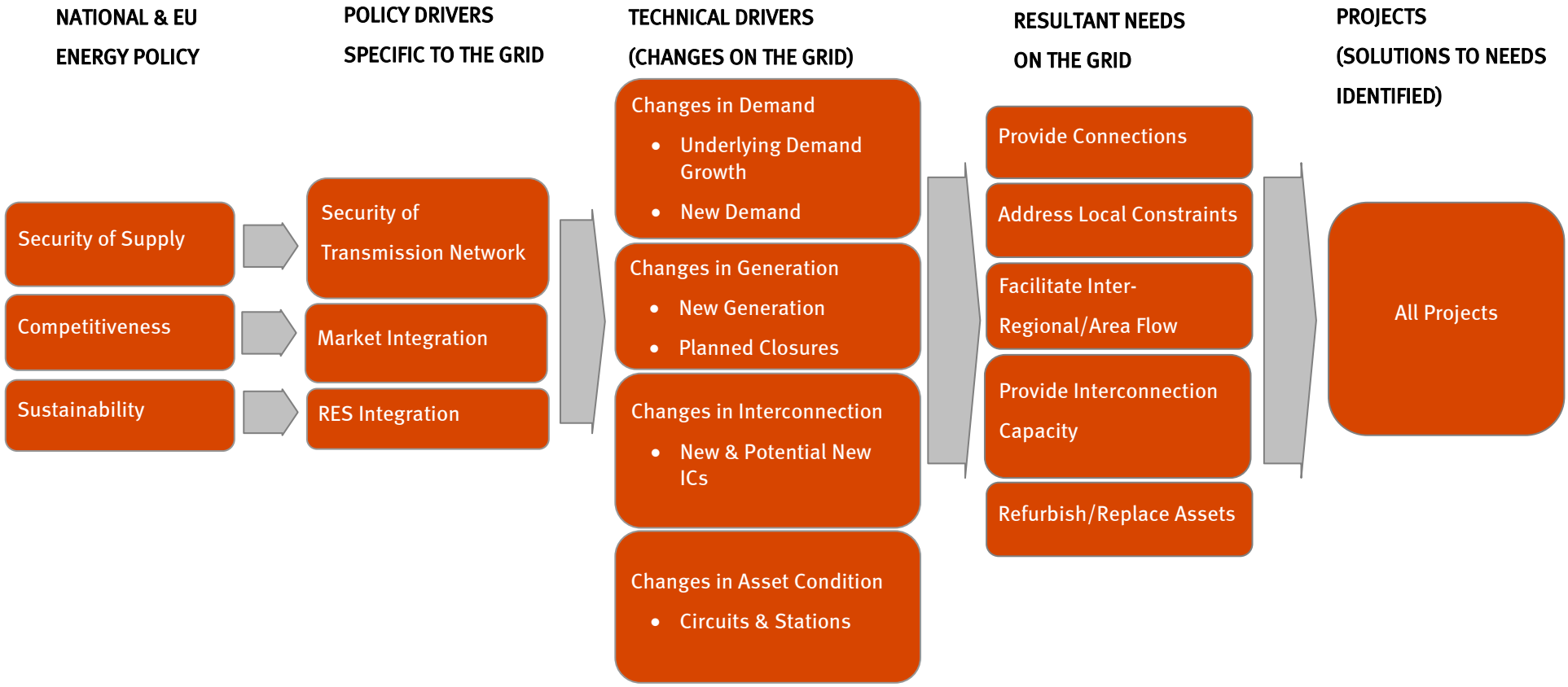


Figure 3-1 Summary of how Policy, Drivers, Needs and Projects relate to each other

3.2 National and European Energy Policy

3.2.1 Security of Supply

Security of supply deals with generation adequacy and the availability of generation to meet the fluctuating demand needs over time. Hence, electricity policy seeks to promote broadening the country's access to generation and promotes further interconnections with neighbouring countries.

Security of supply is also concerned with the reliability and security of the transmission network. Policy therefore also seeks to promote the timely development of the transmission network to maintain an acceptable level of performance and reliability.

3.2.2 Competitiveness

Low or competitively priced electricity is viewed as the product of a competitive electricity market. As a result, electricity policy generally seeks to promote increased competition. This is achieved through further market integration, by removing network constraints and broadening the market by interconnecting to neighbouring electricity markets.

3.2.3 Sustainability

Ireland is heavily reliant on imported fossil fuels for the generation of electricity. The long-term sustainability of the Irish economy is impacted by the sustainability of the fossil fuels upon which it relies. Furthermore, burning fossil fuels produces greenhouse gasses. This has a long-term environmental impact and is not environmentally sustainable. Electricity policy therefore attempts to address these two factors and drives the integration of energy produced from renewable energy sources (RES).

3.3 Policy Drivers of Transmission Network Investment

In order to achieve the identified strategic objectives laid out by national and EU policies, we must continue to invest in the development and maintenance of the electricity transmission network. Specific drivers of investment in transmission network infrastructure are identified, and described in the following sections.

3.3.1 Security of Transmission Network

Security of supply generally addresses two separate issues:

- The availability of primary energy resources to generate sufficient electricity to meet demand; and
- The ability of the transmission network to reliably transport electrical energy from the generators, where it is generated, to the demand centres, where it is consumed.

The TDP is aimed at addressing the security of supply issues that relate to the transmission network.

Therefore, for this document, security of supply means the ability of the transmission network to reliably and securely transport electrical energy from where it is generated to the demand centres where it is consumed.

3.3.2 Market Integration

With increased market integration, electrical power can flow from areas where it is cheap to produce to areas where it is more highly valued. Therefore, the aim is to make the EU electricity markets more integrated.

The integration of RES and other forms of low carbon generation significantly increases the power exchange opportunities across the region. Differences in national targets combined with varying availabilities of renewable sources across Europe will lead to greater penetration of RES in certain areas compared to others. Therefore, there is a need to reinforce the transmission networks between and within EU countries.

3.3.3 Renewable Energy Sources Integration

Developing renewable energy is an integral part of Ireland's sustainable energy objectives and climate change strategy. In comparison to fossil fuels, RES has lower or no net emissions when compared to fossil fuels. RES contribute to the decarbonisation of the energy supply and reduction in greenhouse gases emissions. They also contribute to energy security, being, for the most part, an indigenous energy source. In a period of volatile energy costs RES can also

contribute to cost competitiveness by reducing dependence on imported fossil fuels. At the moment windfarms and hydro stations are the main sources of renewable electricity generation in Ireland. However, as Ireland moves to fully decarbonise its energy system, it is expected that additional forms of renewable energy will be further developed e.g. solar, biomass, wave and tidal.

In order to fulfil both European and national renewable targets, many RES-related projects are expected to be initiated throughout the period of this TDP. Many of these projects are located in rural areas where the transmission network is less developed. This places pressure on the electricity transmission network in these rural areas. Significant challenges will arise in extending and reinforcing the network to connect new RES.

3.4 Technical Drivers for Transmission Network Investment

Technical drivers of transmission network investment include changes in demand, generation and interconnection, inter-regional power flows and changes in asset conditions.

3.4.1 Demand, Generation and Interconnection

Changes in Demand and Generation

Demand growth and the connection of new demand can give rise to higher power flows which may trigger the need to reinforce the network as a result. Closure or reduction in the size of demand facilities can reduce the power flows on lines feeding the load. However, in certain cases where the demand is absorbing local generation and reducing the amount of generation exported from the area, the closure can lead to increased power flows.

Our All-Island Generation Capacity Statement 2016 (GCS)[31], available here[32], details the forecast of electricity demand for the years 2016 to 2025[33, 34]. The

[31] It is important to note that the information in the GCS 2016 is based on the best information available at the freeze date, October 2015.

[32] http://www.eirgridgroup.com/site-files/library/EirGrid/Generation_Capacity_Statement_20162025_FINAL.pdf

[33] In Table 3-1 below, the 2026 forecasts have been extrapolated from the 2025 forecasts.

[34] GCS 2017 was published in April 2017. GCS 2017 demand forecasts will be used in TDP 2017.

peak demand in Table 3-1 corresponds to the forecast median transmission system peak demand published in GCS 2016. We expect a significant increase in data centre connections over the period of this plan. Due to these expectations the peak demand forecast for 2025 has increased by 400 MW compared to the 2015 forecast.

Year	Demand (MW)	Generation (MW)
	Peak Demand	Generation Capacity
2016	4,994	9,568
2017	5,070	10,920
2018	5,112	11,577
2019	5,146	11,595
2020	5,196	11,604
2021	5,241	13,141[35]
2022	5,319	13,141
2023	5,400	13,141
2024	5,481	12,551
2025	5,558	12,551
2026	5,635	12,551

Table 3-1 Forecast Demand and Generation growth over the period 2016 to 2026[36]

[35] This figure (and the generation values for subsequent years) includes generation projects that do not have an estimated energisation date, but are expected to connect to the system over the period of this TDP.

[36] This forecast is based on information presented in GCS 2016 and TYTFS 2015. EWIC (which can act as a 500 MW generation source or 530 MW demand source) is not included in the figures above. The generation figure assumes that contracted generation that does not have a connection date will connect to the system in 2020. In addition to the generation figures above there exists further generation in the applications queue.

Our All-Island Ten Year Transmission Forecast Statement 2015 (TYTFS)[37], available here[38], includes information on how the GCS demand forecast relates to each individual demand centre node over the period covered by this TDP. Areas in the transmission network where changes in demand are resulting in network development needs are highlighted on the map in Figure 3-2.

Because of the relative size of individual generators, changes in generation installations, whether new additions or closures can have a more significant impact on power flows than demand. This is equally so in the case of interconnectors which are treated as generators during periods when power is imported.

The addition of new generation capacity requires network development to connect the new generator to the network. This provides a path for electric power flow between the new generator and the transmission network. This is known as the shallow connection. The new generation capacity will inevitably alter the power flows across the network, which has the potential to create overload problems deep into the network. To resolve these overloads we need further reinforcements (known as deep reinforcements) to allow full network access.

The connection of large generators, or groups of generators, combined with the increasingly meshed nature of the transmission network results in lower network impedance and consequently increased short circuit levels. This is a safety issue, as under fault conditions such high short circuit levels may cause catastrophic failure of high voltage equipment. We monitor fault levels on the network and take measures to prevent such conditions occurring. The areas where the network is close to the fault rating of installed equipment are highlighted on the map in Figure 3-2.

Table 3-1 highlights the level of existing generation and projected levels of generation expected to connect over the period of this TDP, as detailed in the

[37] It is important to note that the information in the TYTFS 2015 is based on the best information available at the freeze date, July 2015.

[38] http://www.eirgridgroup.com/site-files/library/EirGrid/2015-TYTFS-Complete_Approved.pdf

TYTFS 2015. It is important to note that this figure does not include additional generation that is in the applications queue, but is not contracted.

The projected increased levels of generation are accommodated by the reinforcements included in this TDP. This includes the identified future potential projects discussed in chapter 6. The map in Figure 3-2 highlights areas of the transmission network where changes in generation result in network development needs.

Changes in Interconnection

EU Policy recognises the economic and technical benefits associated with increased interconnection and therefore seeks to promote interconnection between European transmission systems. Increased interconnection between transmission networks results in a larger energy market. With increased market integration there is greater competition and the potential for prices to be reduced. With increased interconnection there is also access to a broader generation base, which enhances the networks' security of supply. This can potentially defer the need for additional generation to be constructed to meet security of supply standards or requirements.

The following interconnections are addressed in this TDP:

- North South Interconnector between Ireland and Northern Ireland;
- A possible interconnector between Ireland and France; and
- Possible further interconnection between Ireland and Great Britain.

3.4.2 Changes in Inter-Regional Power Flows

The following factors have the potential to significantly change the flow of electrical power throughout the transmission network. They can drive the need for network reinforcements over the next ten years and beyond:

- Changes in demand;
- Further internal integration of the All-Island Single Electricity Market;
- Further integration with neighbouring countries; and

- Integration of significant levels of new generation (both conventional and renewable).

There is now a growing need to accommodate a much broader range of plausible, credible flow patterns across the network. This is due to the extent of the likely changes that are envisaged for Ireland, particularly in respect of the RES targets[39]. To cater for a broader range of flow patterns, greater transmission network flexibility is required.

This is due to the extent of the likely changes that are envisaged for Ireland, particularly in respect of changes in demand, generation and interconnection.

3.4.3 Changes in Asset Condition

Transmission network assets have a finite lifespan. The useful life of transmission assets are impacted by a number of factors. These include:

- the age of the asset;
- technology type and its propensity for obsolescence;
- maintenance adequacy and effectiveness;
- environmental conditions; and
- utilisation.

In order to ensure that security of supply is not compromised, routine condition assessments are carried out. These assess the condition of the assets and estimate remaining useful life.

Typically, where asset condition is poor, assets are:

- Refurbished;
- Replaced on a like-for-like basis; or
- Replaced with higher rated equipment to cater for future needs.

[39] The Energy White Paper - Ireland's Transition to a Low Carbon Energy Future 2015 and the National Renewable Energy Action Plan (NREAP) Update (2012) chart a course for Ireland's renewable energy sector out to 2030.

3.5 Network Development Needs

The technical drivers of transmission network investment listed above, result in network development needs. To address these needs, we must provide on-going and timely reinforcement of the Irish electricity transmission network.

The primary measure of network development needs is assessed by comparing transmission network performance with the required performance levels set out in the TSSPS.

Our TSO licence, granted by the CER, specifically requires us to ensure the maintenance of and, if necessary, develop the transmission network in accordance with the TSSPS.

It is possible to separate the resulting reinforcement needs into a number of categories, namely:

- Reinforcements required to provide connections or changes in demand or generation;
- Reinforcements required to address local network constraints such as a shortage of transmission capacity or voltage support;
- Reinforcements related to providing and facilitating interconnection capacity;
- Reinforcements to facilitate inter-regional/ area power flows; and
- Reinforcements to address the condition of existing assets.

Figure 3-2 illustrates the areas of change on the network and the resultant network development needs over the period of this plan.

