Appendix 2

DRAFT Transmission Development Plan Northern Ireland 2020-2029

Disclaimer

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Information in this document does not amount to a recommendation as regards to any possible investment. Before taking a business decision based on the content of this document, we advise that interested parties seek separate and independent opinion in relation to the matters covered by this document.

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DOCUMENT STRUCTURE

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 Northern Ireland (TDPNI) is outlined.

Section 2: Strategy for Developing the Grid: describes the overall strategy followed when developing the grid and the key strategic considerations when identifying reinforcements.

Section 3: General Approach to Developing the Grid: describes our approach to the network planning process and how we plan the development of the transmission network.

Section 4: Implementation: describes how the strategy for developing the grid will be implemented. This section is based on policies and objectives derived from Section 3.

Section 5: 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.

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Section 7: Project Description: summarises and categorises the development projects that are currently in progress by location.

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Appendix A: Project Terms

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ABBREVIATIONS and GLOSSARY OF TERMS

Abbreviations

AA	Appropriate Assessment
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
EU	European Union
GCS	Generation Capacity Statement
GIS	Gas Insulated Switchgear
GW	Gigawatt
HV	High Voltage
HVDC	High Voltage Direct Current
MW	Megawatt
NIE Networks	Northern Ireland Electricity Networks
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
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
Utility Regulator	Utility Regulator for Northern Ireland

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 (DSO)	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.
	The DSO in Northern Ireland is Northern Ireland Electricity Networks (NIE Networks). NIE Networks is also the asset owner of the Northern Ireland distribution system.
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).
Generation Dispatch	The configuration of outputs from the connected generation units.
Grid	A network of high voltage lines and cables (275 kV and 110 kV, and in future 400 kV) used to transmit bulk electricity supplies around Northern Ireland. The terms grid, electricity transmission network, and transmission system are used interchangeably in this Development Plan.
Interconnector	The electrical link, facilities and equipment that connect the transmission network of one EU member state to another.

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. Depending on its installation and configuration, it is typically employed on the electrical network to either: • limit short circuit levels; or • prevent voltage rise.
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.
SONI	The independent statutory electricity Transmission System Operator in Northern Ireland.
Summer Valley	The annual minimum electrical demand that usually occurs in August. Annual minimum demand is typically 30 % of the winter peak.
Summer Peak	The week-day peak electrical demand value between March and September, inclusive, which is typically 79 % 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 (TSSPS)	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.
Transmission Asset Owner (TAO)	In the electrical power business, a transmission asset owner is the entity which owns all of the assets associated with the transmission system, including substations, cables, overhead lines and associated structures. The TAO is responsible for the condition of transmission assets and thus all asset replacement projects. The TAO in Northern Ireland is Northern Ireland Electricity Networks.
Transmission System Operator (TSO)	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.

SONI is the TSO for Northern Ireland.

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 reference to winter 18 covers the period from October 2018 to February 2019. The winter peak figures take account of the impact of projected Demand-Side Management initiatives.

EXECUTIVE SUMMARY

SONI is the Electricity System Operator for Northern Ireland, we plan and operate the electricity system, the single electricity wholesale market (all-island) and manage the flows on interconnectors with our neighbours.

We ensure that electricity is always available when and where it's needed, every second of every day and for decades to come. We do this in the most cost-effective way possible and in the interests of all electricity users across Northern Ireland. We do so to meet the needs of all consumers, rather than pursue our own commercial interests.

SONI is an independent entity, with no vested interest in the generation or selling of electricity. We don't own the grid infrastructure and have no self interest in adding to it. We work every day with Northern Ireland Electricity Networks who build, own and maintain the grid transmission assets.

SONI is regulated by the Utility Regulator for Northern Ireland who determines our funding.

We play a key role in Northern Ireland's economic development, delivering a safe, secure and efficient electricity supply; which is important for Northern Ireland business and for foreign direct investment. In order to ensure Northern Ireland continues to have a reliable and high quality power supply SONI must continue to upgrade and improve the Northern Ireland transmission grid.

Our New Purpose

SONI's work is not limited to supporting economic benefit for Northern Ireland. The environment and our society are at the heart of what we do and as such, we are committed to delivering a clean energy system as a direct response to the climate crisis.

By strengthening the electricity grid, by connecting green energy projects and through our world leading innovation in managing electricity from renewable schemes, we have made a significant contribution to Northern Ireland meeting its 2020 renewable electricity targets a year in advance of the timeline.

To build on this momentum we need a strong, resilient and flexible transmission grid. By having this we can help deliver the Economy Minister's ambition of at least 70% electricity from renewables by 2030.

Our new corporate strategy outlines our commitment to transforming the power system for future generations[1].

SONI has a unique role to play in making the grid ready for Northern Ireland's low carbon future. This document, The Transmission Development Plan Northern Ireland (TDPNI) 2020-2029 is the blueprint for the development of the transmission network and interconnection over the next ten years.

[1] www.soni.ltd.uk/strategy2025

This ten-year plan presents projects that are expected to meet the operational needs 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 Article 22 of European Directive 72/2009 and Conditions 18 and 40 of the SONI Transmission System Operator Licence.

We welcome your views and encourage your participation in our consultation which runs from 10 November 2020 to 11 December 2020. For more information on how you can give us your feedback please visit www.soni.ltd.uk/the-grid/projects/tdpni/the-project/

Drivers of Transmission Network Development

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

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

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

- Facilitating the economic and efficient 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 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. SONI and NIE Networks are obliged to develop an economic, efficient and coordinated transmission system.[3]

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. This is the responsibility of NIE Networks.

Reinforcement drivers and needs can be separated into a number of categories:

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

SONI are currently changing the way we develop the grid through the production of 'Tomorrow's Energy Scenarios Northern Ireland' (TESNI)[4], a new approach which

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

[3] The Electricity (Northern Ireland) Order 1992, Article 12

[4] http://www.soni.ltd.uk/newsroom/press-releases/tesni-2020/index.xml

involves developing a range of possible energy scenarios dealing with renewables and the electrification of heat and transport.

In the process of developing the range of energy scenarios, key policy makers, industry experts, and stakeholders are asked how they see the energy landscape changing over time. The final scenarios are published and reviewed every two years. These scenarios will act as an input to our grid development process, aid in the identification of system needs and the practicality and merit of different solutions. The first TESNI was published in 2020 and can be seen on the SONI website[4].

Transmission Network Reinforcements

This development plan considers the 79 projects that are planned. Of this, 43 are NIE Networks asset replacement projects, and 36 are network development projects. Since the TDPNI 2019-2028:

- 1 project has been initiated;
- 2 projects have been cancelled; and
- 4 projects have been reviewed and consolidated into 2 projects.

Details of these projects can be seen in Section 1.7.

The network development projects are shown by region and project category in Table E-1 below.

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

Network Development Projects by Planning Area				
Project Category	**North and West**	**South-East**	**Projects in Both Areas**	**TOTAL**
New Build	10	6	0	16
Uprate/ Modify	7	7	4	18
Refurbish/ Replace	0	0	0	0
Combination	0	2	0	2
TOTAL	17	15	4	36

As well as the project categories detailed in Table E-1, Appendix B highlights the drivers and needs of each project. Changes to projects including costs are described in Section 7.

Capital Expenditure

SONI's expenditure on transmission development projects due for completion over the period 2020 – 2029 is estimated at £37.3 million, of which £9.9 million has been spent already. This figure is the amount required to bring projects to the point of handover to NIE Networks. The projects are subject to SONI's governance procedures. Estimated TAO costs associated with these projects are £497.2 million. The Utility Regulator will determine the amount that can eventually be recovered from customer and generator tariffs for these projects.

The Utility Regulator has already approved expenditure for asset replacement of £43.3 million for NIE Networks for the period 2017-2024[5]. There are three further asset replacement projects sitting outside this mechanism with indicative costs estimated at £73.4 million[6]. Asset replacement projects currently planned after RP6 are estimated to cost £59.7 million, subject to the Utility Regulator's determination of next NIE Networks price control (RP7). Total estimated asset replacement costs over the ten years covered by this plan are approximately £215 million.

The total estimated cost of all projects described in the TDPNI 2020-2029 is £750 million.

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 TDPNI 2020 is 1 July 2020.

Strategic Environmental Assessment

The TDPNI 2018-2028 was subject to Strategic Environmental Assessment[7] (SEA) and Appropriate Assessment[8] (AA) (see section 3.5.3). An Environmental Appraisal Report (EAR) was carried out on TDPNI 2020-2029 to assess the

[5] See the NIE Networks RP6 final determination: https://www.uregni.gov.uk/nie-networks-rp6. Please note that the costs reported in the RP6 final determination are from 2015-16 and have been adjusted for inflation in this TDPNI for 2020.

[6] Coolkeeragh – Magherafelt 275 kV refurbishment, Ballylumford – Eden 110 kV Refurbishment and Ballylumford 110 kV switchboard replacement

[7] EU Directive (2001/42/EC) Strategic Environmental Assessment is a requirement for certain plans and programmes.

[8] EU Habitats Directive: Council Directive 92/43/EEC of 21st May 1992 on the conservation of natural habitats and of wild fauna and flora

Plan against the adopted SEA statement. This EAR accompanies the TDPNI and the main findings have influenced and are incorporated into the Plan.

1 INTRODUCTION

The Northern Ireland transmission system is a network of 275 kV and 110 kV (and in future 400 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 to everyday life and to the local economy, and a reliable electricity network is the means by which we move electricity around Northern Ireland. The development of transmission network infrastructure is, therefore, of strategic importance.

This TDPNI outlines the:

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

1.1 Statutory and Legal Requirements

Regulations that are relevant to planning the transmission network include:

1.1.1 Statutory and Licence Requirements

- The Electricity Order (Northern Ireland) 1992:
  - Article 12.
- The Electricity Safety, Quality and Continuity Regulations (Northern Ireland) 2012.
- The Construction (Design and Management) Regulations (NI) 2016.
- SONI's TSO Licence:
  - Condition 18 – Transmission Interface Arrangements

- Condition 20 – Operation of the Transmission System and the System Security and Planning Standards
- Condition 40 – Transmission Development Plan NI

- NIE Networks Transmission Licence:
  - Condition 19 – Developing and Maintaining the Transmission System

1.1.2 European Statutory Requirements

- Regulation (EC) No 714/ 2009 on conditions for access to the network for cross-border exchanges in electricity:
  - Article 4; Article 8 paragraph 3(b); Article 12.
- Directive 2009/ 72/ EC concerning common rules for the internal market in electricity:
  - Paragraphs 1 and 4 of Article 22.
- Directive 2009/ 28/ EC on the promotion of the use of energy from renewable sources:
  - Paragraph 2 of Article 16.
- Directive 2012/ 27/ EC on energy efficiency:
  - Paragraph 5 of Article 15.

SONI is responsible for the planning and operation of the transmission network within Northern Ireland. We have a licence obligation to produce both a TDPNI annually and to contribute to a European Ten-Year Network Development Plan (TYNDP) every two years.

NIE Networks is responsible for the development and maintenance of the transmission system[9], including asset replacement projects, in accordance with the

[9] NIE Networks Transmission Licence, Condition 19. Available here: https://www.uregni.gov.uk/sites/uregni/files/media-files/NIE%20Transmission%20Licence%20effective%202%20October%202017.pdf

Transmission Interface Arrangements (TIA)[10]. SONI reviews all asset replacement proposals and these are incorporated in this Plan.

1.2 Context of the Plan

This TDPNI covers a period of ten years which, as well as being a statutory requirement under our licence, is in line with the European Network of Transmission System Operators for Electricity's (ENTSO-E) TYNDP. As part of the preparation of the TDPNI, we consult with EirGrid as TSO in Ireland and with NIE Networks in compliance with the licence condition. SONI is obliged to undertake a public consultation on the draft TDPNI. Following feedback received from the public consultation we update the TDPNI, as required, and provide a report to the Utility Regulator on feedback received. We prepare the final version of the TDPNI and submit it to the Utility Regulator for approval. A public consultation on the TDPNI is held by the Utility Regulator for Northern Ireland before approval[11].

This TDPNI, TDPNI 2020-2029, has been assessed against the adopted SEA statement through the accompanying Environmental Appraisal Report (EARA Strategic Environmental Assessment (SEA) was undertaken on TDPNI 2018-2027 under the provisions of the European Communities Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (SEA Directive) as transposed through the Environmental Assessment of Plans and Programmes Regulations (Northern Ireland) 2004 (S.R. 280/2004). A Habitat Regulations Assessment (HRA) was also prepared (Council Directive 92/43/EEC,

[10] These are described in section 3.3

[11] Directive 2009/28/EC, Article 22, Paragraph 4: *"The regulatory authority shall consult all actual or potential system users on the ten-year network development plan in an open and transparent manner. Persons or undertakings claiming to be potential system users may be required to substantiate such claims. The regulatory authority shall publish the result of the consultation process, in particular possible needs for investments."*

and Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995). The SEA aims to provide a high level of protection for the environment and to promote sustainable development. The SEA and HRA are anticipated to be valid for five years.

The Transmission Asset Owner (TAO), NIE Networks, is responsible for the detailed design and construction of projects. NIE Networks is also responsible for delivering asset replacement projects.

The development of the transmission network involves forecasting future needs. Solutions chosen to address these needs must maintain security and quality of supply within standards, while balancing costs and environmental impacts. The process is flexible to enable the long-term development of the network, and derogations against standards can be obtained in exceptional circumstances.

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

1.2.1 All-Island and European Context

Our TSO licence obliges us to carry out transmission planning on a coordinated all-island basis in conjunction with EirGrid. This requirement is met by the System Operator Agreement in place between SONI and EirGrid. Together we now publish All-Island Generation Capacity and Ten Year 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 EirGrid 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 Ten Year Network Development Plan (TYNDP).

Projects of pan-European and regional significance[12] are identified in the TDPNI using the following labels: "TYNDP/ TYNDP_Project_No" or "RegIP/ RegIP_Project_No". The most recent final versions of TYNDP[13] and RGNS RegIP[14] were issued in 2018 and 2017 respectively. Northern Ireland projects in European plans are listed in Appendix C.

1.2.2 United Kingdom's Departure from the European Union

The departure of the United Kingdom from the European Union in January 2020 has presented uncertainties for the single electricity market on the island of Ireland.

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 Northern Ireland, Great Britain and Ireland on energy matters. This TDPNI is based on the most up-to-date information available at the freeze date of 01 July 2020. Future TDPNIs will reflect any change in Northern Ireland's relationship with the EU.

1.3 Period Covered by the TDPNI 2020-2029

TDPNI 2020-2029 presents our view of future transmission needs and our plan to develop the network through specific projects to meet these needs over the next

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

[13] TYNDP 2018 can be found here: https://tyndp.entsoe.eu/tyndp2018/

[14] https://docstore.entsoe.eu/Documents/TYNDP%20documents/TYNDP2018/rgip_NS_Full.pdf

ten years. It also includes NIE Networks' view of asset replacement needs on the transmission system, including those provided for through its price control.

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 TDPNIs. As such, the long-term development of the network is under review on an on-going basis, and at least every year.

This TDPNI 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.

1.4 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 TDPNI summarises transmission projects applicable as at the data freeze date, 1 July 2020. Future TDPNIs will highlight the changes that have happened since the previous plan.

1.5 Planning Area Categorisation

Power flows on the transmission network are not contained within specific localities. Therefore, from a transmission planning viewpoint, it is more appropriate to represent planning areas that best reflect the conditions and power flows on the transmission network. For this purpose we refer to two planning areas in Northern Ireland:

- The North and West; and
- The South-East.

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

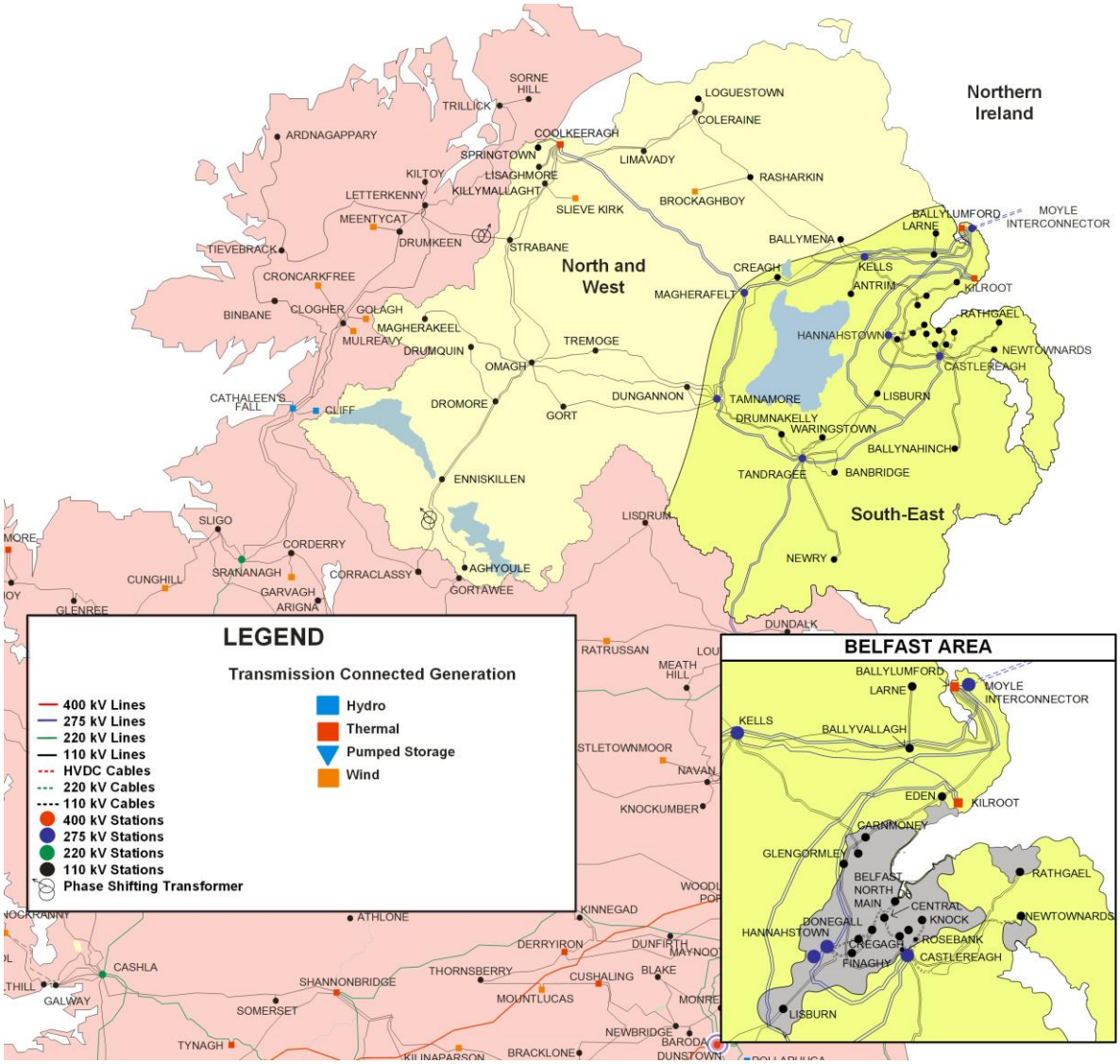


Figure 1-1 Illustration of the Northern Ireland planning areas

1.6 The TDPNI and Other EirGrid Group Publications

SONI and EirGrid are responsible for the publication of a number of statutory documents under their respective TSO licences. Two of these documents (the Generation Capacity Statement and the Ten Year Transmission Forecast Statement) are published on an all-island basis by both TSOs.

The other statutory documents published by both SONI and EirGrid are detailed below. Figure 1-2 shows the relationships between the statutory documents published by SONI.

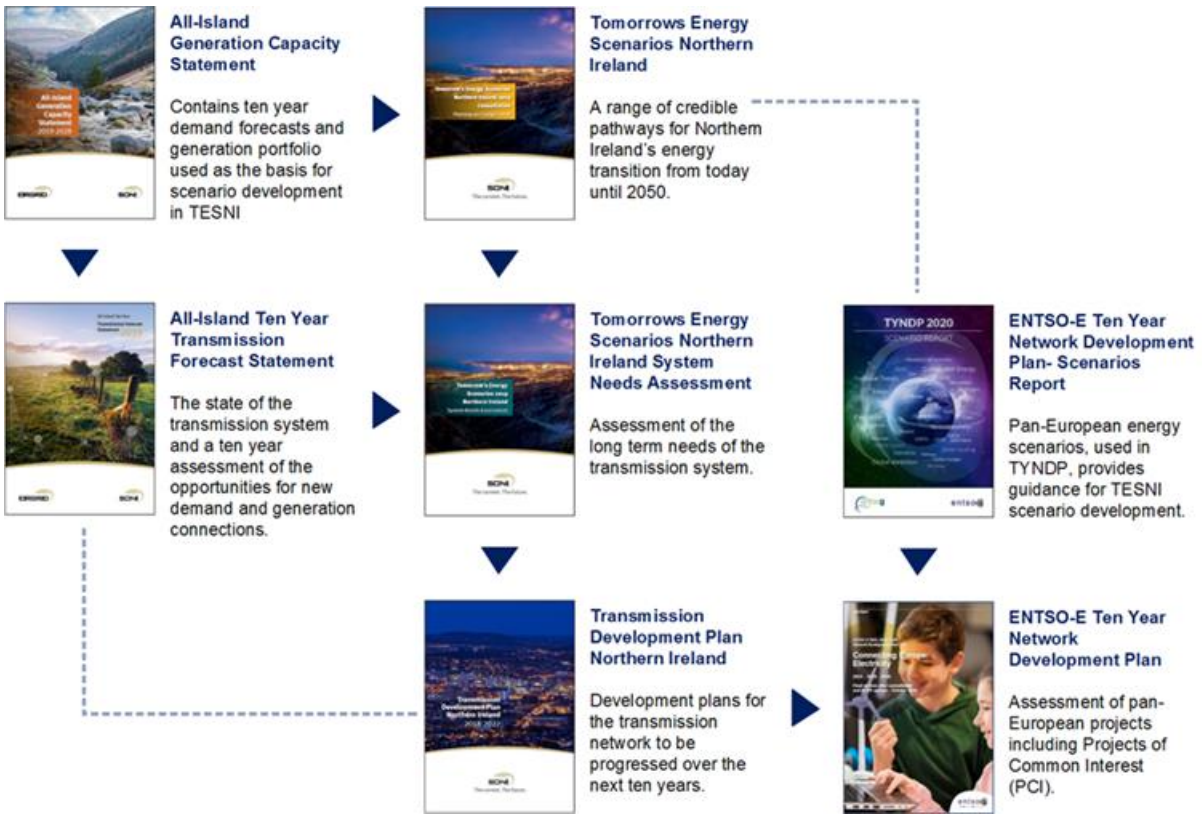


Figure 1-2 The TDPNI in context with other SONI publications

1.6.1 Generation Capacity Statement

The Generation Capacity Statement (GCS) is published annually by SONI and EirGrid. The GCS provides:

- A ten year forecast of electricity demand in Northern Ireland and Ireland;

- Contracted changes to conventional generation;
- Forecasted changes to renewable generation; and
- A ten-year forecast of the generation capacity required to meet demand.

The most recent version of the GCS is Generation Capacity Statement 2020-2029 and is available from the SONI website[15].

1.6.2 Ten Year Transmission Forecast Statement

The Ten Year Transmission Forecast Statement (TYTFS) is published annually by SONI and EirGrid. The TYTFS provides:

- Network models and data of the all-island transmission system;
- Forecast generation capacity and demand growth (taken from the GCS);
- Maximum and minimum fault levels at transmission system stations;
- Predicted transmission system power flows at different points in time; and
- Demand and generation opportunities on the transmission system.

The most recent version of the TYTFS is Ten Year Transmission Forecast Statement 2019 and is available from the SONI website[16].