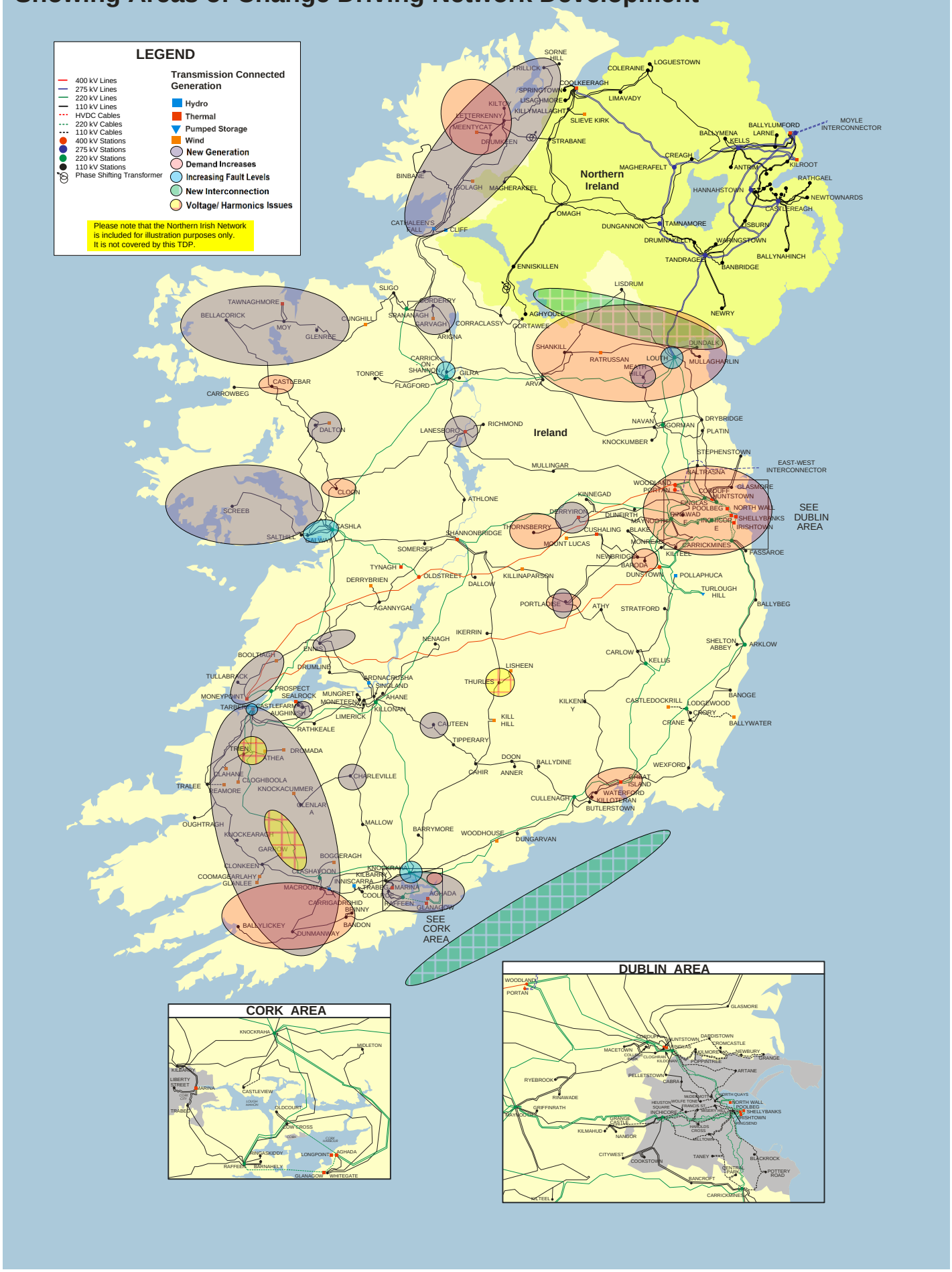


Figure 3-2 Network Map Showing Areas of Change Driving Network Development

4 CHANGES TO THE PLAN SINCE 2015

TDP 2015 is available here[40]. TDP 2015 had a data freeze date of 31 March 2015. TDP 2016 has a data freeze date of 31 March 2016.

The changes that have occurred since 31 March 2015 are summarised in Table 4-1 below.

Description of Projects	No. of Projects
Total TDP 2015 projects	138
New projects introduced since TDP 2015	(+) 13
Projects completed since TDP 2015	(-) 20
Active TDP 2015 projects which have changed in scope[41]	(-) 1
Active TDP 2015 projects put on hold	(-) 1
Inactive projects in TDP 2016	(-) 13
Total Active Projects in TDP 2016	116

Table 4-1: Summary of Changes since TDP 2015

Table 4-1 shows the number of projects that have been completed (20 projects) since TDP 2015 and new projects introduced (13 projects) to the development plan. These projects are listed in Appendices B and C.

In addition, Appendix B also lists projects which are not active in TDP 2016. These are projects which:

- are on hold;
- have changed in scope since previous versions of the TDP; or
- are being managed in accordance with customer connection agreements.

[40] http://www.eirgridgroup.com/site-files/library/EirGrid/TDP-2015-CER-Approved-(2).pdf

[41] One inactive TDP 2015 project has also changed in scope, please see Appendix B for further information

5 PLANNED NETWORK DEVELOPMENTS

5.1 Overview of the Plan

This chapter summarises the network development projects that are a result of the transmission network development planning process (outlined in Section 2.4). Projects are described in greater detail in Chapter 6 and Appendix C.

The TDP includes a total of 116 projects that are currently in progress. These projects are categorised as either; New Build; Uprate/ Modify; Refurbish/ Replace related projects or Other.

New Build projects: are projects that involve the construction of new stations or new circuits. This category also includes projects that involve the installation of new equipment in existing stations.

An example of a new build project is the installation of new transformers or new reactive support devices within existing stations.

Uprate/ Modify projects: are projects that involve the uprating of existing assets. An example of an uprate project is changing equipment to increase the capacity rating of circuits or busbars.

This category also includes projects that involve the modification of existing assets.

An example of a modification project is the installation of new couplers or new bays in existing stations. Reconfiguration of existing stations is also included in this category.

Refurbish/ Replace projects: are projects that involve the maintenance of existing stations or existing circuits. This category also includes projects that involve the replacement of existing assets. For example the replacement of stations at or close to the end of their useful life or replacement and upgrading of protection in existing stations.

Other: are projects that do not fall naturally into any of the three categories above.

Table 5-1 below summarises the active 116 projects into their respective categories.

Project Category	No of Projects
New Build	34
Uprate/ Modify	60
Refurbish/ Replace	20
Other	2
TOTAL	116

Table 5-1 Summary of Projects by Category

5.2 Summary of Phase of Projects

Table 5-2 below summarises the number of projects in phase 2 and 3 of network development[42].

Phase 2 involves outline design, EIA, public consultation, the public planning process and the IA process up to PA with ESB Networks.

Phase 3 involves detailed design, procurement, construction, commissioning and energisation.

No of Projects in Each Phase		
Phase 2	Phase 3	TOTAL
69	47	116

Table 5-2 No. of Projects in each Phase of Development

[42] The process of network development is described in section 2.4. Further information on project phase is available in Appendix A

There are currently 69 projects in Phase 2 of project development and 47 projects in Phase 3.

Figure 5-1 illustrates the location of the larger network development projects in Phase 3, while Figure 5-2 shows those in Phase 2. All new developments shown in Figure 5-2 are subject to existing/ on-going EIA.

For those projects not yet in the planning process, the lines shown on the map are indicative only and do not represent a preferred line route. A full list of projects and their corresponding phase of development is given in Appendix C.

In addition to the projects summarised in this chapter, we also co-ordinate capital projects which are classified as minor capital works with the TAO, such as line diversions and alterations. These projects are numerous and generally deal with the day-to-day operation and maintenance of the network. These are not included in this chapter nor itemised in Appendix C.

Figure 5-1 Planned Network Developments in Phase 3

Figure 5-2 Planned Network Developments in Phase 2

5.3 Project Delivery

The development of the transmission network is subject to delivery risk. We use risk management plans and processes to identify, analyse, monitor and manage project and programme risks. These plans and processes facilitate the management of project dependencies and critical path issues within the context of a changing environment.

Project Estimated Completion Dates (ECDs) in the TDP are forecasts based on the best project information available at the time of the data freeze, 31 March 2016. Certainty with regard to completion dates increases as a project moves through the various phases in its lifecycle, as represented below in Figure 5-3.

The project schedule at the concept stage is developed based on standard lead times for generic project types. As a project moves forward from the concept phase a detailed schedule is developed, milestones are achieved and there is therefore greater certainty regarding the completion date.

Figure 5-3 Relationship between Phases in Project Lifecycle and Completion Date Certainty

The level of certainty or risk in a project also varies by project type as shown in Figure 5-4.

Figure 5-4 Project Certainty Depending on Project Type

We differentiate between moderate and high risk projects based on project type and project phase. Thus, line and station busbar uprate projects which are due to be completed by 2017 are considered to be within the moderate risk category. Large scale linear developments, scheduled to be completed post 2018 have a higher level of risk. Projects that are due for completion in the near-term generally carry less risk than those due for completion in later years.

The region or location of a project also has an impact on its risk profile. When interdependent projects are on-going at the same time, care has to be taken scheduling the required outages. In this case we will prioritise projects according to our prioritisation processes. This programme risk review may drive changes to the way projects are sequenced and the timing of project delivery in a region.

We review the network development programme on an on-going basis, which may result in project delivery changes for the reasons cited above. In such cases we endeavour to communicate with and mitigate impacts on customers.

In summary, completion dates are subject to change and the level of change typically depends on:

- The type of project;
- Phase-specific project and programme risks; and
- The region a project is in.

6 REGIONAL PERSPECTIVE OF THE PLAN

6.1 Overview

As described in Chapter 1, planned projects are categorised on a planning area basis, as per Figure 6-1.

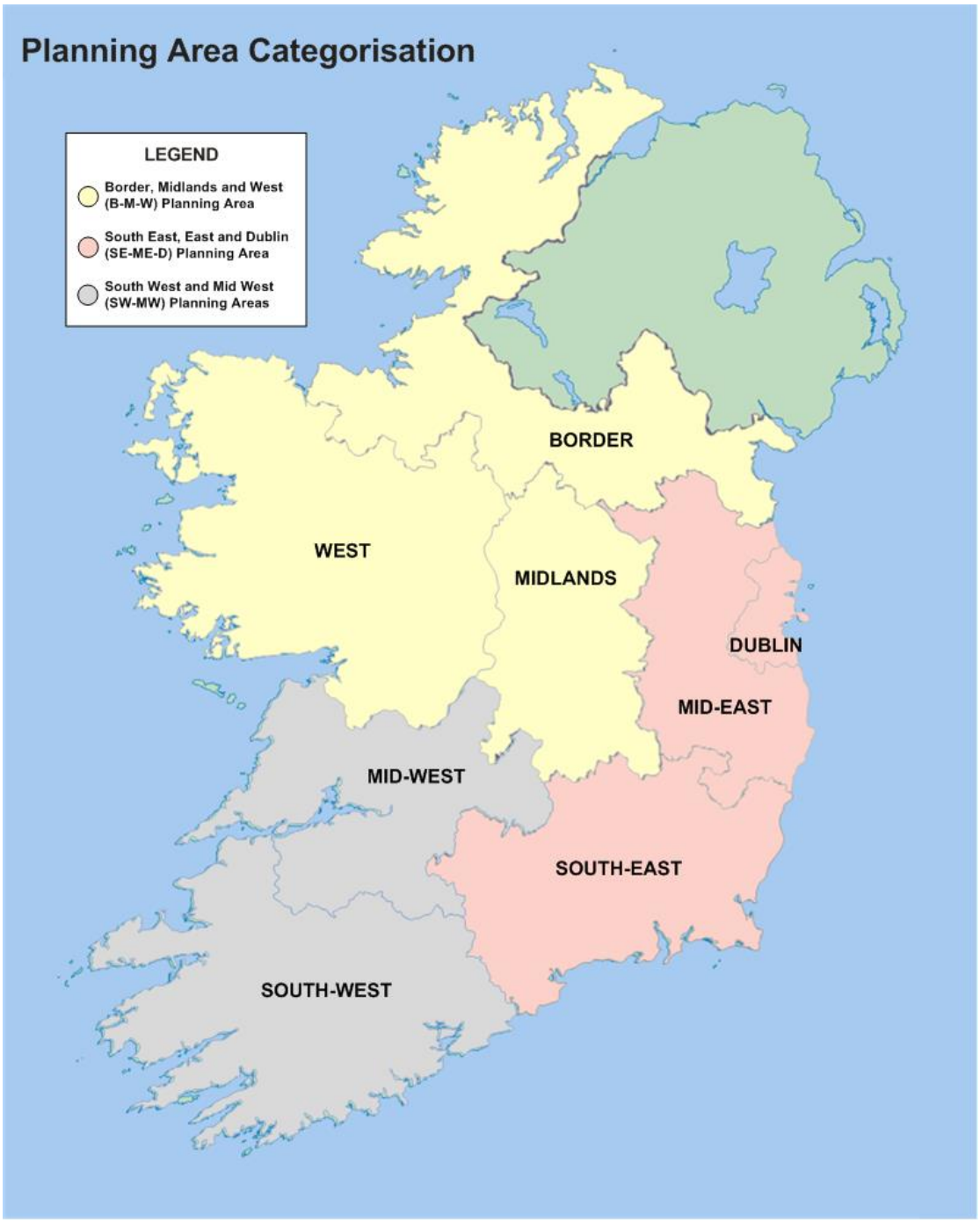


Figure 6-1 Illustration of the eight regions and three planning areas

Table 6-1 below summarises the number of active projects by planning area with the more detailed project data listed in Appendix C[43].

Active TDP Projects by Planning Area	
Planning Area	**No. of Active Projects**
Border, Midlands and West (B-M-W)	39
South-West and Mid-West (SW-MW)	38
South-East, Mid-East and Dublin (SE-ME-D)	33
National Projects[44]	6
Total	116

Table 6- 1 Summary of Active Projects by Planning Area

There are eight individual projects that are in, or have the potential[45] to be in, multiple planning areas. These eight projects are listed in Table C-1 in Appendix C.

Projects of pan-European and regional significance in, or partly in, Ireland are identified in ENTSO-E's most recent TYNDP[46] and RegIP documents. These projects are identified in this TDP using the following labels: "TYNDP/ TYNDP_Project_No" or "RegIP/ RegIP_Project_No" and are listed in Appendix D.