1.6.3 Transmission Development Plan (Ireland)

The Transmission Development Plan (TDP) for Ireland is published annually by EirGrid. It is the equivalent document to the TDPNI for Ireland and is the plan for the development of the Irish transmission network and interconnection. It covers a ten year period. The TDP presents projects that are needed for the secure

[15] http://www.soni.ltd.uk/media/documents/All-Island-Generation-Capacity-Statement-2020-2029.pdf

[16] http://www.soni.ltd.uk/media/documents/All-Island-Ten-Year-Transmission-Forecast-Statement-2019.pdf

operation of the Irish transmission network. EirGrid and SONI work to co-ordinate the two plans.

The most recent version of the TDP (Ireland) is TDP 2019-2028 and is available from the EirGrid website[17].

1.6.4 Tomorrow's Energy Scenarios Northern Ireland

Tomorrow's Energy Scenarios Northern Ireland (TESNI) was published for the first time in 2020. TESNI considers a range of possible ways that energy usage in Northern Ireland may change into the future. For TESNI 2020 SONI consulted on three credible pathways for the transformation of the power system. Two of these scenarios see Northern Ireland delivering its contribution to the UK's 2050 net-zero emissions target. These scenarios will be used to inform power system studies out to 2040 and will form a key input to future versions of the TDPNI.

Information on TESNI is available from the SONI website[18].

1.6.5 Associated Transmission Reinforcements

Associated Transmission Reinforcements (ATRs) refer to new or upgraded transmission infrastructure. They are associated with a generation project and must be complete to release a generation project's Firm Access Quantity (FAQ) allocation. To achieve firm access up to its Maximum Export Capacity (MEC) value in the Single Electricity Market, the generation project must be connected via its permanent connection as well as its ATRs being complete. Planned ATRs are captured within this TDPNI.

[17] http://www.eirgridgroup.com/site-files/library/EirGrid/TDP-2019-2028-Final-For-Publication.pdf

[18] http://www.soni.ltd.uk/customer-and-industry/energy-future/

SONI publishes ATR status reports on its website so that generators can track the status of the ATRs associated with their generation project(s). Where the scheduled FAQ date for a generation project changes as a result of a change to the scheduled completion date or the completion of an ATR for that generation project, the customer is notified in writing and the website is updated.

1.7 Changes Since TDPNI 2019-2028

Since the production of TDPNI 2019-2028, a number of SONI projects have had their status or scope changed:

Table 1-1 Project changes since TDPNI 2019-2028

Project	Status
Coolkeeragh – Killymallaght 110 kV Uprate	Combined into 'Coolkeeragh – Killymallaght-Strabane 110 kV Uprate project
Killymallaght – Strabane 110 kV Uprate	
Limavady Transformer Replacement	New project
Carnmoney – Castlereagh 110 kV Circuit Uprate/Reconfiguration	Scope changed; now 'Castlereagh – Hannahstown 110 kV Reinforcement' as part of the *Belfast Metropolitan Redevelopment Project*
Belfast Power Station Connection	Connection offer expired, project cancelled
Castlereagh 275 kV New no. 4 Inter-Bus Transformer	Now part of 'Castlereagh – Hannahstown 110 kV Reinforcement' within the *Belfast Metropolitan Redevelopment Project*
Augmentation of Capacity at Transmission/Distribution Interface	Cancelled, needs anticipated to be met by Limavady Transformer Replacement, Gort 110/33 kV 2nd Transformer, Rasharkin

	Cluster 110/33 kV 2nd Transformer, East Tyrone Reinforcement Project, NW of NI 110 kV Reinforcement

2 STRATEGY FOR DEVELOPING THE GRID

As the TSO for Northern Ireland, we have a statutory duty to ensure 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 transmission network. This in turn supports economic development in Northern Ireland.

Changes to demand, generation merit order, or to interconnection with neighbouring transmission networks may alter the flow of electrical power throughout the Northern Ireland 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 and that the cost of constraints is minimised.

The Northern Ireland electricity industry and its development take direction from a number of broad local[19] and European[20] strategic objectives. These objectives

[19] The Strategic Energy Framework can be found here: https://www.economy-ni.gov.uk/sites/default/files/publications/deti/sef%202010.pdf. Note that the SEF expires in 2020 and there is currently nothing in place beyond this date. The Department for the Economy is currently in the process of developing an energy strategy for NI ,expected to be published in 2021.

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

guide investment in the Northern Ireland transmission network and are summarised in the legislation[21] which requires SONI to:

- ensure the development and maintenance of an efficient, co-ordinated and economical system of electricity transmission which has the long-term ability to meet reasonable demands for the transmission of electricity; and
- contribute to security of supply through adequate transmission capacity and system reliability; and
- facilitate competition in the supply and generation of electricity

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

In the development of the network reinforcements we are led by the following strategy statements:

- Inclusive consultation with local communities and landowners will inform how we plan the development the network;
- All practical technology options will be considered for network development; and
- The network will be optimised to minimise the requirement for new infrastructure to be built.

3 GENERAL APPROACH TO DEVELOPING THE GRID

3.1 Scenario Planning

As TSO, we are obliged to plan the development of a safe, secure, reliable, economical, efficient, and coordinated transmission network that is able to meet all

[21] Article 12, The Electricity (Northern Ireland) Order 1992

reasonable demands for electricity, in accordance with the activities permitted by our licence.

With the increase in the pace of decarbonisation driven by the 2015 Paris Agreement and local and UK-wide targets and legislation, we anticipate a significant change in how energy is used over the coming decades. The form this change will take and the exact role that the electricity transmission system will play is uncertain and so SONI carries out analysis on a range of scenarios of energy usage out to 2040 as part of Tomorrow's Energy Scenarios Northern Ireland (TESNI) which we published for the first time in 2020[22].

This analysis outlines the impact of three potential scenarios on the power system. These scenarios (Modest Progress, Addressing Climate Change, and Accelerated Ambition) consider different paces of decarbonisation, with different levels of government and citizen engagement. Two of these scenarios see Northern Ireland delivering its contribution to the UK's 2050 net-zero emissions target.

We will now use these scenarios to identify future needs of the transmission grid. These needs arise from changes in the usage of the grid, which is influenced by the scale and location of electricity consumption, generation, interconnection and storage. The scenarios will inform the TESNI 2020 System Needs Assessment, to be published later in 2020, which will consider these future needs. This will, in turn, inform future versions of the TDPNI.

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

[22] http://www.soni.ltd.uk/customer-and-industry/energy-future/

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.

3.2 Planning Standards

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. To ensure transmission system reliability and security, predicted power flows of the network are compared with the requirements of the Transmission System Security and Planning Standards (TSSPS).

The TSSPS establishes a set of design criteria for the transmission system. This includes setting the minimum level of redundancy that should be incorporated into the design to deal with credible faults and outages. The standard includes checking for any circuits that would be overloaded or where voltages would fall below statutory levels.

SONI assesses the present and future transmission system against these standards and, when breaches are forecast, establishes plans to address these breaches. However, in some limited circumstances it may be more appropriate to seek derogation in the case, such as economic reasons. This derogation would be directed by The Utility Regulator following consultation with SONI and materially affected electricity undertakings, including the TAO and the TSO of Ireland.

3.3 Roles and Responsibilities

There are three parties licensed to participate in the transmission of electricity in Northern Ireland. Northern Ireland Electricity Networks (NIE Networks) is responsible for the development and maintenance of the transmission system in accordance with the Transmission Interface Arrangements (TIA), as mandated by Condition 18 of the SONI licence. SONI holds the Transmission System Operator licence and is responsible for the operation and planning of the transmission system. Moyle Interconnector Limited also holds a transmission licence as the owner of the interconnector to Scotland.

The arrangements between NIE Networks and SONI are governed by the Transmission Interface Arrangements (TIA). The TIA arrangements include responsibilities regarding the preparation of draft asset replacement plans by NIE Networks and the system development plans prepared by SONI. The TIA allows for the ongoing development of an asset replacement and system development investment plan. SONI is responsible for ensuring that asset replacement and system development are integrated into an investment plan.

Some projects included in the investment plan will be well developed whereas others will be conceptual or indicative and therefore more likely to be changed from year to year. The plan is modified regularly as planning assumptions and scenarios are changed.

The investment plan is then circulated between SONI and NIE Networks before becoming a draft Transmission Development Plan Northern Ireland (TDPNI). The

draft TDPNI is subject to public consultation [23] by SONI and consultation and approval by the Utility Regulator.

3.4 SONI's Grid Development Process

The planning of grid development projects by SONI is done under a three part process (see Figure 3-1 below). Asset replacement projects are progressed separately by NIE Networks. The process includes stakeholder and public participation in the development of projects.

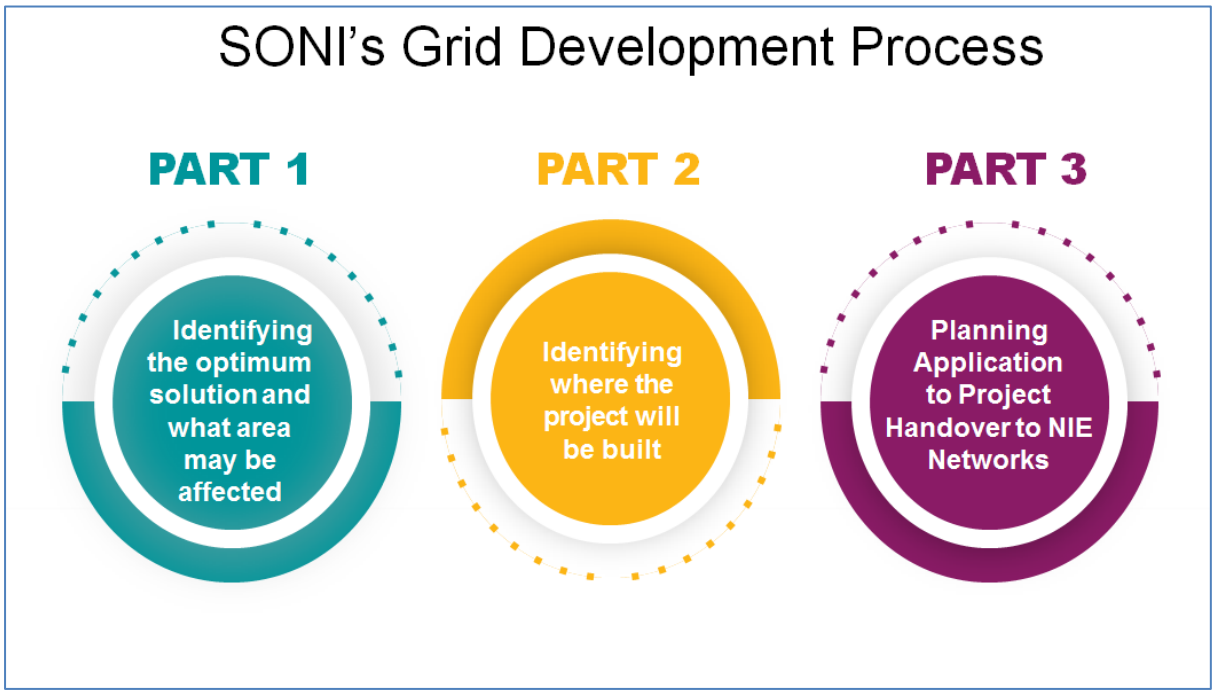


Figure 3-1: SONI's Grid Development Process

Part 1: Planning: Identifying the optimum solution and what area may be affected

When a potential breach of the standards is identified (operationally or through SONI's planning studies, including the Ten Year Transmission Forecast Statement and Tomorrow's Energy Scenarios), SONI will study the potential breach in detail

[23] In parallel with the SEA process

including any other related issues. Consistent with good practice, as set out in the TSSPS, SONI may seek ways that would allow the potential breach to be managed operationally and put into place any changes to operational practice as may be required. For example, SONI can manage potential overloads of the transmission system by constraining the output of generators. In particular given the increased penetration in renewables it is necessary to constrain the output until reinforcement options are assessed and developed. However, in certain cases where that operational mitigation would lead to unacceptable cost or risk for customers, SONI will instigate a project to develop the transmission system.

When we identify the need to develop a transmission project we will consider how best to deliver it. This means looking at a number of solutions and narrowing these down based on their technical viability, deliverability, cost, potential impact on the environment and on those living and working in the general area where the project may be located. This process is conducted in close cooperation with NIE Networks.

The steps in planning are to first identify a long list of options across a range of different technologies. Such options will include the need for any new substations or overhead line and underground cables. In some cases where appropriate the use of flexible AC transmission systems (FACTS) and HVDC will also be considered depending on the need identified. The long list of options will be assessed against multi-criteria analysis including technical implications, asset management issues, and environmental and cost benefit assessments to identify a shorter list of potential options.

SONI will then consider the short list in greater detail, continue to engage with NIE Networks and in some cases engage expert consultants to assist. These studies may include sensitivity studies to assess the performance of the options

against different generation and demand assumptions. The process culminates with a recommendation for a preferred solution and tiering to establish the level of stakeholder engagement and consultation required. Depending on the nature of the project, SONI will seek to engage with key stakeholders before progressing the recommendation further. SONI will consider the stakeholder engagement findings and amend any plans accordingly before progressing further. Wewill also publicise the results of the stakeholder engagement process and further sdecisions.

In parallel with the stakeholder engagement phase, and recognizing that the Utility Regulator is also a key stakeholder, SONI will seek approval for cost recovery through the Utility Regulator and progress the project to the outline design stage. This stage will identify any study areas for identification of new substations or corridors for overhead line and/or cable routes.

Part 2: Outline Design: Identifying where the project will be built

SONI manages the pre-construction outline design of transmission projects once the need has been identified (Part 1 in Figure 3-1). This also includes consultation with the TAO and NIE Networks. The projects can involve the development of new substations, overhead lines or cable circuits operating at 110 kV and above.

SONI is responsible for preparing documentation required to apply for planning consent for the development of the projects - this entails developing the design to the level required for obtaining planning consent including any necessary environmental reports or assessments, and consultations with stakeholders and landowners to obtain the right to gain access and install transmission equipment on their lands.

Part 3: Consents: Planning application to NIE Networks project handover

SONI submits planning applications with the relevant planning authority. SONI is also responsible for submitting any other consent applications that may be required, e.g. Marine Licence, with the relevant consenting authority. The planning authority will make a legally binding decision on the project. It may grant full planning permission, grant permission on the basis that we make changes or refuse permission. SONI is responsible for the acquisition of any wayleaves, easements, access rights, land options, leases and any other legal rights required for the installation of the new infrastructure.

Following receipt of planning and landowner consents the project is handed over to NIE Networks for detailed design. This includes a review of the SONI functional specification (outline design and consents) and preparation of a design specification. Separate preconstruction work for NIE Networks will also include tendering and procurement. Following receipt and review of the design specification from NIE Networks, SONI issues a Transmission Project Instruction and enters into a Project Agreement with NIE Networks. NIE Networks then deliver the project.

3.5 Public Planning and Environmental Considerations

Planning and environmental considerations are integrated into the three part process for grid development. This section details SONI's public planning and environmental responsibilities and how these issues are considered in grid development (See also Section 4).

3.5.1 Public Planning Considerations

SONI is supported by 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.

3.5.2 Environmental Considerations

Environmental considerations are integrated into the functioning of grid development at both the strategic (i.e. plan level) and at the project level.

The requirements for Environmental Impact Assessment (EIA- for projects) and Appropriate Assessment (AA) (see below) are transposed into Northern Ireland law in Statutory Rules of Northern Ireland **2017 No. 83** The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017 and Conservation (Natural Habitats) Regulations 1995 (as amended).

Where necessary applications for statutory consent are accompanied by an Environmental Statement (ES) or an Environmental Report (ER) the need for a statutory ES 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.

3.5.3 Strategic Environmental Assessment

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 as early as possible. A SEA is prepared in respect of this transmission development plan. The purpose of the SEA is to ensure that environmental considerations are integrated into the development plan and that to anticipate and avoid, where possible, potential adverse environmental impacts arising from the TDPNI.

The SEA has a five year lifespan, with review and drafting processes for the next SEA beginning in the final year. An SEA was carried out on TDPNI 2018-2027. However, as the preparation of a TDPNI is an annual rolling process, each TDPNI prepared is accompanied by an Environmental Appraisal Report (EAR) which assesses the plan against the provisions of the adopted SEA statement. This process ensures consistency of approach in environmental issues of each TDPNI across the lifespan of the SEA.

A summary of the environmental assessment and mitigation measures of this SEA is presented in Section 8 of this report. The relationship between the TDPNI, SEA and EAR is set out graphically in Figure 3-2 below.

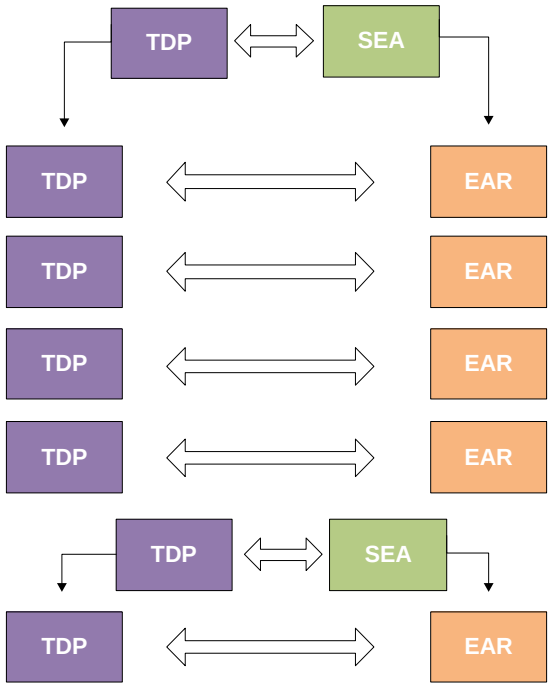


Figure 3-2 Structure for TDPNI, SEA, and associated EARs

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 Environmental Report, through to preparation of an Environmental Statement (ES). Projects where an ES 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 circuit length is more than 15 km.

An ES may be required for sub-threshold development where likely significant impacts on the environment are identified by the relevant planning authority.

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 (92/ 43/ EEC), 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 Habitats Directive is implemented via the Conservation (Natural Habitats) Regulations 1995 (as amended) in Northern Ireland.

The Appropriate Assessment process in Northern Ireland is generally referred to as a Habitats Regulations Assessment (HRA). A Screening for Appropriate Assessment is referred to as a Test of Likely Significance (ToLS), with the resultant report being referred to as a ToLS Report.

In Northern Ireland, the HRA process is undertaken by Shared Environmental Services (SES), a centralised body comprising specialist staff that provides expert environmental advice and support to Councils. SONI as project proponent will usually submit a ToLS Report or a HRA Report as part of a bundle of environmental information when seeking planning permission.

4 IMPLEMENTATION: HOW THE STRATEGY FOR DEVELOPING THE GRID WILL BE IMPLEMENTED

In this chapter we set out how our strategy for developing the grid is implemented. SONI is responsible for the inclusion of asset replacement projects in the investment plan and TDPNI, but the delivery of these asset replacement projects (including planning, consents and all detailed assessments) are the responsibility of the TAO, NIE Networks.

SONI's strategy for planning the development of the grid is discussed under the following headings:

- Our approach to the environment;
- Our approach to technology;
- Our approach to project development;
- Our approach to planning and consenting of projects; and
- Our approach to consultation and engagement.

These topics build upon the previous chapter which detailed our general approach to developing the grid. Policies and objectives are set out to assist in delivery of the grid strategy objectives in a sustainable manner.

4.1 Our Approach to the Environment

4.1.1 Introduction

SONI has a legal responsibility to comply with planning law, including all relevant environmental legislation. In practice this means that environmental issues inform the decision making process when it comes to developing the grid in Northern Ireland.

This TDPNI is subject to Strategic Environmental Assessment as outlined in previous sections. (See Chapter 8 for a detailed description of the process.)

Planning and environmental considerations are embedded into every grid development project that SONI undertakes in order to ensure that environmental issues are at the forefront of decision-making. Early involvement in projects allows potential environmental issues to be identified and avoided or managed in the course of project development.

4.1.2 Policies and Objectives

The following environmental policies (ENVP) have been compiled to ensure that SONI has due regard for existing environmental protection legislation and environmental best practice when developing projects.

Environmental objectives (ENVO) have also been developed for a number of environmental topics.

4.1.3 General

It is the policy of SONI:

ENVP1: To promote best environmental practice in the design and appraisal of transmission development projects.

4.1.4 Biodiversity

It is the policy of SONI:

ENVP2: To exercise its functions as a TSO in line with the Wildlife and Natural Environment Act (Northern Ireland) 2011 and the Northern Ireland Biodiversity Strategy (2015) to further the conservation of biodiversity so far as is consistent with the proper exercise of those functions.

ENVP3: To avoid adverse effects on sites designated for nature conservation including, Special Conservation Areas, Special Protection Areas, RAMSAR Sites, Areas of Special Scientific Interest and National Nature Reserves.

ENVP4: To protect NI priority species and habitats and other species protected under legislation in the development of any transmission infrastructure and to preserve key ecological linkage features

It is the objective of SONI:

ENVO1: To prepare and utilise industry specific Ecology Guidelines for the development of Transmission projects. This will ensure a standard approach to ecological impact assessment for transmission projects.

4.1.5 Climate Change

It is the policy of SONI:

ENVP5: To integrate measures related to climate change into grid development, by way of both effective mitigation and adaptation responses, in accordance with available guidance and best practice.

4.1.6 Noise

It is the policy of SONI:

ENVP6: To employ methods on transmission infrastructure which minimise noise emissions in line with best industry practice.

It is the objective of SONI:

ENVO2: To give careful consideration to the siting of transmission infrastructure so as to ensure that noise-sensitive receptors are protected from potential noise emissions.

ENVO3: To seek to preserve and maintain noise quality in accordance with good practice and relevant legislation.

4.1.7 Landscape

It is the policy of SONI:

ENVP7: To have regard to the Northern Ireland Landscape Character Assessment 2000, and the Northern Ireland Seascape Character Assessment in the design and appraisal of its transmission development projects.

It is the objective of SONI:

ENVO4: To protect landscapes through the sustainable planning and design of transmission infrastructure and to have regard to important landscape designations including AONBs and the World Heritage Site.

4.1.8 Cultural Heritage

It is the policy of SONI:

ENVP8: To take reasonable measures to ensure that the special interest of protected structures, including their curtilages and settings, are protected when considering site or route options for the planning of transmission infrastructure.

ENVP9: To protect archaeological material when planning transmission infrastructure, by avoidance or by best practice mitigation measures.

4.1.9 Water

It is the policy of SONI:

ENVP10: That there is no increase in flood risk as a result of transmission development, and to ensure any flood risk to the development is appropriately managed.

ENVP11: To promote the use of sustainable urban drainage systems in any new developments where it is appropriate.

ENVP12: To have regard to Planning Policy Statements and Supplementary Planning Guidance: PPS 15 Planning and Flood Risk Development Control Considerations in the preparation of grid development strategies and plans.

It is the objective of SONI:

ENVO5: That all grid development proposals, and in particular, transmission substation developments, shall carry out, to an appropriate level of detail, a site-specific Flood Risk Assessment that shall demonstrate compliance with all current Guidelines, standards and best practice. The Flood Risk Assessment shall pay particular emphasis to residual flood risks, site-specific mitigation measures, flood-resilient design and construction, and any necessary management measures.

4.1.10 Air Quality

It is the policy of SONI:

ENVP13: To preserve and maintain air quality in accordance with good practice and relevant legislation in the proposed construction of its transmission projects.

ENVP14: To ensure appropriate dust suppression during construction works.

4.1.11 Tourism

It is the policy of SONI:

ENVP15: To consider the potential impact upon tourism in the planning of transmission projects.

It is the objective of SONI:

ENVO6: To identify the nature of tourism in a project area; to consider the cumulative / in combination impact on tourism of a project and to consider short term and long term impacts of grid development projects on tourism as appropriate.

4.1.12 Conclusion

All of the environmental policies and objectives detailed above are assessed against Strategic Environmental Objectives. This is provided in the SEA Environmental Report.