[43] Prior to reviewing Appendix C consult Appendix A Project Details which explains some of the terms that are used to describe projects.

[44] These involve multiple individual projects at various locations across the country.

[45] Please note that the routes for projects in Phase 2 have yet to be determined thus the planning areas these projects are in also has yet to be determined.

[46] TYNDP 2016 is currently in draft version - the draft TYNDP 2016 was recently published for consultation and the finalised version of the document is expected imminently

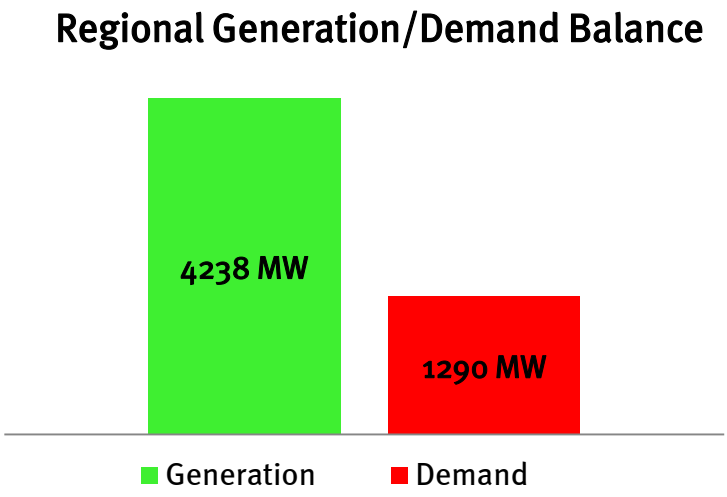
6.2 The Border, Midlands and West Planning Area

The Border, Midlands and West Planning Area Overview

The Border, Midlands and West planning area is made up of the following counties categorised by region:

- The Border: Donegal, Sligo, Leitrim, Cavan, Monaghan and Louth
- The Midlands: Longford, Westmeath, Offaly and Laois
- The West: Mayo, Galway and Roscommon

2026 Forecast Regional Generation and Demand Balance[47]



Summary of TDP Projects

TDP project category	No. of Projects
New Build	10
Uprate/ Modify	27
Refurbish/ Replace	2
Total	39

[47] The Forecast Regional Generation and Demand Balance is based on Demand levels published in GCS 2016, and the Generation figures published in the TYTFS 2015.

Regional Description

The Border, Midlands and West planning area has a wide variety of generation sources. These are dispersed around the planning area and include wind; hydro; gas; and peat burning power stations.

The planning area has considerably more generation than demand. The existing transmission network is predominantly 110 kV and 220 kV. There is limited high capacity 400 kV infrastructure in the southern part of the planning area. The existing local transmission network allows limited power flows between Northern Ireland and Ireland via the existing 275 kV Tandragee-Louth interconnector.

There is an 110 kV transmission network in the area which supplies a relatively low local demand. Development of this network is mainly required to connect a high level of renewable generation.

The excess of generation in the area is set to increase significantly in the coming years. This is due to generators that currently have connection agreements and live connection offers connecting to the transmission and distribution networks.

To cater for the high levels of generation described above, network reinforcement is necessary. This will enable the efficient export of generation from this area towards areas with high load, such as the eastern seaboard.

There are also reinforcement needs due to:

- Local constraints related to a shortage of transmission capacity and voltage support;
- Asset condition; and
- To accommodate further market integration with Northern Ireland.

The projects described in this section will enable the transmission network to safely accommodate the more diverse power flows which are a result of excess regional generation. They will also provide benefits to existing and future users of the transmission network in the planning area and facilitate broad future regional load growth.

The 39 projects in the Border, Midlands and West planning area are discussed in more detail below. The status of the network development projects is noted in Appendix C.

Please refer to Figures 5-1 and 5-2 for locational information of planned Network Developments in the Border, Midlands, and West Planning Area in Phases 2 & 3.

Reinforcement of the Transmission Network between Ireland and Northern Ireland

Project

- North South Interconnection Development (CP0466) (TYNDP/ 81.462, PCI/ 2.13.1) – 400 kV Circuit from Woodland Transmission Station in Co. Meath to Turleenan Transmission Station in Northern Ireland[48]

Description

The drivers for this project are market integration, security of supply and RES integration. There is a requirement for increased power to flow between Ireland and Northern Ireland. This is mainly driven by changes to the all-island generation portfolio, plant retirements and the relative operational costs of generation plants in each jurisdiction.

The capacity for power flows between Ireland and Northern Ireland is limited by the existing infrastructure. In particular, there is a risk that a single event could take the existing 275 kV interconnector out of service. This would lead to a system separation of Ireland and Northern Ireland, requiring each system to instantly adjust to achieve a new demand-supply balance.

The North South Interconnection Development will remove this risk of system separation and significantly increase cross-border transmission capacity. The North South Interconnection Development will offer significant economic benefits, by:

- Improving security of supply, by:

[48] More information is available at http://www.eirgridnorthsouthinterconnector.ie/

- allowing sharing of generation across the island; and
- removing the scenario where a single event could lead to system separation of Ireland and Northern Ireland;

- Improving competition and economic operation by removing constraints;
- Providing the required flexibility for renewable generation; and
- Ensuring security of supply for the North East of Ireland.

This is a joint EirGrid and SONI project.

Reinforcement of the Transmission Network in and out of Donegal

Project

- The North West Project (CP0800) (TYNDP/ 82.463, PCI/ 2.13.2) – Reinforcement of the grid in the north-west

Description

In association with SONI we carried out an assessment of north-west Ireland and western Northern Ireland. This investigation resulted in a submission to the European Commission (EC) requesting Project of Common Interest (PCI) status for a project titled the Renewable Integration Development Project (RIDP). The EC has since accepted that application.

The North West Project comprises reinforcement of the grid in the north-west. In line with our grid development strategy[49] we are reviewing the solutions, technology and timing of this work.

The driver of this project is RES integration.

The amount of renewable generation seeking to connect in Donegal is in excess of the local demand. This generation therefore needs to be transferred out of the area to relieve congestion on the network.

[49] Grid Development Strategy Review - Your Grid, Your Views, Your Tomorrow, March 2015 - Strategy Statement 2 "We will consider all practical technology options". Our updated grid development strategy was published in January 2017.

Reinforcement of the Transmission Network within and out of Mayo

Projects

- The Grid West Project (CP0721) (RegIP/ 115[50]) – High Capacity Circuit from Bellacorick area to Flagford Transmission Station[51] OR
- North Connacht 110 kV Reinforcement Project (CP0816)[52]

Description

The driver for these projects is RES integration. The need for reinforcement arises due to the requirement to connect new RES generation. The level of generation is greater than the capacity of the local 110 kV network, even when uprated. The generation contracted to connect in the area could result in overloads on the existing infrastructure, under both intact network and single contingency conditions. Originally there was a need for both the Grid West and North Connacht projects to facilitate all of the Gate 3 applications. However approximately 200 MW of Gate 3 offers were not taken up. EirGrid is currently reassessing the needs in the area. It is likely that only one project will progress at this time.

In line with our grid development strategy[53] commitments, for either project all practical technology options would be investigated.

For Grid West, a number of technical solutions for this circuit have been considered. In 2014 we conducted a comprehensive analysis on both underground and overhead solutions for the Grid West Project. A report on this analysis was submitted to the Government appointed Independent Expert Panel for their review.

The report considers three options:

- a HVDC underground cable;
- a 400 kV overhead line; and

[50] Formerly part of TYNDP Project No. 82
[51] More information is available at http://www.eirgridgroup.com/the-grid/projects/grid-west/the-project/
[52] A potential solution involves a new 110 kV circuit between Castlebar and Moy 110 kV stations.
[53] Grid Development Strategy Review - Your Grid, Your Views, Your Tomorrow, March 2015. Our updated grid development strategy was published in January 2017.

- a 220 kV overhead line which may incorporate sections of underground AC cable.

The report was published in July 2015. Should it be determined that this project is required, we will consult on the information contained in the IEP report. We will do this before selecting the preferred option to take forward.

Reinforcement of the Transmission Network in Mayo and Sligo

Projects

- Castlebar 110 kV Station – Busbar Uprate, New Coupler and Refurbishment Works (CP0771)
- Moy 110 kV Station – Busbar Uprate, New Coupler and Refurbishment Works (CP0839)
- Bellacorick - Castlebar 110 kV Line Uprate (CP0731)
- Bellacorick - Moy 110 kV Line Uprate (CP0819)

Description

The drivers for these projects are RES integration and security of supply.

The need for these reinforcements arises due to a shortage of transmission capacity. The existing infrastructure could overload under single contingency and maintenance-trip conditions. This overload could occur primarily as a result of the planned connection of new generation.

In addition, the projects also involve refurbishment works due to the condition of the assets. Refurbishment works will be carried out at the same time as the uprating works.

New couplers will be installed in Castlebar and Moy 110 kV stations. These works will improve security of supply and increase operational flexibility. This is something which is of particular relevance during the outage season, which is when maintenance and construction works are scheduled.

These projects are part of an overall strategy, in conjunction with the Grid West Project or the North Connacht 110 kV Reinforcement Project mentioned above.

This strategy aims to increase the capacity for the potentially large power flows out of Mayo to other areas at times of excess local generation.

Reinforcement of the Transmission Network in the Border, Midlands and West Planning Area for New Generation Connections

Projects

- Knockranny (previously referred to as West Galway in TDP 2015), Uggool/ Seecon 110 kV Stations – New Stations, new Wind Farm Connections (CP0737)[54]
- Clogher and Mulreavy 110 kV Stations – New Stations, new Wind Farm Connection (CP0603)
- Sliabh Bawn 110 kV Station – New Station, new Wind Farm Connection (CP0861)
- Derryiron 110 kV Station – New 110 kV DSO Transformer Bay (CP0836)
- Tawnaghmore and Moy 110 kV Stations – Mayo Renewable Power Connection (CP0833)
- Bellacorick 110 kV Station – Uprate DSO Transformer (CP0837)
- Binbane 110 kV Station – New 110 kV DSO Transformer Bay (CP0878)
- Letterkenny 110 kV Station – New 110 kV DSO Transformer Bay (CP0879)
- Shranakilly (previously referred to as Oweninny in TDP 2015) 110 kV Station – New Station, new Wind Farm Connection (CP0850)
- Glenree 110 kV Station – New 110 kV DSO Transformer Bay (CP0882)
- Dalton 110 kV Station – New 110 kV DSO Transformer Bay (CP0838)
- Garvagh 110 kV Station Redevelopment (CP0951) (NEW)
- Portlaoise 110 kV Station – Uprate two DSO Transformers (CP0976) (NEW)

[54] More information is available at http://www.eirgridgroup.com/the-grid/projects/west-galway/the-project/

Description

The driver for these projects is RES integration. The need for reinforcement arises due to the requirement to connect new generation.

Reinforcement of the Transmission Network in the Border, Midlands and West Planning Area for New and Modified Demand Connections

Projects

- Bracklone 110 kV Station – New Station, New DSO Demand Connection (CP0644)
- Portlaoise 110 kV Station – 2 New 110 kV Bays for DSO Transformers (CP0645)
- Castlebar 110 kV Station – Uprate 110 kV Bay for DSO Transformer (CP0680)
- Cloon 110 kV Station – New 110 kV Bay for DSO Transformer (CP0706)
- Letterkenny 110 kV Station – Relocation of 110 kV Bay and 2 New Couplers (CP0740)

Description

The driver for these projects is security of supply.

The need for reinforcement arises due to the requirement for new and modified demand connections.

Reinforcement of the Transmission Network in the Cavan area

Project

- Arva - Shankill No.1 110 kV Line Uprate (CP0847)

Description

The drivers for this project are RES integration and security of supply.

There are two areas of need for the project:

- The need for network reinforcement; and
- The need for refurbishment and replacement works due to the condition of the assets.

The need for reinforcement arises due to a shortage of transmission capacity. The circuit could overload under single contingency conditions.

A condition assessment identified the need for the refurbishment and replacement of assets.

Reinforcement of the Transmission Network in the Louth area

Project

- Louth 275 kV Station Refurbishment – 110 kV Busbar Re-configuration and New Couplers (CP0799)

Description

The driver for this project is security of supply.

There are two areas of need for the project:

- The need for network reinforcement; and
- The need for refurbishment works due to the condition of the assets.

The need for reinforcement arises due to:

- A shortage of transmission capacity; and
- Possible overload of the 110 kV busbar and some circuit breakers

In addition, the station works also involve refurbishment works due to the condition of the assets. These works will be undertaken at the same time as the uprating works.

Reinforcement of the Transmission Network in Galway

Projects

- Cashla – Salthill 110 kV Circuit Uprate and Refurbishment (CP0865)
- Cashla 110 kV Station – Uprate Two 110 kV Circuit Breakers (CP0849)
- Galway 110 kV Station – Uprate Two 110 kV Circuit Breakers (CP0881)

Description

The drivers for these projects are RES integration and security of supply.

The need for reinforcement arises due to a shortage of transmission capacity.

Network studies have indicated future overloads on the Cashla - Salthill 110 kV circuit under single contingency conditions. This overload could occur primarily

as a result of the planned connection of new generation. In addition, a Line Condition Assessment and Line Project Assessment Report identified the need for refurbishment due to the condition of the line. Refurbishment works will be carried out at the same time as the uprating works.

The driver for the uprate of the circuit breakers in Cashla and Galway 110 kV stations is RES integration.

Planning studies indicate that the level of generation connecting to the network will increase the fault level and could overload existing equipment.

Reinforcement of the Transmission Network in Roscommon and Leitrim

Projects

- Carrick-on-Shannon 110 kV Station – Busbar Uprate, New Coupler and Refurbishment Works (CP0697)
- Carrick-on-Shannon 110 kV Station – Uprate Four 110 kV Circuit Breakers (CP0834)
- Carrick-on-Shannon - Arigna T - Corderry 110 kV Line Uprate and Refurbishment (CP0870)

Description

The drivers for these projects are RES integration and security of supply.

The need for reinforcement arises due to a shortage of transmission capacity. Network studies have indicated future overloads on the Carrick-on-Shannon - Arigna T - Corderry 110 kV line under single contingency conditions. In addition, a Line Condition Assessment and Line Project Assessment Report identified the need for refurbishment due to the condition of the line.