4.2 Our Approach to Technology

4.2.1 Introduction

As outlined in Chapter 2 of this document, the SONI Strategy sets out three strategy statements, two of which directly relate to technology in transmission infrastructure development:

- We will consider all practical technology options; and
- We will optimise the existing grid to minimise the need for new infrastructure.

The use of new technologies can bring a number of advantages, including enhanced operational performance, improved system reliability, shortened construction times and reduced impact on the environment. All of these have the potential to reduce system costs.

We developed a world-leading initiative *"Delivering a Secure, Sustainable Electricity System"* (DS3 programme). The aim of the programme is to meet the challenges of operating the electricity system in a secure manner while achieving the 2020 renewable electricity targets for Northern Ireland. The programme is designed to ensure that we can securely operate the power system with increasing amounts of variable renewable generation over the coming years.

We continue to examine the performance of underground cables and their technical impact on the network, noting their advantage in terms of the potential for reduced visual impact compared with overhead lines. However, this must be balanced against costs as well as the potential impacts on sensitive environmental and ecological areas from what can be significant civil engineering works. We will continue to assess technological developments in this area to ensure the full capability of this technology is available for use on the Northern Ireland grid.

The transmission grid in Northern Ireland, similar to other European and international grids, uses high voltage alternating current (HVAC). Where power is to be transferred over long distances it may be cost effective and technically possible to do so using high voltage direct current (HVDC). Over the last number of years we have continued to examine the performance of HVDC and its technical impact on the network.

Demand Side Management and Response has been used in Northern Ireland for many years, primarily at industrial level. It works by customers reducing their

electricity consumption on request. This helps us to operate the grid more securely.

We are also investigating the use of modular power flow control technologies that may enable us to make better use of the existing transmission network.

In most cases overhead line technology remains the most reliable and least expensive option for developing new circuits.

Over the last number of years, we have learned that the level of uncertainty over the future usage of the grid is increasing. To cater for this, we are changing how we plan the grid. Our new approach involves developing a range of energy scenarios (possible situations or events that impact on energy) called 'Tomorrow's Energy Scenarios Northern Ireland'.

In the process of developing the range of energy scenarios, key policy makers, industry experts, and stakeholders are asked how they see the energy landscape changing over time. The final scenarios are published and reviewed every two years. We will use these scenarios throughout our planning analysis to assess the future needs of the electricity system, and to test the practicality and merits of different options for grid development. These scenarios were first published in 2020 [24] and will serve as an input to our grid development process and consequently future iterations of the TDPNI.

[24] http://www.soni.ltd.uk/customer-and-industry/energy-future/

4.2.2 Policies and Objectives

It is the policy of SONI:

TP1: To promote and facilitate the sustainable development of a high-quality transmission grid to serve the existing and future needs of NI.

TP2: To consider all practical technology options in the development of projects, including maximising use of existing transmission grid.

4.3 Our Approach to Project Development

4.3.1 Introduction

SONI undertakes a number of grid development projects as part of its statutory role in planning the development of and operating the transmission grid.

A focus in the development of our projects is on matters of proper planning and sustainable development. This requires a careful balancing of the technical need and solutions for a project with appropriate and adequate opportunities for public participation in the project development process.

SONI has established an approach to developing grid projects in Northern Ireland. This is a three part process, from the identification of need to develop the grid to the eventual hand over to NIE Networks for construction and operation of a project by SONI. The details of this process can be seen in Section 3.4.

4.3.2 Policies and Objectives

The following policies and objectives have been adopted by SONI in order to ensure an appropriate and sustainable approach to the development of our transmission projects.

It is the policy of SONI:

PDP1: To develop projects in accordance with SONI's *Process for Developing the Grid in Northern Ireland.*

PDP2: To promote sustainable grid development by balancing complex and/or competing technical, economic, environmental, social and deliverability goals and priorities in decision-making.

PDP3: To ensure that grid development is carried out in an economically efficient manner, and seek derogation from the Utility Regulator when this is not possible.

4.4 Our Approach to Planning and Consenting of Projects

4.4.1 Introduction

The SONI licence requires it to plan and operate the transmission system. SONI is also required to carry out these duties in accordance with the TIA. The TIA requires SONI to develop the design of projects to the point where consents are obtained. Our grid developments occur within a planning and environmental context. In this context the focus is on matters of proper planning and sustainable development. Public participation is of key importance alongside the environmental and ecological impact of our projects in order to provide an economic solution for end-users of the network.

4.4.2 Policies and Objectives

The following policies and objectives have been adopted by SONI in order to ensure an appropriate and sustainable approach to the planning and consenting of our transmission projects.

It is the policy of SONI:

PCP1: To have regard to relevant legislation and guidelines in respect of planning and consenting of transmission infrastructure development projects and make provision for any policies for the provision of transmission infrastructure set out in these documents.

PCP2: To have regard to precedent arising from decisions of the Competent Authorities, and of the High Court in Judicial Review of decisions, relating to the planning and consenting of transmission infrastructure development projects.

PCP3: To promote sustainable grid development by balancing complex and/or competing technical, economic and environmental goals and priorities in decision-making.

4.5 Our Approach to Consultation and Engagement

4.5.1 Policies and Objectives

The following policies and objectives have been adopted by SONI in order to ensure an appropriate and sustainable approach to consultation and engagement in the development of our transmission projects.

It is the policy of SONI:

CEP1: To consult and engage with statutory and non-statutory stakeholders including communities, landowners and the general public, at the earliest appropriate stage of a project's development.

CEP2: To recognise and develop the essential role that communities, landowners and other stakeholders play in transmission infrastructure development

and to engage with different stakeholders as appropriate during the life of a grid development project.

CEP3: To ensure consultation and engagement feedback is appropriately considered in decision making.

5 INVESTMENT NEEDS

SONI is responsible for planning and operating an economic, efficient and coordinated electricity transmission network in Northern Ireland. Key to achieving this is a reliable and high-quality electricity infrastructure which powers the Northern Irelan economy and supports investment in the region.[25]

The Strategic Energy Framework (SEF)[26] released in 2010 set out Northern Ireland's energy future. Investment in the transmission system is necessary to enable Northern Ireland's transition to a low carbon energy future. The SEF expires in 2020 and there is currently nothing in place beyond this date, however it is assumed that decarbonisation targets will continue to increase beyond 2020. In 2019, the UK government set a legally binding target of full decarbonisation by 2050 and it is anticipated that future energy policy in Northern Ireland will reflect this. The Department for the Economy is currently engaged in preparing a new Energy Strategy, expected to be completed in 2021 and SONI is engaged in this process. In this regard, the TDPNI is developed to support local government objectives and enable this energy transition.

By facilitating new connections onto the network, reviewing maintenance plans and identifying the future electrical needs of Northern Ireland, SONI can direct and plan investment in the transmission system. This investment will, in turn, secure the electricity supply into the future.

[25] Grant Thornton: "Powering Northern Ireland A report exploring SONI's role in the economy", October 2016. Available here: http://www.grantthorntonni.com/globalassets/1.-member-firms/ireland/insights/publications/powering-northern-ireland_grant-thornton.pdf

[26] https://www.economy-ni.gov.uk/sites/default/files/publications/deti/sef%202010.pdf
Note that the SEF expires in 2020 and there is currently nothing in place beyond this date.

5.1 Policy Drivers of Transmission Network Investment

In order to achieve the identified strategic objectives laid out by national and European policies, we must continue to produce investment plans and progress individual projects to develop the electricity transmission network. Specific drivers of investment in transmission network infrastructure are identified and described in the following sections.

5.1.1 Security of Transmission Network

Security of supply generally addresses two separate issues:

- The availability of primary energy resources and ability to generate sufficient electricity to meet demand (which is the responsibility of the UR and the Department for the Economy); 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, as set out in the TSSPS.

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

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

5.1.2 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 European 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 European countries to obtain these economic benefits.

5.1.3 Renewable Energy Sources Integration

Developing renewable energy is an integral part of Northern Ireland's sustainable energy objectives and climate change strategy. In comparison to fossil fuels, RES have lower or no net emissions. RES contribute to the decarbonisation of the energy supply and to the reduction in greenhouse gas 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. Currently wind farms are the main sources of renewable electricity generation in Northern Ireland. However, additional forms of renewable energy continue to develop in Northern Ireland with significant increases in solar and biomass generation in recent years. It is expected that additional forms of renewable energy will be further developed e.g. wave and tidal.

In order to fulfil both European and local renewable targets[27], many RES-related projects are expected to be initiated throughout the period of this TDPNI. 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

[27] Northern Ireland currently has a non-binding target of 40% electricity consumption to be met by renewable sources by 2020. This was achieved in 2019. New targets are expected to be announced in 2021.

rural areas. Significant challenges will arise in extending and reinforcing the network to connect new RES.

5.2 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.

5.2.1 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 on specific transmission lines.

Our All-Island Generation Capacity Statement 2020 (GCS)[28], available here[29], details the forecast of electricity demand for the years 2020 to 2029. The peak demand in Table 5-1 corresponds to the forecast median transmission system peak demand published in GCS 2020.

[28] It is important to note that the information in the GCS 2020 is based on the best information available at the Time of publication, September 2020.

[29] http://www.soni.ltd.uk/media/documents/All-Island-Generation-Capacity-Statement-2020-2029.pdf

Year	Peak Demand (GW)	Generation Capacity (GW)
2020	1.74	3.21
2021	1.75	3.21
2022	1.76	3.31
2023	1.77	3.48
2024	1.79	3.66
2025	1.80	3.79
2026	1.81	3.79
2027	1.82	3.39
2028	1.83	3.79
2029	1.83	3.79

Table 5-1 Forecast Peak Demand and Generation Capacity over the period 2020 to 2029[30]

Our All-Island Ten Year Transmission Forecast Statement 2019 (TYTFS)[31], available here[32], includes information on how the GCS demand forecast relates to each individual demand centre node over the period covered by this TDPNI.

Because of the relative size of individual generators, changes in generation installations, whether new additions or closures can have a more significant impact

[30] This forecast is based on information presented in GCS 2020. The Moyle interconnector is not included in these figures.

[31] It is important to note that the information in the TYTFS 2019 is based on the best information available at the freeze date, January 2019.

[32] http://www.soni.ltd.uk/media/documents/All-Island-Ten-Year-Transmission-Forecast-Statement-2019.pdf

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 asunder 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, without mitigation, are highlighted on the map in Figure 5-1. Note that mitigation measures will be used to manage fault levels that would otherwise exceed switchgear rating. This may include reconfiguration of the transmission system as necessary until switchgear is replaced or alternative permanent solutions put in place.

Table 5-1 highlights the level of existing generation and projected levels of generation expected to connect over the period of this TDPNI, as detailed in the TYTFS 2019. It is important to note that this figure does not include additional generation that is in the applications queue, but is not contracted as of the freeze date of January 2020, as these generators do not yet have an agreed connection method.

The projected changes in generation are accommodated by the reinforcements included in this TDPNI. This includes the identified future potential projects discussed in Chapter 6.