The connection of renewable generation facilitates higher flows on the 110 kV network. These higher flows may result in higher loading of the Carrick-on-Shannon 110 kV busbar. The existing rating of the busbar is inadequate for the future needs of the station; therefore, Carrick-on-Shannon 110 kV busbar needs to be uprated.

In addition, four 110 kV line bay circuit breakers in Carrick-on-Shannon 110 kV station will be replaced and uprated due to the condition of the assets.

Reinforcement of the Transmission Network in the Mullingar Area

Project

- Kinnegad - Mullingar 110 kV New Circuit (CP0596)[55]

Description

The driver for this project is security of supply.

The need in the Mullingar area was identified through network studies which indicated violations of voltage limits under maintenance-trip conditions. The installation of capacitors is an interim solution until the long term solution of a new circuit between Kinnegad and Mullingar 110 kV stations is in place.

Reinforcement of the Transmission Network in the Offaly Area

Projects

- Mount Lucas - Thornsberry 110 kV New Circuit (CP0197)[56]
- Thornsberry 110 kV Station – Busbar Uprate (CP0724)

Description

The driver for these projects is security of supply.

The DSO has requested a second connection to the existing Thornsberry 110 kV station. This is provided by the new Mount Lucas - Thornsberry 110 kV circuit (CP0197).

Planning studies indicate that the connection of new generation and the building of new infrastructure will increase the power flowing through the area. This could potentially overload the existing busbar in Thornsberry 110 kV station. Therefore, the busbar needs to be uprated.

[55] More information is available at www.eirgridgroup.com.

[56] Formerly Cushaling – Thornsberry 110 kV New Circuit.

Reinforcement of the Transmission Network in Laois

Project

- Coolnabacky - Portlaoise 110 kV Line Uprate (CP0835)

Description

The drivers for this project are security of supply and RES integration. This project is related to the Laois - Kilkenny Reinforcement Project (CP0585) which is required to address quality of supply and provide security of supply in the area. The need for reinforcement arises due to a shortage of transmission capacity. Studies have indicated overloading for an intact network, single contingency and maintenance trip conditions.

In addition, refurbishment works due to the condition of the circuit will be undertaken at the same time as the uprating works.

Other approved projects

In addition to the network reinforcement projects described above, there are also other approved projects in the Border, Midlands and West planning area, namely:

- Castlebar 110 kV Station – Transmission Works Associated with Installation of New 38 kV GIS (CP0778).
- Flagford - Louth 220 kV Line Refurbishment (CP0867) (NEW)

Future Needs Driving Potential Projects

At the time of the data freeze date there are also projects at earlier stages of development and investigation. Detailed studies will determine whether these projects are required.

It is expected to progress with projects to uprate Corderry – Srananagh and Lanesboro – Sliabh Bawn 110 kV lines, both driven by RES. Lanesboro 110 kV station also requires redevelopment to address expected future flows driven by RES that are in excess of the rating of the busbar.

It is expected that new projects in the Galway area will be progressed, driven by existing, future and potential demand in the area.

The need for voltage support at a number of stations in the Border, Midlands and West planning area was identified through system wide transmission network studies. Detailed studies on the individual areas requiring support are being undertaken. Future TDPs will report on the specific projects resulting from these detailed studies.

As discussed, it is likely that we will progress either the Grid West Project or the North Connacht 110 kV Reinforcement Project as the reinforcement project to facilitate the RES in Co. Mayo.

Either reinforcement on its own does not fully meet the need, as the generation will need to travel further through the network. These flows will drive a number of 110 kV uprates to the existing network. A different subset of uprates is required for either Grid West or North Connacht.

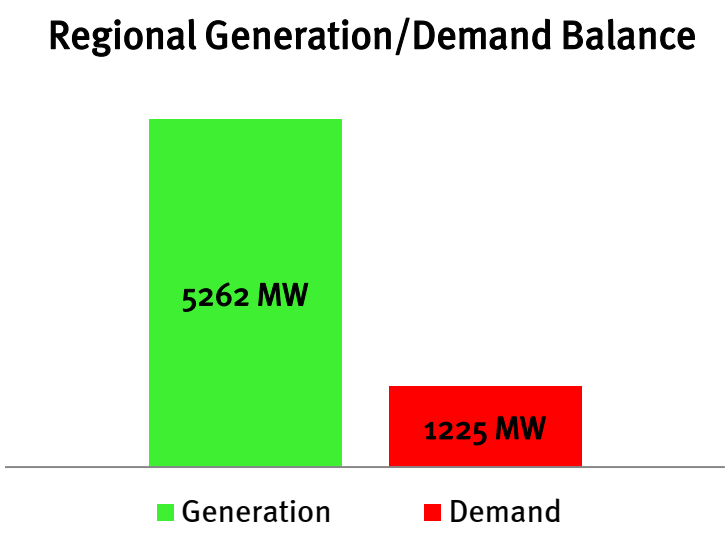
6.3 The South-West and Mid-West Planning Area

The South-West and Mid-West Planning Area Overview

The South-West and Mid-West planning area is made up of the following counties categorised by region:

- The South-West: Kerry and Cork
- The Mid-West: Clare, Limerick and North Tipperary

2026 Forecast Regional Generation and Demand Balance[57]



Summary of TDP Projects

TDP Project Category	No. of Projects
New Build	16
Uprate/ Modify	17
Refurbish/ Replace	5
Total	38

[57] The Forecast Regional Generation and Demand Balance is based on Demand levels published in GCS 2016, and the Generation figures published in the TYTFS 2015.

Regional Description

The South-West and Mid-West planning area has a wide variety of generation sources dispersed around the planning area. These include: wind, hydro, gas, and coal burning power stations.

The planning area has considerably more generation than demand. The existing transmission network is composed of 110 kV, 220 kV and 400 kV infrastructure. The high capacity 220 kV and 400 kV circuits facilitate high inter-regional power flows from the planning area.

The development of the transmission network in the area is characterised by the connection of high levels of wind generation in the Co. Cork and Co. Kerry areas. These high levels of generation result in transmission network constraints as power is exported out of the area towards the Moneypoint and Knockraha transmission stations. Generation levels in the area are set to increase in the coming years. This is due to generators that currently have connection agreements and live connection offers connecting to the transmission and distribution networks.

In addition, we are undertaking a joint project with the French TSO, Réseau de Transport d'Électricité (RTE), to investigate the development of a HVDC interconnector between Ireland and France that could potentially connect along the south coast.

To cater for the high levels of generation relative to local demand, network reinforcement is needed to enable the efficient export of generation from the area.

There are also reinforcement needs due to:

- Local constraints related to a shortage of transmission capacity and voltage support; and
- Asset condition.

The projects described in this section will enable the transmission network to safely accommodate the power flows, resulting from an excess of regional generation. They will also provide benefits to existing and future users of the transmission network in the planning area and facilitate broad future regional load growth.

The 38 projects in the South-West and Mid-West planning area are discussed in more detail below. The status of the network development projects is noted in Appendix C.

Please refer to Figures 5-1 and 5-2 for locational information of planned Network Developments in the South-West & Mid-West Planning Area in Phases 2 & 3.

Reinforcement of the 220 kV Transmission Network in Kerry and West Cork for New Connections

Projects

- Ballyvouskil 220/ 110 kV New Station (CP0650)
- Ballynahulla 220/ 110 kV New Station (CP0651)
- Knockanure 220/ 110 kV New Station (CP0500)
- Ballynahulla 220/ 110 kV Station – Second 220/ 110 kV Transformer (CP0840)

Description

The driver for these projects is RES integration.

The need for reinforcement arises as the existing 110 kV network will not be able to accommodate the amount of wind generation planned for the area.

The new Knockanure (CP0500), Ballynahulla (CP0651) and Ballyvouskil (CP0650) 220/ 110 kV stations will be looped into the existing Tarbert – Clashavoon 220 kV circuit. The second 220/ 110 kV transformer in Ballynahulla will provide increased capacity and mitigate harmonic resonances introduced by the connection of 110 kV cables in the area.

Reinforcement of the 220 kV Transmission Network out of Kerry and West Cork towards the North and East directions

Projects

- Kilpaddoge - Knockanure and Ballyvouskil - Clashavoon 220 kV Line Uprates and Kilpaddoge - Tarbert 220 kV Line Refurbishment (CP0763)

- Ballynahulla - Ballyvouskill and Ballynahulla - Knockanure 220 kV – Line Uprates (CP0883)

Description

The driver for the line uprate projects is RES integration and the driver for the line refurbishment is security of supply.

The need for refurbishment arises due to asset condition. The need for uprating arises due to the connection of large amounts of wind generation in Kerry, west Cork and west Limerick. This results in higher power flows on the transmission network. Studies have indicated overloading of these circuits under single contingency and maintenance-trip conditions.

These projects are part of an overall strategy to increase the capacity for the potentially large power flows out of the area. The power will flow north towards Moneypoint and east towards Knockraha transmission stations and onwards to the large demand centres of Cork and Dublin.

Reinforcement of the Transmission Network in North Kerry

Projects

- Kilpaddoge 220/ 110 kV Station – New Station to the West of Tarbert 220/ 110 kV Station (CP0647)
- Tarbert 220/ 110 kV Station Refurbishment (CP0622)

Description

The driver for these projects is security of supply.

The need for reinforcement arises due to local constraints on the transmission network. The physical capacity of Tarbert 220/ 110 kV station is close to being reached. The new Kilpaddoge station will replace many of the functions of the existing Tarbert station.

The new Kilpaddoge station is necessary to allow for the essential expansion of transmission connections in north Kerry. The existing Tarbert transmission station is being retained. However, due to the age and condition of the assets in

Tarbert station, a project involving the refurbishment of the 220 kV assets is progressing.

Reinforcement of the Transmission Network across the Shannon Estuary between North Kerry and Clare

Projects

- Moneypoint - Kilpaddoge 220 kV New Cable (CP0399) (RegIP/ 117)[58]
- Moneypoint - Knockanure 220 kV Project (CP0726) (RegIP/ 117)[59]

Description

The drivers for these projects are RES integration and security of supply.

The need for reinforcement arises due to the connection of large amounts of wind generation in Kerry, west Cork and west Limerick. This results in higher power flows on the transmission network. Studies have indicated overloading of circuits in the area under single contingency and maintenance-trip conditions.

The new Moneypoint - Kilpaddoge 220 kV cable will relieve constraints and allow for the increased power flows in the Mid-West and South-West that arise from the connection of renewable and conventional generation.

These projects are part of an overall strategy to increase the capacity for the potentially large power flows out of the area. The power will flow north towards Moneypoint and east towards Knockraha transmission stations and onwards to the large demand centres of Cork and Dublin.

Reinforcement of the Transmission Network in Clare

Projects

- Moneypoint 400/ 220/ 110 kV GIS Development (CP0688)
- Ennis - Booltiagh - Tullabrack T - Moneypoint 110 kV Line Uprate (CP0597)
- Ardnacrusha 110 kV Station Redevelopment (CP0054)

[58] Formerly part of TYNDP Project No. 83.

[59] Formerly part of TYNDP Project No. 83.

Description

The drivers for these projects are security of supply and RES integration.

The need for reinforcement arises due to a shortage of transmission capacity and voltage support in the area.

These needs were identified through network studies. These indicated potential overloading and violations of voltage limits in the Clare area under maintenance-trip and single contingency conditions.

The preferred solution to address voltage violations in the area is a new 220/ 110 kV transformer in Moneypoint 400 kV station[60]. The new transformer and the uprate of the Ennis - Booltiagh - Tullabrack T - Moneypoint 110 kV circuit will address the shortage of transmission capacity in the area.

The 400 kV transmission equipment in Moneypoint and the entire Ardnacrusha 110 kV transmission station need to be replaced because of the condition of the assets. These projects will also contribute to facilitating the growing number of renewable generators in west Clare.

Reinforcement of the Transmission Network in West Cork

Projects

- Clashavoon - Dunmanway 110 kV New Line (CP0501)[61]
- Dunmanway 110 kV Station – Busbar Uprate and New Coupler (CP0709)
- Clashavoon - Macroom No. 2 New 110 kV Circuit and Increased Transformer Capacity in Clashavoon (CP0829)

Description

The drivers for these projects are security of supply and RES integration.

The need for the new Clashavoon - Dunmanway and Clashavoon - Macroom 110 kV circuits, and increased transformer capacity in Clashavoon 220 kV station

[60] The recent installation of capacitors at Ardnacrusha and Drumline 110 kV stations are interim solutions to the voltage needs in the area.

[61] More information is available at http://www.eirgridgroup.com/the-grid/projects/clashavoon-dunmanway/the-project/

arises due to a shortage of transmission capacity in the area. Studies have indicated overloading of existing circuits and of a transformer in the area under maintenance-trip conditions. The new Clashavoon - Dunmanway and Clashavoon - Macroom 110 kV circuits will provide other routes into the west Cork area. This will secure supplies to the area and enable export of excess generation.

In addition, the capacity of the existing Dunmanway 110 kV busbar is inadequate for the future potential power flows through the station. Therefore, Dunmanway 110 kV busbar needs to be uprated. A new coupler is also being installed in Dunmanway 110 kV station to improve security of supply in the area and to increase the flexibility of the network.

Reinforcement of the Transmission Network in the Cork City area

Projects

- Raffeen - Trabeg 110 kV No. 1 Line Uprate (CP0830)
- Aghada 220/ 110 kV Station Upgrade (CP0794)
- Knockraha 220 kV Station Upgrade (CP0796)

Description

The driver for these projects is security of supply. Together they will create and maintain the requisite levels of reliability and flexibility in the transmission network.

The need for the Raffeen - Trabeg 110 kV line uprate is due to a shortage of transmission capacity. Studies have indicated overloading of the circuit under single contingency conditions.

The need for the Aghada and Knockraha 220/ 110 kV station upgrade projects arises due to a number of local constraints on the transmission network. Studies have indicated the potential unacceptable loss of generation and voltage violations without these projects. In addition, without these projects, potential overloading of equipment within Aghada station and of circuits in the Cork and Waterford area have been identified.

The Aghada project also involves refurbishment works due to the condition and age of assets in the station.

Reinforcement of the Transmission Network in Limerick

Project

- Killonan 220/ 110 kV Station Redevelopment (CP0624)

Description

The driver for the Killonan 220/ 110 kV project is security of supply.