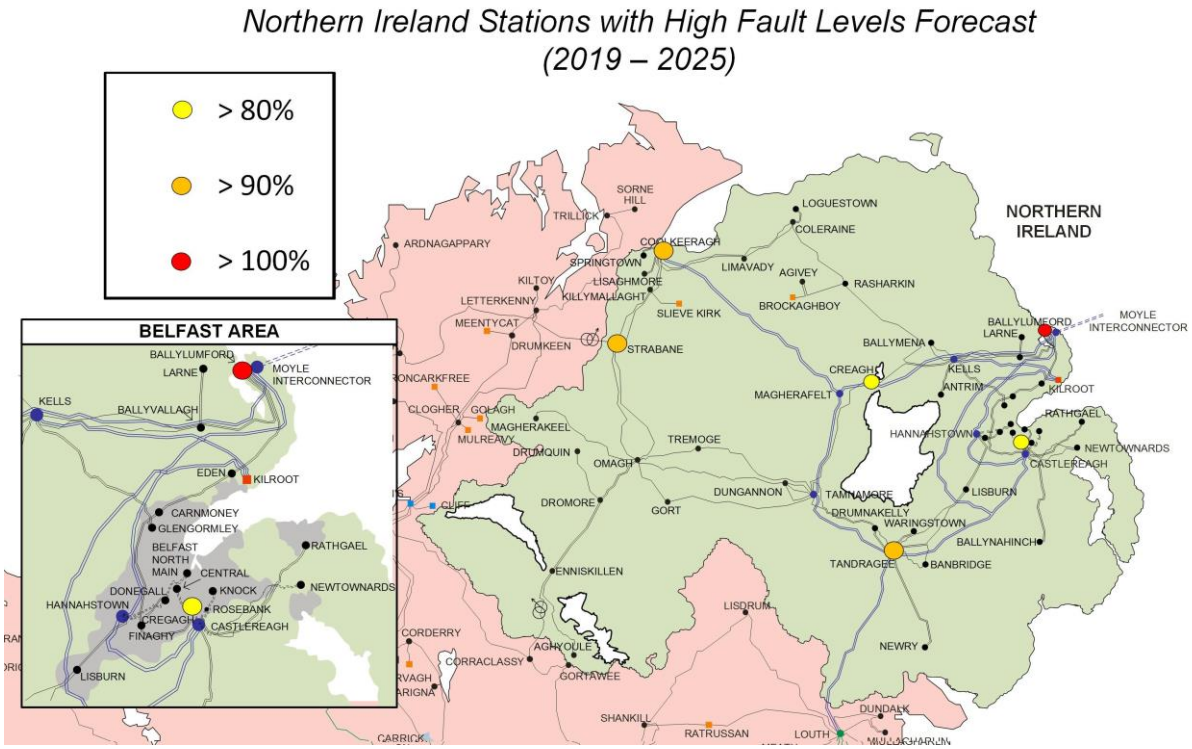


Figure 5-1 Stations with forecast high fault levels, 2019 – 2025 (from TYTFS 2019)

Changes in Northern Ireland's 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. 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 planned second North-South Interconnector between Northern Ireland and Ireland is addressed in this TDPNI.

5.2.2 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 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 and credible flow patterns across the network. This is due to the extent of the likely changes that are envisaged for Northern Ireland, particularly in respect of RES integration. To cater for a broader range of flow patterns greater transmission network flexibility is required.

5.2.3 Changes in Asset Condition

Transmission network assets have a finite lifespan their useful life is 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 by the TAO. These assess the condition of the assets and estimate remaining useful life.

Typically, where assets are considered to have reached the end of their useful life and they continue to be required, assets are:

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

6 PLANNED NETWORK DEVELOPMENTS

6.1 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 7 and Appendix B.

The TDPNI includes a total of 79 projects that are currently in progress. These projects are categorised as either:

- New Build;
- Uprate/Modify;
- Refurbish/Replace related projects; or
- Combination.

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

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 the changing of equipment to increase the capacity of circuits between stations; or busbars within existing stations.

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

An example of a modification project is the installation of new couplers in existing substations.

Refurbish/ Replace projects: are projects that involve the refurbishment of existing substations or 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.

Combination: are projects that involve a combination of any of the three categories above.

Table 6-1 below summarises the 79 active projects into their respective categories.

Table 6-1 Summary of Projects by Category

Project Category	Network Development Projects	Asset Replacement projects
New Build	16	0
Uprate/ Modify	18	2
Refurbish/ Replace	0	40
Combination	2	1
TOTAL	36	43

6.2 Summary of Stage of Projects

Table 6-2 below summarises the number of development projects (not including the 43 asset replacement projects) in each phase of network development[33].

Table 6-2 Number of Development Projects in each stage of development

No. of Development Projects in Each Stage				
Part 1 Planning	**Part 2 Outline Design**	**Part 3 Consents**	**Under Construction**	**TOTAL**
25	1	8	2	36

Figure 6-1 below illustrates the location of the larger network development projects in Parts 1 to 3, excluding the NW of NI large scale Reinforcement project, which are detailed in Figure 6-2. Figure 6-3 shows NIE Networks asset replacement projects.

For those projects in the early stages of the planning process, indicative corridors are shown on the map as a specific solution or line route has not yet been decided on. A full list of projects and their corresponding stage of development is given in Appendix B.

[33] The process of network development is described in section 2. Further information on the stage of the project is available in Appendix A.

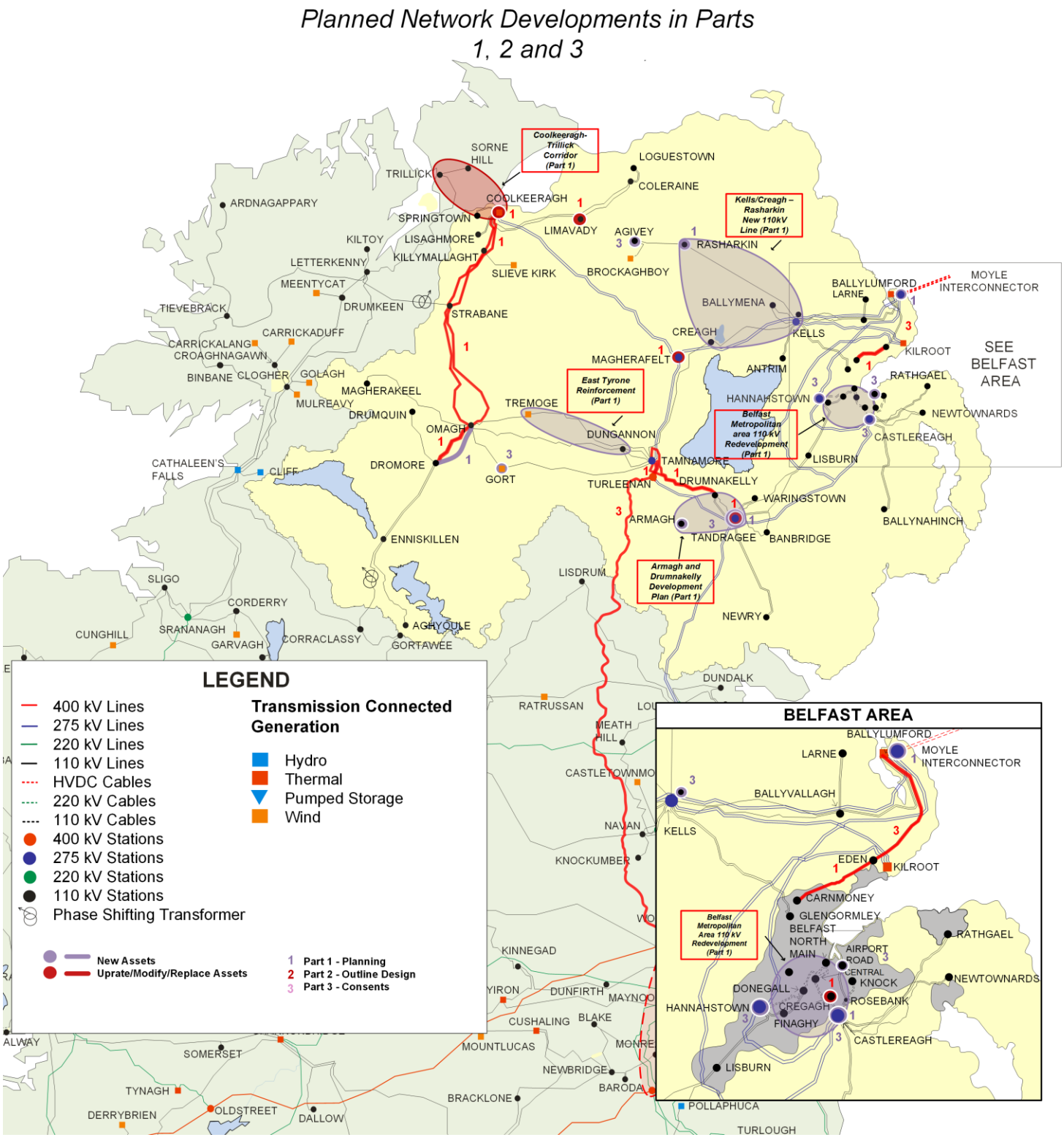


Figure 6-1 Planned Network Developments in Parts 1, 2 and 3 (not including NW of NI Reinforcement)