The Killonan station forms the main bulk supply point for the Mid-West region and is an important node on the network.

The project involves the redevelopment of the entire station. This is required because of the condition and age of the transmission equipment in the station.

Reinforcement of the Transmission Network in the South-West and Mid-West Planning Area for New Generation Connections

Projects

- Clahane 110 kV Station – Reconfiguration works associated with Wind Farm Extension (CP0852)
- Kilpaddoge 220 kV Station – New 110 kV DSO Transformer Bay (CP0925)
- Aughinish 110 kV Station – New 110 kV DSO Transformer Bay (CP0892)
- Charleville 110 kV Station – New 110 kV DSO Transformer Bay (CP0875)
- Cordal 110 kV New Station and Connection to Ballynahulla 220/ 110 kV New Station – New Wind Farm Connections (CP0818)
- Slievecallan 110 kV Station – New Station (CP0926) (NEW)[62]
- Barnadivane 110 kV Station – New Station (CP0930) (NEW)
- Moneypoint 110 kV Station – New 110 kV Transformer Bay (CP0941) (NEW)

[62] Formerly Keelderry Windfarm 110 kV Connection (CP 602), change in project scope

Description

The driver for these projects is RES integration.

The need for reinforcement is because of the requirement for new generation connections. These are the shallow connections for a number of wind farms.

Reinforcement of the Transmission Network in the South-West and Mid-West Planning Area for New and Modified Demand Connections

Projects

- Macroom 110 kV Station – New 110 kV Bay for DSO Connection to Hartnett's Cross 110 kV New Station (CP0041)
- Trabeg 110 kV Station – Uprate 2 110 kV Bays for DSO Transformers (CP0741)
- Cow Cross 110 kV Station – New 110 kV Bay for DSO Transformer (CP0743)
- Midleton 110 kV Station – New 110 kV Bay for DSO Transformer (CP0863)

Description

The driver for these projects is security of supply.

The need for reinforcement is because of the requirement for new and modified demand connections. These projects are the shallow connections for a number of DSO demand connections.

Reinforcement of the Transmission Network in the South-West and Mid-West Planning Area for Reactive Power Support

Projects

- Ballynahulla 220/110 kV Station – New Statcom (CP0934) (NEW)
- Ballyvouskill 220/110 kV Station – New Statcom (CP0935) (NEW)
- Knockanure 220/110 kV Station – New Reactor (CP0936) (NEW)
- Thurles 110 kV Station – New Statcom (CP0933) (NEW)

Description

The driver for these projects is RES integration and security of supply.

The need for reinforcement arises due to a shortage of voltage support across the South West region and around the Thurles area. These needs were identified through network studies.

Both capacitive and inductive reactive support is required in the South West region across three separate 220 kV stations; Knockanure, Ballynahulla and Ballyvouskill. The planned reactive support at the three stations makes up an overall South West regional solution and the works at all three stations are required for the solution to perform adequately.

The need for additional reactive support in the Thurles area is due to the connection of distribution wind farms in the area and heavily loaded transmission lines during contingencies.

Other approved projects

In addition to the network reinforcement projects described above, there are also other approved projects in the South-West and Mid-West planning area, namely:

- Moneypoint - Oldstreet 400 kV Line Refurbishment (CP0824);
- Tarbert - Tralee No. 1 Line Refurbishment (CP0864); and

Future Needs Driving Potential Projects

At the time of the data freeze date there are also projects at earlier stages of development and investigation.

The DSO is considering, in conjunction with us, a new 110 kV station in the Blackpool/ Kilbarry area of Cork City.

We are also currently working on a joint project with the French TSO, RTE, investigating an interconnector between Ireland and France (TYNDP/ 107). The potential connection point is expected to be in the south of the country including this planning area. The main drivers of this future potential project are increased market integration, generation integration and security of supply.

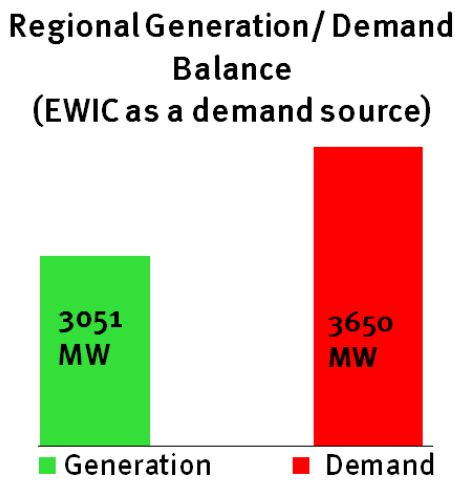
6.4 The South-East, Mid-East and Dublin Planning Area

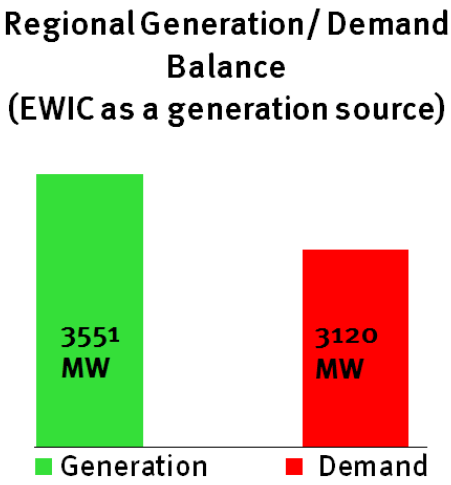
The South-East, Mid-East and Dublin Planning Area Overview

The South-East, Mid-East and Dublin planning area is made up of the following counties categorised by region:

- The South-East: South Tipperary, Waterford, Wexford, Kilkenny and Carlow
- The Mid-East: Wicklow, Kildare and Meath
- Dublin

2026 Forecast Regional Generation and Demand Balance[63,64]





[63] The Forecast Regional Generation and Demand Balance is based on Demand levels published in GCS 2016, and the Generation figures published in the TYTFS 2015.

[64] The EWIC point of connection is in this Region. EWIC can be either a generation or demand source. In the forecast Generation/ Demand balance portrayed in the graph on the left above, EWIC is considered to be a 530 MW demand source (Max. export capacity of EWIC: 530 MW). In the forecast Generation/ Demand balance portrayed in the graph on the right above, EWIC is considered to be a 500 MW Generation Source (Max. import capacity of EWIC: 500 MW)

Summary of TDP Projects	
TDP Project Category	Total no. of Projects
New Build	8
Uprate/ Modify	16
Refurbish/ Replace	8
Other	1
Total	33

Regional Description

The South-East, Mid-East and Dublin planning area has a wide variety of generation sources dispersed around the planning area including pumped storage; gas burning power stations; and the 500 MW East West Interconnector.

The Greater Dublin Area is the major load centre on the Irish transmission network. It accounts for approximately one third of the total Irish demand. In contrast to the other planning areas the South-East, Mid-East and Dublin planning area does not have a substantial excess of generation relative to demand. The existing regional transmission network is comprised of 110 kV, 220 kV and 400 kV infrastructure.

The transmission network has to meet a number of diverse power flows that can vary depending on:

- The generation dispatch;
- Network demand;
- Interconnector flows; and
- Network topology.

The network must accommodate high density demand in the area, and local generation exports. Additionally the network can be subject to high inter-regional power transfers from both north to south and south to north.

The development of the transmission network in the area is characterised by the displacement of thermal generation in Dublin for wind generation. This wind generation is coming from the West and South-West in particular. The effect of this

is an increase in power flows through the South-East.

In addition, we are undertaking a joint project with the French TSO, Réseau de Transport d'Électricité (RTE), to investigate the development of a HVDC interconnector between Ireland and France that could potentially connect along the south coast.

Network reinforcement will be required to cater for the power flows resulting from additional generation and interconnection. This will enable the efficient transfer of power to the load centres of the eastern seaboard and the Dublin area.

There are also reinforcement needs due to ;

- Local constraints related to a shortage of transmission capacity and voltage support;
- Asset condition; and
- To accommodate further market integration.

The projects described in this section will enable the transmission network to safely accommodate more diverse power flows. They will also provide benefits to existing and future users of the transmission network in the planning area and facilitate broad future regional load growth.

The 33 projects in the South-East, Mid-East and Dublin planning area are discussed in more detail below. The status of the network development projects is noted in Appendix C.

Please refer to Figures 5-1 and 5-2 for locational information of planned Network Developments in the South-East, Mid-East & Dublin Planning Area in Phases 2 & 3.

Reinforcement of the Transmission Network between Munster and Leinster

Project

- Regional Solution[65] (formerly Grid Link[66]), comprising:
  - Series Compensation on the existing 400 kV overhead lines that cross the country from Moneypoint in County Clare to Dunstown in County Kildare and Woodland in County Meath. The series compensation devices are planned for:
    - Moneypoint;
    - Oldstreet in County Galway; and
    - Dunstown 400 kV stations.
  - A new underwater cable, across the Shannon estuary. This will run from Moneypoint on the northern bank of the estuary to Kilpaddoge, a new station on the southern bank of the estuary.
  - Uprating the Great Island to Wexford and Great Island to Kilkenny 110 kV circuits.
  - Uprating of the busbar at Wexford 110 kV station.

Description

There is a significant amount of existing, new and contracted conventional and renewable generation connected or seeking to connect in the south and south-west.

As a result, the main flow of electricity in the southern half of the Irish network is from the south and south-west towards the demand centres on the east coast.

Despite the recent drop in electricity demand, there remains a risk to the security of supply in the south - eastern area of the country. This is largely caused by heavy power flows through the network.

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[65] The reinforcements which make up the regional solution are currently in phase 1 (see appendix A for further information) and do not currently have capital approval.

[66] The Grid Link Project (CP0732) (RegIP/ 83) – following comprehensive analyses of overhead, underground and innovative technical solutions for the Grid Link project; we developed and are progressing with the regional solution described above. For more information on the analyses we carried out on Grid Link please refer to our report to the Government appointed Independent Expert Panel, available on our website here.

Network studies indicate the existing network cannot manage such large power flows. Numerous contingency scenarios result in widespread voltage violations and voltage collapse.

Large changes in system voltage can also prevent automatic reclosing of lines. This has a serious impact on circuit availability and system reliability, hence reducing security of supply.

There are also some overloads of transmission circuits. Thus the network between Munster and Leinster needs to be strengthened.

The projects that make up the Regional Solution are currently being progressed through the capital approval process.

Reinforcement of the Transmission Network in the Midlands and South East Regions including Kildare

Project

- Laois - Kilkenny Reinforcement Project (CP0585), comprising:
    - A new 400/ 110 kV station near Portlaoise (looped into the existing Dunstown - Moneypoint 400 kV and Athy - Portlaoise 110 kV lines);
    - A new 110 kV circuit from this station to a new 110 kV station at Ballyragget, Co. Kilkenny;
    - A 80 Mvar 400 kV Shunt Reactor relocated from Dunstown; and
    - A 110 kV uprate to the existing Ballyragget - Kilkenny line which is currently operated at 38 kV[67].

[67] More information is available at http://www.eirgridgroup.com/the-grid/projects/laois-kilkenny/the-project/

Description

This project is required to address quality of supply issues and provide security of supply in Kilkenny, Carlow, Kildare and Laois.

The need for reinforcement arises due to a shortage of transmission capacity and voltage support across the planning area. These needs were identified through network studies. These studies indicated potential violations of voltage limits throughout the area under single contingency conditions and loss of load violations in Kilkenny under maintenance-trip conditions.

The installation of a capacitor in Kilkenny 110 kV station in 2010 was a short term measure to maintain supply standards to the area. The Laois - Kilkenny reinforcement addresses the medium to long term quality and security of supply concerns.

Reinforcement of the Transmission Network in Kildare

Project

- Dunstown 400/ 220 kV Station – New 400/ 220 kV 500 MVA Transformer (CP0683)

Description

This project is required to support the connection of the East West Interconnector. The need for reinforcement arises due to a shortage of transmission capacity in the station. This need was identified through network studies which indicated overloading of the existing transformer in the station under single and maintenance-trip contingency conditions.

Reinforcement of the Transmission Network in the South East

Projects

- Great Island 220 kV Station Redevelopment (CP0623)[68]
- Great Island 110 kV Station Redevelopment (CP0729)

[68] Station complete and cable transfer complete, de-commissioning won't be complete until mid-2016

Description

The driver for these projects is security of supply.

Great Island 220/ 110 kV station is one of the main bulk supply points in the South-East region. A major redevelopment is required due to the condition and age of the assets. These works will involve the development of a new station which will replace the current one.

Reinforcement of the Transmission Network between Limerick and the South Midlands

Projects

- Cauteen - Killonan 110 kV Line Uprate (CP0755)
- Cauteen - Tipperary 110 kV Line Uprate (CP0756)

Description

The driver for these projects is RES integration.

The need for these reinforcements arises due to a shortage of transmission capacity. The capacity of the existing infrastructure is close to being exceeded primarily as a result of the connection of new wind farms.

These needs were identified by network studies which indicated the overloading of a number of existing circuits under single contingency conditions.

Reinforcement of the Transmission and Distribution[69] Networks in the Greater Dublin Area

Projects

- Belcamp 220/ 110 kV Project[70] – New 220/ 110 kV Station to the East of Finglas 220/ 110 kV Station[71] (CP0437)

[69] The DSO operates the 110 kV network in Dublin.

[70] Formerly referred to as "Dublin North Fringe".

[71] More information is available at http://www.eirgridgroup.com/the-grid/projects/dublin-north-fringe/the-project/

- Carrickmines 220/ 110 kV Station – New 4th 220/ 110 kV 250 MVA Transformer and GIS Development (CP0580)
- Finglas 110 kV Station Redevelopment (CP0646)
- Inchicore 220 kV Station Upgrade (CP0692)
- Finglas 220 kV Station Upgrade (CP0792)
- West Dublin New 220/ 110 kV Station (CP0872)[72]

Description

The driver for these projects is security of supply.

The need for reinforcement arises due to local constraints on the transmission and distribution networks. There is a requirement for additional capacity at a number of locations in the Greater Dublin Area due to load growth. This is primarily at:

- The existing Carrickmines 220/ 110 kV station;
- The new Belcamp 220/ 110 kV station to the east of the existing Finglas 220/ 110 kV station; and
- The new West Dublin 220/ 110 kV station between Inchicore and Maynooth 220/ 110 kV stations.