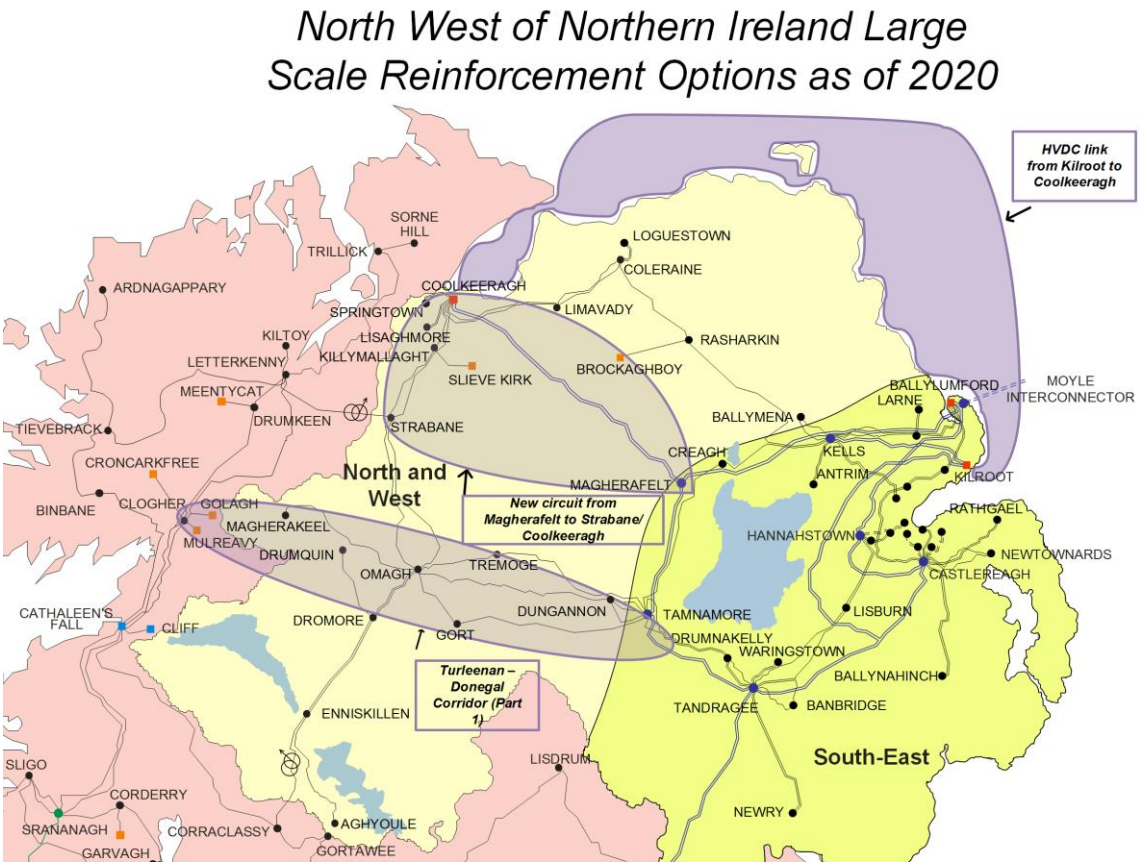


Figure 6-2 North West of NI Large Scale reinforcement – potential options

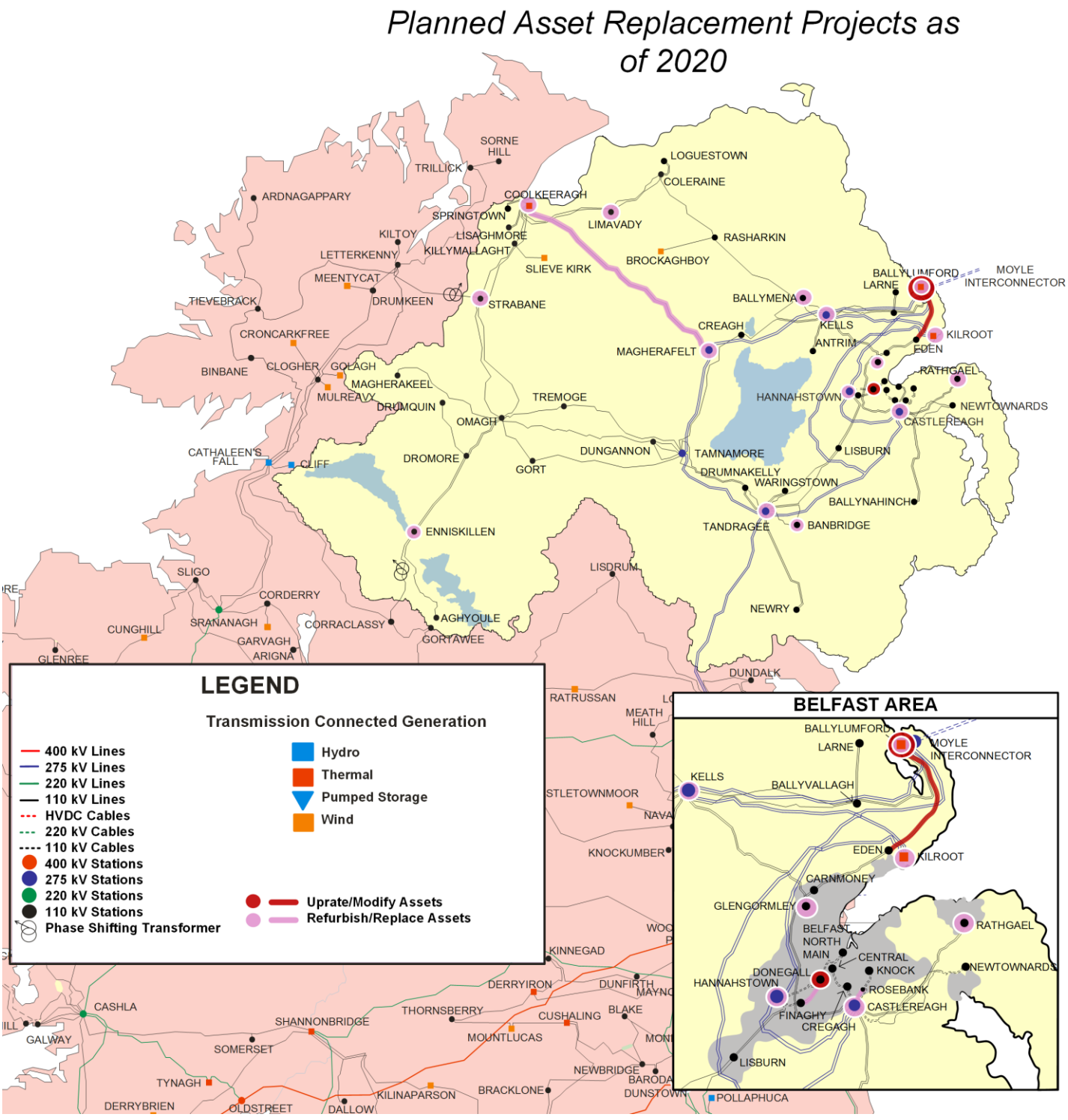


Figure 6-3 Planned NIE Networks asset replacement projects

7 PROJECT DESCRIPTION

7.1 Overview

As described in Chapter 1, planned development projects are categorised on a planning area basis as per Figure 1-1. Asset replacement projects are listed together as these are the responsibility of NIE Networks and are not subject to SONI's grid development process. There are 5 individual projects that are in or have the potential to be in both planning areas. These projects are listed in Table B-1 in Appendix B.

Projects of pan-European and regional significance in, or partly in, Northern Ireland are identified in ENTSO-E's most recent TYNDP and RegIP documents. Such projects are identified in this TDPNI using the following labels: "  TYNDP/ TYNDP_Project_No" or "  RegIP/ RegIP_Project_No" and are listed in Appendix C.

7.2 Asset Replacement Projects

NIE Networks' asset replacement projects (in both areas) are detailed below. Projects with a completion date beyond 2024 are indicative as they are subject to the outcome of NIE Networks' RP7 price control.

For all projects in RP6, a reference is included in brackets to the sub-project code used by NIE Networks in their RP6 price control submission where applicable. Full details of this, including the original cost estimates, can be seen here on the UR website[34] in Annex O[35] and Annex P[36].

One asset replacement project **(Hannahstown 275 kV Structures, Busbars and Disconnectors Replacement)** has been cancelled since TDPNI 2019-2028.

Ballylumford-Eden 110 kV Circuit Uprate

The driver for this project is security of supply. The conductor on the existing tower line as well as a number of towers and foundations will be replaced due to the condition and age of the existing assets. The conductor will also be uprated to cater for increased demand. The estimated cost of this project has increased from £9.5 million to £15.5 million due to updated costs provided by NIE Networks.

Estimated completion: Winter 2022

Ballylumford 275 kV CVT Replacement (T11o)

The Capacitor Voltage Transformers (CVTs) on a number of 275 kV circuits at

[34] https://www.uregni.gov.uk/publications/nie-networks-td-6th-price-control-final-determination-rp6

[35] https://www.uregni.gov.uk/sites/uregni/files/media-files/Annex%20O%20-%20Assessment%20of%20Network%20Investment%20Direct%20Allowances.pdf

[36] https://www.uregni.gov.uk/sites/uregni/files/media-files/Annex%20P%20-%20Planned%20Network%20Investment%20Volumes%20and%20Allowances.pdf

Ballylumford are to be replaced due to the age and condition of the existing assets. **Completion date: by 2024.**

Ballylumford Switchgear Replacement (T501)

The existing 110 kV switchgear at Ballylumford is to be replaced with a new 110 kV GIS double busbar and the 110 kV circuits diverted accordingly. The need for this project arises from the age, condition and obsolescence of the existing equipment as well as the need for a higher short circuit rating. **Completion date: Winter 2023.**

Ballymena Transformer 3 and 4 Replacement (T14)

The 110/33 kV transformers TX 3 and 4 at Ballymena Main are to be replaced due to the condition of the assets. **Completion date: 2020.**

Castlereagh and Tandragee Capacitor Bank Replacement (NEW)

Capacitor cans at Castlereagh and Tandragee are due for replacement due to age, corrosion and di-electric failure. **Completion date: By 2024.**

Castlereagh Inter-Bus Transformer 3 Replacement

The 275/110 kV 240 MVA interbus transformer IBTx 3 at Castlereagh is to be replaced due to the age and condition of the existing transformer. This was previously scheduled in RP7 but has been brought forward to RP6. **Completion date: By 2024.**

Coolkeeragh - Magherafelt 275 kV Circuits Refurbishment (T502)

The need for this project arises from the condition and rating of the existing conductor on the double circuit tower line, originally installed in the 1960s. Under certain scenarios there is a risk of overloading the existing conductor. The rating of the replacement conductor will be increased to cater for increased generation and will be defined as part of the redesign of the circuit. **Completion date: Winter 2022.**

Donegall Main (North) Transformer Replacement (T14)

The 60 MVA transformer Tx B at Donegall North is to be replaced by a new 90 MVA unit. The need for this arises because of the condition of the asset. The rating of 90 MVA is the standard rating now procured for 110/33 kV transformer applications. **Completion date: 2021.**

Enniskillen Main Transformer 1 and 2 Replacement (T14)

The 110/33 kV transformers TX 1 and 2 are to be replaced due to the condition of the assets. **Completion date: by 2024.**

Glengormley Main Transformer Tx B Replacement (T14)

The 110/33 kV transformer Tx B is to be replaced due to the condition of the asset. **Completion date: 2021.**

Hannahstown 110 kV Disconnectors Replacement (T12r)

The 110 kV disconnectors at Hannahstown are to be replaced due to the condition of the assets. **Completion date: by 2024.**

Hannahstown Inter-Bus Transformer 1 and 2 Replacement (T13)

The 275/110 kV 240 MVA interbus transformers IBTx 1 and 2 at Hannahstown are to be replaced due to the condition of the existing transformers. **Completion date: 2024.**

Kells and Tandragee Shunt Reactor Replacement (T15)

Kells TR1 and Tandragee TR2 shunt reactors are to be replaced due to the age and condition of the existing assets. **Completion date: by 2024.**

Kilroot 275 kV CT Replacement (T11p)

The Current Transformers (CTs) on the 275 kV circuits at Kilroot are to be replaced due to the condition of the existing assets. **Completion date: By 2024.**

Limavady Main 110 kV Refurbishment (T10)

The 110 kV mesh at Limavady Main is to be refurbished due to the condition and rating of the existing assets. **Completion date: by 2024.**

Strabane Main 110 kV Refurbishment (T10)

The 110 kV mesh at Strabane Main is to be refurbished due to the condition of the existing assets. **Completion date: by 2024.**

Tandragee Transformer Replacement (T13)

One of the 275/110 kV transformers (yet to be determined) at Tandragee is to be replaced during RP6 due to the age and condition of the transformer. **Completion date: by 2024**

RP6 275 kV Tower Maintenance (T17)

This project includes maintenance of 275 kV towers and condition assessment of towers and foundations. **Completion date: Before 2024.**

RP6 110 kV Tower and Overhead Line Maintenance (T19)

This project includes conductor replacement on the Castlereagh – Rosebank and Donegall – Finaghy 110 kV circuits, as well as wood pole replacement, tower maintenance and tower and foundation condition assessments elsewhere. **Completion date: Before 2024.**

RP6 110 kV Cable Maintenance (T20)

This project includes 110 kV cable refurbishment, cable flushing and maintenance of ancillaries. **Completion date: Before 2024.**

RP6 110 kV Transmission Protection (T602)

This project includes replacement, maintenance and upgrading of protection at 110 kV substations. **Completion date: Before 2024.**

RP6 275 kV Transmission Protection (T602)

This project includes replacement, maintenance and upgrading of protection at 275 kV substations. **Completion date: Before 2024.**

RP6 22 kV Transmission Protection (T602)

This project includes replacement, maintenance and upgrading of protection relating to 22 kV connected reactors at 275/110 kV stations. **Completion date: Before 2024.**

Miscellaneous RP6 Works (T11a-T11n, T11r, T12d-T12q, T12s, T16, T40)

This includes a number of small, within-station works including asbestos removal, concrete refurbishment, transformer bunding, auxiliary transformer replacement, transformer cooler replacement, 33 kV earthing transformer replacement, bushing replacement, station electrical systems, civil works, painting, earthing transformer replacement, transformer cooler replacement, security upgrades, health and safety upgrades, and provision of spares. This work is to be completed within the RP6 period and thus should be completed **by 2024.**

Banbridge Main Transformer 1, 2, 3 and 4 Replacement

The 110/33kV transformers Tx 1-4 at Banbridge Main are to be replaced due to the age and condition of the existing transformers. **Completion date: After 2024.**

Castlereagh 275 kV Structures, Busbars and Disconnectors Replacement

The 275 kV structures, busbars and disconnectors at Castlereagh are to be replaced due to the age and condition of the existing assets. **Completion date: After 2024.**

Castlereagh Interbus Transformer 1 Replacement

The 275/110 kV 240 MVA interbus transformer IBTx 1 at Castlereagh is to be replaced due to the condition of the asset. This was previously scheduled in RP6 but has been delayed to RP7. **Completion date: After 2024.**

Coolkeeragh 275 kV Structures, Busbars and Disconnectors Replacement

The 275 kV structures, busbars and disconnectors at Coolkeeragh are to be replaced due to the condition of the existing assets. **Completion date: After 2024.**

Coolkeeragh 110 kV Disconnectors Replacement

The 110 kV disconnectors at Coolkeeragh are to be replaced due to the condition of the existing assets. **Completion date: After 2024.**

Hannahstown 275 kV Structures, Busbars and Disconnectors Replacement

The 275 kV structures, busbars and disconnectors at Hannahstown are to be replaced due to the age and condition of the existing assets. **Completion date: after 2024**

Kells and Hannahstown Shunt Reactor Replacement (NEW)

One shunt reactor at each of Hannahstown and Kells is due to be replaced due to the condition and age of the existing assets. **Completion date: After 2024.**