These needs were identified through co-ordinated TSO and DSO network studies. These studies indicated the overloading of a number of existing circuits and transformers under single contingency conditions.

Replacement of substation equipment works are progressing in Inchicore and Carrickmines 220/ 110 kV stations to address the condition and age of the assets. These stations are major bulk supply points in Dublin.

Inchicore and Finglas 220 kV stations also have their own specific needs. The need for these stations' upgrade projects arises due to a number of local constraints on the transmission network.

[72] More information is available at http://www.eirgridgroup.com/the-grid/projects/west-dublin/the-project/

In the case of Inchicore, network studies have indicated that the capacity of some of the existing switchgear is close to being exceeded. While in Finglas 220 kV station, studies have indicated the potential for loss of load without this project.

Reinforcement of the Transmission Network in the Greater Dublin Area

Projects

- Corduff - Ryebrook 110 kV Line Uprate and Ryebrook 110 kV Station Busbar Uprate (CP0668)
- Inchicore - Maynooth No. 1 and 2 220 kV Line Uprate (CP0667)
- Maynooth - Ryebrook 110 kV Line Uprate (CP0747)
- Installation of 100 Mvar Voltage Support in Poolbeg 220 kV Station (CP0760)
- Cloghran - Corduff 110 kV New Cable (CP0859)

Description

The driver for these projects is security of supply.

The need for reinforcement arises due to local constraints on the transmission network. There is a requirement for additional capacity and voltage support in the Dublin region.

The capacity needs were identified by network studies. These indicated the overloading of a number of existing circuits under single and maintenance-trip contingency conditions.

The need for voltage support in the Dublin region was identified through analysis and operational experience. Violations of upper voltage limits at a number of transmission stations were identified.

Reinforcement of the Transmission Network in the South-East, Mid-East and Dublin Planning Area for New and Modified Demand Connections

Projects

- Great Island 220/ 110 kV Station – New 110 kV DSO Transformer Bay for DSO Connection to Knockmullen (New Ross) (CP0490)

- Wexford 110 kV Station – New 110 kV Bay for DSO Transformer and New Coupler (CP0486)
- Ryebrook 110 kV Station Redevelopment (CP0789)
- Baroda 110 kV Station – 2 New 110 kV Bays for DSO Transformers (CP0693)
- Waterford 110 kV Station – Uprate 110 kV Bay (CP0753)
- Cloghran 110kV Station – New Cable Bay and New Transformer Bay (CP0862)
- Great Island 220/ 110 kV Station – New DSO Transformer Bay (CP0894)
- Clonee 220 kV Station – New 220 kV Station to supply a Demand load (CP0927) (NEW)
- Cloghran 110 kV Station – 2 New Transformer Bays – (CP0928) (NEW)

Description

The driver for these projects is security of supply.

The need for reinforcement arises due to the requirement for new and modified demand connections. These are the shallow connections for a number of DSO connections and directly connected large scale transmission demand customers.

Reinforcement of the Transmission Network in the South-East, Mid-East and Dublin Planning Area for New Generation Connections

Projects

- Meath Hill 110 kV Station – Uprate 2 DSO Transformers (CP0914)
- Cauteen 110 kV Station – Busbar expansion and station development (CP0915) (NEW)

Description

The driver for these projects is RES integration. The need for reinforcement arises due to the requirement for new generation connections.

Other approved projects

In addition to the network reinforcement projects described above, there are also other approved projects in the South-East, Mid-East and Dublin planning area, namely:

- Dunstown - Turlough Hill 220 kV Line Refurbishment (CP0798);
- Oldstreet - Woodland 400 kV Line Refurbishment (CP0825);
- Poolbeg 220 kV Station – Fencing (CP0770);
- Dungarvan 110 kV Station – Transmission Works Associated with Installation of New 38 kV GIS (CP0779); and
- Maynooth - Woodland 220kV Line Refurbishment (CP0869).

Future Needs Driving Potential Projects

At the time of the data freeze date there are also projects at earlier stages of development and investigation. We are currently investigating the installation of voltage support in the South-East, Mid-East and Dublin planning area.

The need for voltage support was identified through system wide transmission network studies. Detailed studies on the individual areas requiring support are being undertaken. Future TDPs will report on the specific projects resulting from the detailed studies.

There are also future potential projects to reinforce the transmission network in the Greater Dublin Area. Specifically, the corridors between Dunstown and Woodland 400 kV stations (RegIP/ 84) and between Carrickmines and Dunstown stations[73]. The main driver for these projects is security of supply.

The existing 400 kV network provides a high capacity link between Moneypoint generation station and Galway on the west coast and Dublin on the east. We are currently investigating the expansion of the transmission network in the Greater Dublin Area. This reinforcement could be by the alteration of existing routes and equipment or with new overhead line or cable routes entirely.

[73] This corridor has been identified as an issue; however no solutions have been developed.

A number of new data centre operators have expressed interest in connecting large-scale facilities in the Dublin area.

These proposals would see substantial power loads connecting in this region by 2020 – this would represent a significant increase on current and forecast demand. Depending on the number and scale of projects that materialise, this may require new transmission solutions. We are working to ensure that all reasonable requests for demand can be facilitated.

The DSO is considering, in conjunction with us, a new 110 kV station in the vicinity of Trim, Co. Meath and a new 110kV/ MV installation at Corduff 220/ 110 kV station.

The existing 220 kV circuit between Carrickmines and Arklow currently operates at 110 kV. Together with the DSO we are considering operating this line at 220 kV. We are also assessing the impact of providing an alternative 110 kV connection to Ballybeg 110 kV station.

In addition, the potential connection point for the proposed interconnector between Ireland and France ( TYNDP/ 107) is expected to be in the south of the country, including this planning area. The main drivers of this future potential project are increased market integration, generation integration and security of supply.

7 SUMMARY OF ENVIRONMENTAL APPRAISAL REPORT (EAR)

An Environmental Appraisal Report (EAR) has been prepared as an accompanying document. The purpose of the EAR is to ensure the TDP 2016-2026 is in line with committed strategic environmental objectives. These objectives were set out in the Strategic Environmental Assessment (SEA) for the Grid25 Implementation Programme (IP) 2011-2016[74].

The TDP 2016-2026 includes 116 reinforcement projects that have been approved internally and are on-going. Of these, 103 were presented in TDP 2015, while the other 13 projects are new to TDP 2016.

These 13 projects consist of new builds, refurbishment/ replacement projects and uprate/ modification projects. These new projects are examined in the EAR as the other projects were evaluated against the Strategic Environmental Objectives as part of the 2015-2025 TDP.

The 13 new projects belonging to the three categories of proposed development have been assessed against the Strategic Environmental Objectives (SEOs). Following the implementation of mitigation measures (where necessary) the SEOs will be achieved.

Therefore we consider the TDP 2016-2026 to be in accordance with the provisions of the Grid25 IP and its SEA.

[74] We have started to review and draft the next Implementation Plan and its Strategic Environmental Assessment. These documents should be completed, and adopted in 2017.

APPENDIX A: PROJECT TERMS

This appendix explains terms that are used to describe projects in the following appendices.

Capital Project Number (CP No.): each project is referenced with a Capital Project number for coordination between ourselves and the TAO.

Estimated Completion Date (ECD): the estimates provided are subject to:

- the planning process where applicable;
- the construction progress; and
- availability of transmission outages and commissioning;

and may be liable to change.

Phase: the stage the project has progressed to on the data freeze date. There are three Phases in project development, namely:

Phase 1 involves:

- need identification;
- consideration of solutions;
- selection of the preferred solution(s); and
- internal capital approval

Phase 2 involves:

- outline design;
- EIA;
- public consultation;
- the public planning process; and
- the IA process up to PA with the TAO.

Phase 3 involves:

- detailed design;

- procurement;
- construction;
- commissioning; and
- energisation.

The main focus of the TDP is on projects in Phases 2 and 3. However, in chapter six projects that are in Phase 1 (future potential projects) are described at a high level.

APPENDIX B: CHANGES SINCE TDP 2015

This appendix details the projects:

- Completed or that have changed in scope since TDP 2015; and
- Inactive projects or projects that are on hold as of 31 March 2016.

Projects Completed since TDP 2015

20 projects have been completed since TDP 2015; they are listed in Table B-1

CP No.	Project Title	Date Project Completed
CP0911	Cullenagh - Knockraha Polymeric Insulator Replacement	Q3 2015
CP0736	Cunghill - Sligo 110 kV Line Uprate	Q4 2015
CP0777	Mullingar 110 kV Station - Transmission Works Associated with Installation of New 38 kV GIS	Q4 2015
CP0828	Boggeragh 110 kV Station - New 110 kV Bay	Q4 2015
CP0657	Ikerrin T - Thurles 110 kV Line Uprate and Thurles 110 kV Station - Busbar Uprate and New Coupler	Q2 2015
CP0716	Carrigadrohid - Macroom 110 kV Line Uprate	Q4 2015
CP0627	Bandon 110 kV Station - Uprate 110 kV Bay	Q4 2015
CP0790	Cloghboola 110 kV Station - New Windfarm and New DSO Transformers	Q4 2015
CP0851	Kilbarry 110 kV Station - Uprate Three 110 kV Circuit Breakers	Q4 2015
CP0508	Shelton Abbey 110 kV Station – Protection Upgrade	Q4 2015
CP0705	Woodhouse 110 kV New Station – New Wind Farm Connection	Q2 2015
CP0769	Dunstown - Kellis 220 kV Line Refurbishment	Q4 2015
CP0860	Finglas 220 kV Station - Transformer Replacement Project	Q3 2015

CP0797	Dunfirth - Kinnegad - Rinawade 110 kV Line Refurbishment	Q4 2015
CP0744	Cahir - Tipperary 110 kV Line Uprate and Tipperary 110 kV Station Busbar Uprate	Q4 2015
CP0481	Strategic Spare - 220 kV Mobile Bay	Q3 2015
CP0821	HV Line Tower Painting - North	Q4 2015
CP0727	Balteau CT Replacement at 110 kV and 220 kV	Q1 2016
CP0608	Cloghboola 110 kV New Station and Connection to Trien 110 kV Station – New Wind Farm Connections	Q2 2015
CP0787	Surge Arrestor Replacement – South	Q1 2016

Table B-1 Projects Completed since TDP 2015 (20 Projects)

Projects with a Change of Scope since TDP 2015

Two projects have had a change in scope since TDP 2015, which has resulted in the retiring of their old CP number, and new CP numbers being progressed. These projects are listed in Table B-2 below.

CP No.	Project Title
CP0732	The Grid Link Project (RegIP/ 83)
CP0602[75]	Keelderry Windfarm 110 kV Connection

Table B-2 Projects with a Change of Scope since TDP 2015 (2 Projects)

Projects On Hold

Five projects are on hold as at 31 March 2016; they are listed in Table B-3 below.

[75] This project was inactive in TDP 2015, has since changed in scope and is now referred to as Slievecallan 110 kV Station – New Station (CP0926) (NEW)

CP No.	Project Title	Initiated By	Status
CP0619	Shankill 110 kV Station - Reactive Compensation	TSO	On Hold
CP0404	Mullagharlin 110 kV Station - New 110 kV Transformer Bay	DSO	On Hold
CP0816	North Connacht 110 kV Reinforcement Project	TSO	On Hold
CP0713	Kilbarry 110 kV Station - New 110 kV Bay for Blackpool 110 kV New Station	DSO	On Hold
CP0707	Barrymore 110 kV Station Extension and Loop in	DSO	On Hold

Table B-3 Projects On Hold (5 Projects)

Projects that are Being Managed in Accordance with Customer Connection Agreements[76]

There are six TDP 2015 projects which are no longer active projects, that are being managed in accordance with customer connection agreements. These projects are listed in Table B-4 below.

CP No.	Project Title
CP0641	Nore Power 110 kV Connection
CP0669	Cuilleen Power 110 kV Connection
CP0670	Suir Power 110 kV Connection
CP0609	Glanlee Wind Farm Phase Two
CP0607	Athea Wind Farm Phase Two
CP0874	Booltiagh 110 kV Station Extension

Table B-4 Inactive projects currently being managed in accordance with their connection agreements (6 Projects)

[76] These projects were inactive in TDP 2015 and categorised as projects whose expected energisation dates have yet to be confirmed by the customer.

APPENDIX C: PLANNED NETWORK DEVELOPMENTS

This appendix details active TDP 2016 projects and their driver(s), need(s), location, phase and ECD, as at the data freeze date 31 March 2016. Projects are categorised by planning area[77].

When reviewing the data in this appendix it is important to note the approach to describing the location of projects. If the project involves a circuit then both stations at either end of the circuit, and the counties the stations are located in, are noted. If the counties are in the same Planning Area then the Planning Area is listed only once.

If the project crosses Planning Areas then the multiple Planning Areas are included. If the project refers to a station then only one county and one Planning Area is listed for that project.

Also please note the following labels:

- "(NEW)" included with a project's CP No. signifies that it is a new project that has been approved since TDP 2015;
- "TYNDP/ TYNDP_Project_No" or "RegIP/ RegIP_Project_No" included with a project's title signifies that it is in ENTSO-E's most recent TYNDP[78] or RegIP North Sea. Projects included in the TYNDP are projects of pan-European significance. Projects included in the RegIP North Sea are projects of regional significance. These projects are listed in Appendix D; and
- "*" included with a project's length signifies that the circuit length is an estimate at this time.

[77] Some projects are in, or have the potential to be in, multiple planning areas

[78] TYNDP 2016 is currently in draft version - the draft TYNDP 2016 was recently published for consultation and the finalised version of the document is expected imminently

Data Management

The ECDs for some transmission projects are available and updated on an on-going basis at the following websites:

- Associated Transmission Reinforcements (ATRs) (available here[79])
- On the CER website[80], Transmission Capital Expenditure Monitoring

[79] http://www.eirgridgroup.com/customer-and-industry/general-customer-information/operational-constraints/

[80] http://www.cer.ie/

Projects in Multiple Planning Areas:

There are eight projects that are in multiple Planning Areas; these projects are listed in Table C-1 below.

CPNo.	Project Title	Type	km	DRIVERS			NEEDS					LOCATION		Phase	ECD
				Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition	County/ Counties	Planning Area/s		
CP0755	Cauteen - Killonan 110 kV Line Uprate	Uprate/ Modify	27.9		✓			✓				Tipperary South, Limerick	SE-ME-D, SW-MW	3	2017
CP0596	Kinnegad - Mullingar 110 kV New Circuit	New Build	27*	✓				✓				Meath, Westmeath	B-M-W, SE-ME-D	3	2016
CP0825	Oldstreet - Woodland 400 kV Line Refurbishment	Refurbish/ Replace	126.4	✓							✓	Galway, Tipperary, Offaly, Kildare, Meath	SE-ME-D, B-M-W	3	2017
CP0824	Moneypoint - Oldstreet 400 kV Line Refurbishment	Refurbish/ Replace	102.5	✓							✓	Clare, Galway	SW-MW, B-M-W	2	2019
CP0585	Laois-Kilkenny Reinforcement Project	New Build	30* + 22[81]	✓				✓				Laois, Kilkenny	SE-ME-D, B-M-W	2	2019
CP0466	North South 400 kV Interconnection Development (TYNDP / 81)	New Build	106*	✓	✓	✓	✓	✓		✓		Meath, Cavan, Monaghan, Armagh, Tyrone	B-M-W, SE-ME-D	2	2019
CP0873	Dunstown - Moneypoint 400 kV Line Refurbishment	Refurbish/ Replace	208.5	✓							✓	Clare, Tipperary, Laois Kildare	SE-ME-D, SW-MW, B-M-W	2	2018

[81] 30 km accounts for the proposed new 110 kV circuit between the proposed new 400/110 kV station near Portlaoise and the proposed new 110 kV station at Ballyragget, while 22 km accounts for the proposed 110 kV uprate to the existing Ballyragget – Kilkenny line which is currently operated at 38 kV.

CP0867 (NEW)	Flagford - Louth 220 kV Refurbishment Project	Refurbish/ Replace	110.1	✓							✓	Roscommon, Leitrim, Longford, Cavan, Meath, Louth	B-M-W, SE-ME-D	2	2018

Table C-1 Planned Projects that are in Multiple Planning Areas (8 Projects)

Projects in the Border, Midlands and West Planning Area

There are 39 projects in the Border, Midlands and West Planning Area; these projects are listed in Table C-2 below.

CPNo.	Project Title	Type	km	DRIVERS			NEEDS					Location	Phase	ECD
				Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition	County / Counties		
CP0197	Mount Lucas - Thornsberry New 110kV Line	New Build	30	✓				✓				Offaly, Offaly	3	2017
CP0697	Carrick-on-Shannon 110 kV Station - Busbar Uprate and Other Works	Uprate/ Modify	0	✓	✓			✓			✓	Roscommon	3	2016
CP0724	Thornsberry 110 kV Station - Busbar Uprate	Uprate/ Modify	0	✓				✓				Offaly	3	2017
CP0778	Castlebar 110 kV Station - Transmission Works Associated with Installation of New 38 kV GIS	Refurbish/ Replace	0	✓					✓			Mayo	3	2017
CP0737	Knockranny, Uggool/ Seacon New 110 kV Stations - New Wind Farm Connections	New Build	4.2*		✓				✓			Galway	2	2016
CP0603	Clogher and Mulreavy 110 kV New Stations - New Wind Farm Connections	New Build	7.7*		✓				✓			Donegal, Donegal	3	2016
CP0596	Kinnegad - Mullingar 110 kV New Circuit	New Build	27*	✓				✓				Meath, Westmeath	3	2016

CP0706	Cloon 110 kV Station - New 110 kV Bay	Uprate/ Modify	0	✓					✓			Galway	3	2018
CP0731	Bellacorick - Castlebar 110 kV Line Uprate	Uprate/ Modify	38	✓	✓			✓			✓	Mayo, Mayo	3	2016
CP0740	Letterkenny 110 kV Station - Relocation of 110 kV Bay and 2 New Couplers	Uprate/ Modify	0	✓				✓	✓			Donegal	2	2018
CP0680	Castlebar 110 kV Station - Uprate transformer 110 kV Bay	Uprate/ Modify	0	✓					✓			Mayo	2	2018
CP0466	North South 400 kV Interconnection Development (TYNDP/ 81)	New Build	106*	✓	✓	✓	✓	✓		✓		Meath, Cavan, Monaghan, Armagh, Tyrone	2	2019
CP0645	Portlaoise 110 kV Station - 2 New 110 kV Bays	Uprate/ Modify	0	✓					✓			Laois	2	2021
CP0721	The Grid West Project (RegIP/ 115)	New Build	103-115*		✓			✓	✓			Mayo, Sligo Roscommon	2	2020
CP0799	Louth 220 kV Station Upgrade	Uprate/ Modify	0	✓				✓			✓	Louth	2	2020
CP0800	North West Project - RIDP Phase 1 - Reinforcement of the grid in the north-west (TYNDP/ 82)	New Build	83		✓		✓	✓				Donegal, Leitrim, Sligo	2	2022
CP0819	Bellacorick - Moy 110 kV Line Uprate	Uprate/ Modify	27	✓	✓			✓			✓	Mayo, Mayo	2	2019
CP0833	Tawnaghmore and Moy 110 kV Stations - Mayo Renewable Power Connection	Uprate/ Modify	0		✓				✓			Mayo	3	2016

CP0834	Carrick-on-Shannon 110 kV Station - Uprate Four 110 kV Circuit Breakers	Uprate/ Modify	0	✓							✓	Leitrim	3	2017
CP0835	Coolnabacky - Portlaoise 110 kV Line Uprate	Uprate/ Modify	8.4	✓	✓			✓			✓	Laois, Laois	2	2018
CP0836	Derryiron 110 kV Station - New 110 kV DSO Transformer Bay	Uprate/ Modify	0		✓				✓			Offaly	2	2017
CP0839	Moy 110 kV Station - Reconfiguration and Busbar Uprate	Uprate/ Modify	0	✓	✓			✓			✓	Mayo	2	2019
CP0771	Castlebar 110 kV Station - Busbar Uprate	Uprate/ Modify	0	✓	✓			✓			✓	Mayo	3	2017
CP0849	Cashla 110 kV Station - Uprate Two 110 kV Circuit Breakers	Uprate/ Modify	0		✓			✓				Galway	3	2016
CP0861	Sliabh Bawn 110 kV New Station - New Wind Farm Connection	New Build	1.2		✓				✓			Roscommon	2	2016
CP0837	Bellacorick 110 kV Station - Transformer Uprate	Uprate/ Modify	0		✓				✓			Mayo	2	2017
CP0878	Binbane 110 kV Station - New 110 kV DSO Transformer Bay	Uprate/ Modify	0		✓				✓			Donegal	2	2017
CP0879	Letterkenny 110 kV Station - New 110 kV DSO Transformer Bay	Uprate/ Modify	0		✓				✓			Donegal	2	2017
CP0881	Galway 110 kV Station - Uprate Two 110 kV Circuit Breakers	Uprate/ Modify	0		✓			✓				Galway	2	2016
CP0847	Arva - Shankill No.1 110 kV Line Uprate	Uprate/ Modify	18.6	✓	✓			✓			✓	Cavan, Cavan	2	2017

CP0850	Shranakilly 110 kV New Station - New Wind Farm Connections	New Build	0		✓				✓			Mayo	2	2017
CP0838	Dalton 110 kV Station - New 110 kV DSO Transformer Bay	Uprate/ Modify	0		✓				✓			Mayo	2	2017
CP0870	Carrick-on-Shannon - Arigna T - Corderry 110 kV Line Uprate	Uprate/ Modify	35	✓	✓			✓			✓	Roscommon, Leitrim	2	2017
CP0882	Glenree 110 kV Station - New 110 kV DSO Transformer Bay	Uprate/ Modify	0		✓				✓			Mayo	2	2017
CP0865	Cashla - Salthill 110 kV Line Uprate	Uprate/ Modify	9.4	✓	✓			✓			✓	Galway, Galway	2	2017
CP0644	Bracklone 110 kV New Station & Loop in	New Build	0	◊					◊			Laois	2	2021
CP0951 (NEW)	Garvagh 110 kV Station Redevelopment	Uprate/ Modify	minor		✓				✓			Leitrim	2	2017
CP0976 (NEW)	Portlaoise 110 kV Station – Uprate two DSO Transformers	Uprate/ Modify	0		✓				✓			Laois	2	2017
CP0867 (NEW)	Flagford - Louth 220 kV Refurbishment Project	Refurbish/ Replace	110.1	✓							✓	Roscommon, Leitrim, Longford, Cavan, Meath, Louth	2	2018

Table C-2 Planned Projects in the Border, Midlands and West Planning Area (39 Projects)

Projects in the South-West and Mid-West Planning Area

There are 38 projects in the South-West and Mid-West Planning Area; these projects are listed in Table C-3 below.

				DRIVERS			NEEDS					Location		
CPNo.	Project Title	Type	km	Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition	County / Counties	Phase	ECD
CP0709	Dunmanway 110 kV Station - Busbar Uprate and New Coupler	Uprate/ Modify	0	✓				✓			✓	Cork	3	2016
CP0399	Moneypoint - Kilpaddoge 220 kV New Cable (RegIP/ 117)	New Build	10*	✓	✓		✓	✓				Clare, Kerry	3	2017
CP0500	Knockanure 220/ 110 kV New Station	New Build	1*		✓			✓	✓			Kerry, Limerick	3	2016
CP0501	Clashavoon - Dunmanway 110 kV New Line	New Build	35*	✓	✓			✓				Cork, Cork	3	2017
CP0622	Tarbert 220/110 kV Station Refurbishment	Refurbish/ Replace	0	✓							✓	Kerry	3	2020
CP0763	Kilpaddoge – Knockanure and Ballyvouskil - Clashavoon 220 kV Line Uprates and Kilpaddoge - Tarbert 220 kV Line Refurbishment	Uprate/ Modify	97.3		✓		✓	✓				Cork, Kerry	3	2016
CP0647	Kilpaddoge 220/ 110 kV New Station	New Build	0	✓				✓			✓	Kerry	3	2017

CP0650	Ballyvouskill 220/ 110 kV New Station	New Build	14*		✓			✓	✓			Cork, Cork	3	2016
CP0651	Ballynahulla 220/ 110 kV New Station	New Build	10*		✓			✓	✓			Kerry	3	2016
CP0041	Macroom 110 kV Station - New 110 kV Bay for Hartnett's Cross 110 kV New Station	Uprate/ Modify	0	✓					✓			Cork	2	2019
CP0743	Cow Cross 110 kV Station - New 110 kV Bay	Uprate/ Modify	0	✓					✓			Cork	2	2019
CP0597	Ennis - Booltiagh - Tullabrack T - Moneypoint 110 kV Line Uprate	Uprate/ Modify	50.2	✓	✓			✓				Clare, Clare	2	2017
CP0688	Moneypoint 400/ 220/ 110 kV GIS Development	New Build	0	✓	✓			✓			✓	Clare	3	2017
CP0054	Ardnacrusha 110 kV Station Redevelopment	Refurbish/ Replace	0	✓							✓	Clare	3	2017
CP0824	Moneypoint - Oldstreet 400 kV Line Refurbishment	Refurbish/ Replace	102.5	✓							✓	Clare, Galway	2	2019
CP0794	Aghada 220/ 110 kV Station Upgrade	Uprate/ Modify	0	✓				✓			✓	Cork	3	2016
CP0796	Knockraha 220 kV Station Upgrade	Uprate/ Modify	0	✓				✓				Cork	2	2018
CP0624	Killonan 220/ 110 kV Station Redevelopment	Refurbish/ Replace	0	✓							✓	Limerick	2	2020
CP0726	Moneypoint to Knockanure 220 kV Project (RegIP /117)	New Build	26*		✓		✓	✓				Clare, Kerry	2	2018

CP0818	Cordal 110 kV New Station and Connection to Ballynahulla 220/ 110 kV New Station – New Wind Farm Connections	New Build	0	✓	✓				✓			Kerry	2	2017
CP0830	Raffeen - Trabeg 110 kV No. 1 Line Uprate	Uprate/ Modify	10.4	✓				✓				Cork, Cork	3	2017
CP0829	Clashavoon - Macroom No. 2 New 110 kV Circuit and Increased Transformer Capacity in Clashavoon 220/ 110 kV Station	New Build	6		✓			✓				Cork, Cork	2	2018
CP0883	Ballynahulla - Ballyvouskill and Ballynahulla - Knockanure 220 kV Line Uprates (formerly part of CP0763)	Uprate/ Modify	1.2		✓		✓	✓				Cork, Kerry	2	2017
CP0852	Clahane 110 kV Station - Reconfiguration works associated with Wind Farm Extension	Uprate/ Modify	0		✓				✓			Kerry	3	2016
CP0840	Ballynahulla 220 kV station - Second 220/ 110 kV Transformer	New Build	0	✓	✓			✓	✓			Kerry	2	2017
CP0925	Kilpaddoge 220 kV Station - New 110 kV DSO Transformer Bay	Uprate/ Modify	0		✓				✓			Kerry	2	2017
CP0892	Aughinish 110 kV Station - New 110 kV DSO Transformer Bay	Uprate/ Modify	0		✓				✓			Limerick	2	2017
CP0875	Charleville 110 kV Station - New 110 kV DSO Transformer Bay	Uprate/ Modify	0		✓				✓			Cork	2	2017
CP0863	Midleton 110 kV Station - New 110 kV DSO Transformer Bay	Uprate/ Modify	0	✓					✓			Cork	2	2019

CP0864	Tarbert - Tralee No. 1 110 kV Line Refurbishment	Refurbish/ Replace	41.8	✓							✓	Kerry, Kerry	2	2017
CP0741	Trabeg 110 kV Station - Uprate 2 110 kV Transformer Bays	Uprate/ Modify	0	◊					✓			Cork	2	2020
CP0926 (NEW)	Slievecallan 110 kV Station – New Station	New Build	29.6		✓				✓			Clare	2	2017
CP0930 (NEW)	Barnadivane 110 kV Station – New Station	Uprate/ Modify	Minor		✓				✓			Cork	2	2017
CP0941 (NEW)	Moneypoint 110 kV Station – New 110V Transformer Bay	Uprate/ Modify	Minor		✓				✓			Clare	2	2017
CP0933 (NEW)	Thurles 110 kV Station – New Statcom	New Build	0	✓	✓			✓				N Tipperary	2	2020
CP0934 (NEW)	Ballynahulla 110 kV Station – New Statcom	New Build	0	✓	✓			✓				Kerry	2	2020
CP0935 (NEW)	Ballyvouskill 110 kV Station – New Statcom	New Build	0	✓	✓			✓				Cork	2	2020
CP0936 (NEW)	Knockanure 110 kV Station – New Reactor	New Build	0	✓	✓			✓				Kerry	2	2018

Table C-3 Planned Projects in the South-West and Mid-West Planning Area (38 Projects)

Projects in the South-East, Mid-East and Dublin Planning Area

There are 33 projects in the South-East, Mid-East and Dublin Planning Area; these projects are listed in Table C-4 below.

CPNo.	Project Title	Type	km	DRIVERS			NEEDS					Location	Phase	ECD
				Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition	County / Counties		
CP0753	Waterford 110 kV Station - Uprate 110 kV Bay	Uprate/ Modify	0	✓					✓		✓	Waterford	3	2016
CP0623	Great Island 220 kV Station Redevelopment	Refurbish/ Replace	0	✓							✓	Wexford	3	2016
CP0667	Inchicore - Maynooth No. 1 and No. 2 220 kV Line Uprate	Uprate/ Modify	38	✓				✓			✓	Dublin, Kildare	3	2016
CP0683	Dunstown 400/ 220 kV Station - New 400/ 220 kV 500 MVA Transformer	New Build	0			✓		✓		✓		Kildare	3	2016
CP0747	Maynooth - Ryebrook 110 kV Line Uprate	Uprate/ Modify	9	✓				✓				Kildare, Kildare	3	2016
CP0668	Corduff - Ryebrook 110 kV Line Uprate and Ryebrook 110 kV Station Busbar Uprate	Uprate/ Modify	8	✓				✓				Dublin, Kildare	3	2016
CP0798	Dunstown - Turlough Hill 220 kV Line Refurbishment	Refurbish/ Replace	25.2	✓							✓	Kildare, Wicklow	3	2016

CP0770	Poolbeg 220 kV Station - Fencing	Other	0	✓							✓	Dublin	2	2016
CP0779	Dungarvan 110 kV Station - Transmission Works Associated with Installation of New 38 kV GIS	Refurbish/ Replace	0	✓					✓			Waterford	3	2017
CP0486	Wexford 110 kV Station - New 110 kV Transformer Bay and New Coupler	Uprate/ Modify	0	✓				✓	✓			Wexford	2	2020
CP0756	Cauteen - Tipperary 110 kV Line Uprate	Uprate/ Modify	13		✓			✓				Tipperary South, Tipperary South	3	2017
CP0755	Cauteen - Killonan 110 kV Line Uprate	Uprate/ Modify	27.9		✓			✓				Tipperary South, Limerick	3	2017
CP0729	Great Island 110 kV Station Redevelopment	Refurbish/ Replace	0	✓							✓	Wexford	2	2017
CP0789	Ryebrook 110 kV Station Redevelopment	Refurbish/ Replace	0	✓					✓			Kildare	3	2016
CP0490	Great Island 220/ 110 kV Station - New 110 kV DSO Transformer Bay for DSO Connection to Knockmullen (New Ross)	Uprate/ Modify	0	✓					✓			Wexford	2	2019
CP0646	Finglas 110 kV Station Redevelopment	Refurbish/ Replace	0	✓				✓			✓	Dublin	3	2018
CP0760	Installation of 100 Mvar Reactive Support in Dublin Region	New Build	0	✓				✓				Dublin	2	2017
CP0580	Carrickmines 220/ 110 kV Station - New 4th 220/ 110 kV 250 MVA Transformer and GIS Development	New Build	0	✓				✓			✓	Dublin	3	2017
CP0792	Finglas 220 kV Station Upgrade	Uprate/ Modify	0	✓				✓			✓	Dublin	2	2018

CP0585	Laois-Kilkenny Reinforcement Project	New Build	30* + 22[82]	✓				✓				Laois, Kilkenny	2	2019
CP0825	Oldstreet - Woodland 400 kV Line Refurbishment	Refurbish/ Replace	126.4	✓							✓	Galway, Tipperary, Offaly, Kildare, Meath	3	2017
CP0437	Belcamp 220/ 110 kV Project - New 220/ 110 kV Station to the East of Finglas 220/110 kV Station	New Build	10*	✓				✓	✓			Dublin	3	2017
CP0693	Baroda 110 kV Station - 2 New 110 kV Bays	Uprate/ Modify	0	✓					✓			Kildare	2	2020
CP0692	Inchicore 220 kV Station Upgrade	Uprate/ Modify	0	✓				✓			✓	Dublin	2	2020
CP0859	Cloghran - Corduff 110 kV New Cable	New Build	2.5	✓				✓	✓			Dublin, Dublin	3	2016
CP0862	Cloghran 110 kV Station - New Cable Bay and New Transformer Bay	Uprate/ Modify	0	✓					✓			Dublin	2	2016
CP0894	Great Island 220 kV Station - New DSO 110/ 38 kV Transformer	Uprate/ Modify	0	✓					✓			Wexford	2	2020
CP0872	West Dublin New 220/ 110 kV Station	New Build	0	✓				✓	✓			Dublin	2	2019
CP0869	Maynooth - Woodland 220 kV Line Refurbishment	Refurbish/ Replace	22.3	✓							✓	Dublin, Dublin	2	2017

[82] 30 km accounts for the proposed new 110 kV circuit between the proposed new 400/110 kV station near Portlaoise and the proposed new 110 kV station at Ballyragget, while 22 km accounts for the proposed 110 kV uprate to the existing Ballyragget – Kilkenny line which is currently operated at 38 kV.

CP0914	Meath Hill 110 kV Station – Uprate 2 DSO Transformers	Uprate/ Modify	0		✓				✓			Meath	2	2016
CP0927 (NEW)	Clonee 220kV Station – New 220 kV Station to supply a demand load	New Build	1.4	✓					✓			Meath	2	2017
CP0928 (NEW)	Cloghran Phase 3, Cloghran 110 kV Station – 2 New Transformers and cables	Uprate/ Modify	0.7	✓					✓			Dublin	2	2016
CP0915 (NEW)	Cauteen 110 kV Station – Busbar expansion and station development	Uprate/ Modify	0		✓				✓			S Tipperary	2	2017

Table C-4 Planned Projects in the South-East, Mid-East and Dublin Planning Area (33 Projects)

National Programmes

There are six national programmes each with elements at various locations around the country; they are listed in Table C-5 below.

CPNo.	Project Title	Type	km	DRIVERS			NEEDS					Phase	ECD
				Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition		
CP0752	HV Line Tower Painting - South	Refurbish/ Replace	0	✓							✓	3	2015
CP0788	Micafil Bushings Replacement	Refurbish/ Replace	0	✓							✓	3	2015
CP0786	Surge Arrestor Replacement - North	Refurbish/ Replace	0	✓							✓	3	2016
CP0322	Protection Upgrades at Various Stations	Refurbish/ Replace	0	✓							✓	3	2016
CP0857	Paint Towers Nationwide	Refurbish/ Replace	0	✓							✓	3	2016
CP0757	Remote Control for NCC Phase 3	Other	0	✓								2	2016

Table C-5 Planned National Projects at various locations (6 Projects)

APPENDIX D: IRISH PROJECTS IN EUROPEAN PLANS[83]

How are Irish transmission projects included in ENTSO-E's TYNDP?

Licensed TSOs, who are members of ENTSO-E, and third party promoters propose transmission projects to ENTSO-E for inclusion in ENTSO-E's TYNDP. If these projects match the project of pan-European significance criteria below, they are included in the TYNDP.

Criteria for inclusion in TYNDP

A project of pan-European significance is a set of Extra High Voltage assets, matching the following criteria:

- The main equipment is at least 220 kV if it is an AC overhead line or at least 150 kV otherwise and is, at least partially, located in one of the 34 countries represented within ENTSO-E;
- The project increases the grid transfer capability across a network boundary within the ENTSO-E interconnected network[84] or at its borders[85];
- The grid transfer capability increase (expressed in MW) meets at least one of the following minimums:
    - At least 500 MW of additional Net Transfer Capacity; or
    - Connecting or securing output of at least 1 GW/ 1000 km² of generation; or
    - Securing load growth for at least 10 years for an area representing consumption greater than 3 TWh/ year.

[83] For the avoidance of doubt, the term "Irish Projects in European Plans" refers to Irish projects in ENTSO-E's TYNDP and RegIP NS and Irish projects designated Projects of Common Interest.

[84] For example, additional Net Transfer Capacity between two market areas.

[85] That is, increasing the import and/or export capability of ENTSO-E countries in relation to others.

EirGrid Projects in TYNDP 2016 and RegIP NS 2015

Tables D-1 and D-2 below list the Irish projects we have proposed, that are in ENTSO-E's most recent TYNDP[86] 2016 and RegIP NS 2015 respectively.

Projects which have a CP No. in the table below have achieved internal capital approval and are also listed in Appendix C above. Projects which are labelled "n/a" are currently conceptual and are under investigation.

TYNDP No.	CP No.	Project Title
81	CP0466	North South 400 kV Interconnection Development
82	CP0800[87]	Renewable Integration Development Project (RIDP)
107	n/a	Ireland - France Interconnector (Celtic Interconnector)

Table D-1 Our projects in European TYNDP 2016

CP No.	Project Title
CP0732	The Grid Link Project[88]
n/a	Project to Reinforce the Greater Dublin Area (Dunstown - Woodland corridor)
CP0721	The Grid West Project
CP0399 CP0726	Shannon Crossings: Moneypoint - Kilpaddoge 220 kV New Cable Moneypoint - Knockanure 220 kV Project

Table D-2 Our projects in European RegIP NS 2015

[86] TYNDP 2016 is currently in draft version - the draft TYNDP 2016 was recently published for consultation and the finalised version of the document is expected imminently

[87] CP0800 is the North West Project only i.e. the first phase of RIDP.

[88] This project has changed in scope and we are progressing with a new innovative Regional Solution

Third Party Projects in TYNDP 2016

Table D-3 below lists the Irish projects proposed by third parties that are included in ENTSO-E's TYNDP[89] 2016.

TYNDP No.	Project Title
189	Irish Scottish Links on Energy Study (ISLES)
286	Greenlink
287	Greenwire South
289	Marex UK-Ireland
290	Greenwire North
292	Greenconnect

Table D-3 Third Party projects in European TYNDP 2016

[89] TYNDP 2016 is currently in draft version - the draft TYNDP 2016 was recently published for consultation and the finalised version of the document is expected imminently

Irish Projects of Common Interest (PCIs)[90]

The EC oversees the designation of Projects of Common Interest (PCI). To be eligible for PCI status, inclusion in the last available TYNDP is an explicit condition. Table D-4 below lists the Irish Projects of Common Interest.

PCI No.	TYNDP No.	Project Title
2.13.1	81	North South 400 kV Interconnection Development
2.13.2	82	Renewable Integration Development Project (RIDP)
1.6	107	Ireland - France Interconnector (Celtic Interconnector)
1.9.2	189	Irish - Scottish Isles
1.9.1	286	Greenlink IE-GB

Table D-4 Irish Projects of Common Interest

Irish e-Highway 2050 projects[91]

The e-Highway2050 is a study project funded by the EC aimed at building a development plan for the European transmission network from 2020 to 2050. The development plan supports the EU's overall policy objectives with regard to energy and decarbonising the European economy. Table D-5 below lists the Irish projects included in the e-Highway 2050 plan.

[90] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOL_2016_019_R_0001&from=EN

[91] http://www.e-highway2050.eu/e-highway2050/

TYNDP No.	Project Title
81	North South 400 kV Interconnection Development
82	Renewable Integration Development Project (RIDP)
107	Ireland - France Interconnector (Celtic Interconnector)

Table D-5 Irish projects in e-Highway 2050 plan

How are Irish and European Plans related?

It is worth highlighting how the Irish TDP and the European plans and designations are related. Figure D-1 below illustrates the relationship. All our capital projects, irrespective of size, are described in the TDP.

Only high voltage projects that involve a large increase in transmission capacity are included in European plans. Of those only a small number of large cross border projects which increase the import and/ or export capability of ENTSO-E countries are designated Projects of Common Interest.

Figure D-1 Relationship between Irish and European Plans

APPENDIX E: REFERENCES

Our published documents

I. TDP 2012, July 2013

II. TDP 2015, March 2016

III. TSSPS, May 2016

IV. Grid25 - Grid Development Strategy, October 2008

V. Grid Development Strategy Review - Your Grid, Your Views, Your Tomorrow, March 2015

VI. Ireland's Grid Development Strategy – Your Grid, Your Tomorrow, January 2017

VII. All Island TYTFS 2015-2024, May 2016

VIII. Grid25 IP, May 2012

IX. Strategic Environmental Assessment, May 2012

ENTSO-E published documents

X. Draft TYNDP 2016 for public consultation, consultation closed in September 2016

XI. RegIP North Sea, October 2015

National Legislation

XII. Electricity Regulation Act, 1999

XIII. Planning and Development Act, 2000 (as amended)

XIV. Strategic Infrastructure Act, 2006

XV. Statutory Instrument No. 445 of 2000, European Communities (Internal Market in Electricity) Regulations

XVI. Statutory Instrument No. 60 of 2005, European Communities (Internal Market in Electricity) Regulations

XVII. Statutory Instrument No. 147 of 2011, European Communities (Renewable Energy) Regulations

European Legislation

XVIII. Birds and Natural Habitats Regulations, 2011

XIX. Cross-border Exchanges in Electricity Regulation (EC) No 714/ 2009

XX. Environmental Impact Assessment Directive

XXI. Habitats Directive

XXII. Internal Market in Electricity Directive 2009/ 72/ EC

XXIII. Promotion of the Use of Energy from Renewable Resources Directive 2009/ 28/ EC

XXIV. Energy Efficiency Directive 2012/ 27/ EC

C.E.R. published documents

XXV. TSO Licence granted to EirGrid

XXVI. CER/ 15/ 296; Decision on TSO and TAO Transmission Revenue for 2016 to 2020, December 2015

Government published documents

XXVII. National Spatial Strategy for Ireland 2002-2020, November 2002

XXVIII. Energy White Paper, 2015

XXIX. Government Policy Statement on the Strategic Importance of Transmission and Other Energy Infrastructure, July 2012