Kells 275 kV Structures, Busbars and Disconnectors Replacement

The 275 kV structures, busbars and disconnectors at Kells are to be replaced due to the condition of the existing assets. **Completion date: After 2024.**

Kells Inter-Bus Transformer Replacement

One of the 275/110 kV 240 MVA interbus transformers at Kells is to be replaced due to the age and condition of the existing transformers. In the meantime noise enclosures will be installed on both transformers. **Completion date: By 2025.**

Magherafelt 275 kV Structures, Busbars and Disconnectors Replacement

The 275 kV structures, busbars and disconnectors at Magherafelt are to be replaced due to the condition of the existing assets. **Completion date: After 2024.**

Rathgael 110 kV Structures and Disconnectors Replacement

The 110 kV structures and disconnectors at Rathgael are to be replaced due to the condition of the existing assets. **Completion date: After 2024.**

Tandragee Transformer Replacement

One of the 275/110 kV transformers (yet to be determined) at Tandragee is to be replaced during RP7 due to the age and condition of the transformer. This project previously referred to replacement of both IBTx 1 and 2. **Completion date: after 2024**

Tandragee 275 kV Structures and Disconnectors Replacement

The 275 kV structures and disconnectors at Hannahstown are to be replaced due to the age and condition of the existing assets. **Completion date: After 2024.**

RP7 275 kV Tower and Overhead Line Maintenance

This project includes maintenance of 275 kV towers and lines and condition assessment of towers and foundations. **Completion date: After 2024.**

RP7 110 kV Tower and Overhead Line Maintenance

This project includes conductor replacement on some 110 kV spans, wood pole replacement, tower maintenance and tower and foundation condition assessments. **Completion date: After 2024.**

RP7 110 kV Cable Maintenance

This project includes 110 kV cable refurbishment, cable flushing and maintenance of ancillaries. **Completion date: After 2024.**

RP7 110 kV Transmission Protection

This project includes replacement, maintenance and upgrading of protection at 110 kV substations. **Completion date: After 2024.**

RP7 275 kV Transmission Protection

This project includes replacement, maintenance and upgrading of protection at 275 kV substations. **Completion date: After 2024.**

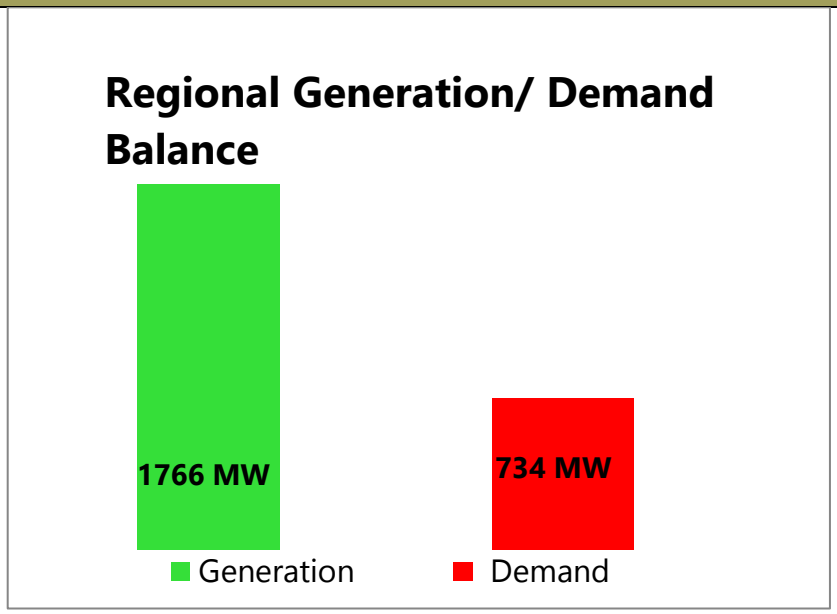
Miscellaneous RP7 Works

This includes a number of small, within-station works including station electrical station upgrades, transformer cooler replacement, transformer bushing replacement, refurbishment of earthing systems, health and safety upgrades, transformer bunding, civil works, and provision of spares. This work is to be completed within the RP7 period and thus should be completed **after 2024.**

7.3 The North and West Planning Area

The North and West Planning Area Overview
The North and West planning area comprises all areas connected to the transmission system north and west of the 275 kV double circuit ring around Lough Neagh and the 275 kV connection with Louth station in Ireland.

2028 Forecast Regional Generation and Demand Balance[37]



Summary of TDPNI Projects

TDPNI project category	No. of Projects
New Build	10
Uprate/ Modify	7
Total	17

Regional Description

[37] The Forecast Regional Generation and Demand Balance is based on peak Demand levels published in GCS 2020, and the Generation figures to be published the TYTFS 2020.

This area is characterised by a significant amount of wind generation connected to the 110 kV network and has more generation than demand. Conventional generation in this area is provided by Coolkeeragh Power Station, connected to the main 275 kV ring by a double circuit spur line which crosses the Sperrin mountains from Magherafelt.

There are two cross-border connections on the 110 kV system, connecting Strabane with Letterkenny in County Donegal and Enniskillen with Corraclassy in County Cavan. Cross-border power flows are managed by power flow controllers (PFCs).

There is limited high capacity 275 kV infrastructure in this area and currently little or no spare capacity for generation on the 110 kV system.

The planning area has considerably more generation than demand.

The excess of generation in the area is set to increase in the coming years. This is due to generators that currently have 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 South-East.

There are also reinforcement needs due to local constraints related to a shortage of transmission capacity and voltage support.

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. This project list is not definitive and will be updated in future TDPs to reflect the changing nature and understanding of the needs of the power system. 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 17 development projects in the North and West planning area are discussed in more detail below as are any changes to the expected completion date from

TDPNI 2019-2028. The status of the network development projects is noted in Appendix B.

Please refer to Figures 6-1 and 6-2 for locational information of planned Network Developments in the North and West Planning Area.

7.3.1 Renewable Generation Cluster Substations

Agivey 110/33 kV Cluster

The driver of this project is RES integration. It is planned to establish a 110/33 kV cluster substation near Garvagh to allow connection of new wind generation. This will be connected to the existing 110 kV Brockaghboy to Rasharkin overhead line. The expected completion date of this project has changed due to delays in obtaining planning permission.

Previous estimated completion: Winter 2020

New estimated completion: Summer 2022

7.3.2 Renewable Integration Developments

Gort 110/33 kV 2nd Transformer

The driver of this project is RES integration and security of supply. A reduction in local demand and increase in small scale generation on the distribution system connected to Omagh Main means that there is a risk of overload from a wind farm connected to this system. This project will involve the installation of a second 110/33 kV transformer at Gort to allow the transfer of a nearby wind farm to Gort from Omagh. The estimated cost of this project has reduced from £1.5 million to £1.3 million due to updated costs from NIE Networks. **Estimated completion: Summer 2022.**

Rasharkin 110/33 kV 2nd Transformer

The driver of this project is RES integration and security of supply. A reduction in

local demand, limited export capability and increase in small scale generation on the distribution system connected to Coleraine Main means that there is a risk of overload. This project will involve the installation of a second 110/33 kV transformer at Rasharkin to allow the transfer of nearby wind farms to Rasharkin from Coleraine. The estimated cost of this project has reduced from £1.5 million to £1.3 million due to updated costs from NIE Networks. The expected connection date has changed due to a need for the Creagh/Kells – Rasharkin reinforcement project to be completed before this project can be implemented.

Previous estimated completion: Summer 2022

New estimated completion: Summer 2026

Coolkeeragh Reactive Compensation

The drivers of this project are security of supply and RES integration. The development of wind generation in the North West of Northern Ireland has resulted in a need for voltage support. The estimated cost of this project has increased from £20.87 million to £21 million due to inflation.

Previous estimated completion date: Winter 2023

New estimated completion: 2025

Coolkeeragh - Magherafelt 275 kV Switchgear

The drivers of this project are RES integration and security of supply. During periods of high generation in the North West, there is a risk that in the event of a double circuit fault on the 275 kV line between Coolkeeragh and Magherafelt its auto-reclose facility would be inhibited. This project involves installing single phase tripping and high speed auto-reclose circuit breakers on these circuits to allow rapid reinstatement following a transient fault and minimise the associated risk.

Estimated completion: 2024

Coolkeeragh - Killymallaght - Strabane 110 kV Uprate

The drivers for this project are security of supply and RES integration. As a result of increasing growth in renewable generation in the northwest of NI there will be a need to uprate the 110 kV circuits between Coolkeeragh, Killymallaght and Strabane. Previous estimated completion: 2028

New estimated completion: 2027

Coolkeeragh - Trillick New 110 kV Circuit

The drivers for this project are security of supply, RES integration and market integration. A need has been identified to strengthen the electricity network on both sides of the border in the north-west to assist in the integration of renewable power sources. This project will interact with the North West of NI Reinforcement (see below) and the scope of the solution required to be delivered through that project. The estimated cost of this project has increased from £8.9 million to £9.8 million due to inflation and development of the project scope. **Estimated completion: 2027**

Creagh/Kells-Rasharkin New 110 kV Circuit

The drivers of this project are security of supply and RES integration. As a result of increasing growth in renewable generation there will be a need to construct a second 110 kV circuit between either Creagh or Kells and Rasharkin 110/33 kV cluster substation. The estimated cost of this project has increased from £21.8 million to £23.6 million due to inflation and an improved understanding of costs arising from project progress. **Estimated completion: Winter 2026**

Limavady Transformer Replacement (NEW)

The drivers for this project are security of supply and RES integration. As a result of increasing growth in renewable generation in the vicinity of Limavady Main there

is a need to replace the existing 2 x 45 MVA transformers with 2 x 90 MVA units. **Estimated completion: 2023**

North West of NI 110 kV reinforcement

The drivers for this project are security of supply and RES integration. As a result of increasing growth in renewable generation in the northwest and potential for voltage instability there will be a need to reinforce the 110 kV transmission system near Rasharkin, Coleraine, Limavady and the proposed Agivey cluster. As well as likely uprating of the circuits from Coolkeeragh to Limavady, the new circuit options to be investigated as part of this project will include:

- 110 kV circuit from Agivey cluster – Limavady; and
- 110 kV circuit from Coleraine – Rasharkin.

The estimated cost of this project has increased from £30 million to £32 million due to inflation. **Completion expected after 2026**

North West of NI Large-scale Reinforcement

The drivers for this project are security of supply and RES integration. As a result of increasing growth in renewable generation in the west there will be a need to construct a new circuit between the 275 kV system and the 110 kV system electrically close to Coolkeeragh.

A long list of options shall be narrowed down to a short list. A combination of these may be required. The long list of main and supporting options will include the following:

- HVDC link from Kilroot to Coolkeeragh;
- 275 kV or 110 kV circuit from Magherafelt to Coolkeeragh;
- 275 kV or 110 kV circuit from Magherafelt to Strabane (new s/s); and

- Turleenan – Omagh South – Co. Donegal New 275 kV Line.

These can be seen in Figure 6-2. The estimated cost of this project has increased from £170 million to £175 million due to inflation. This cost estimate is based on a 275 kV option and if the HVDC option is taken forward it is likely that this will cost significantly more. **Completion expected after 2026**

Omagh Main – Dromore Uprate

The drivers of this project are facilitation of a connection and RES integration. With the connection of Curraghamulkin cluster substation to Dromore it is necessary to restring the Omagh Main – Dromore tower line with higher capacity conductor. The estimated cost of this project has reduced from £4.4 million to £4.2 million due to updated costs from NIE Networks. **Estimated completion: Summer 2022**

Omagh Main – Dromore Third Circuit

The drivers of this project are security of supply and RES integration. There is expected to be further connections that will result in a need for reinforcement in addition to the planned uprate of these circuits. This project will involve further reinforcement including the option of the construction of a third circuit to alleviate these expected future constraints. The estimated completion date of this project has changed due to reprioritisation of projects within existing resources.

Previous estimated completion: 2028

New estimated completion: 2029

Strabane – Omagh 110 kV Uprate

The drivers of this project are RES integration. With increasing generation in the North West there is a risk of overload of the 110 kV circuits between Strabane and Omagh. This project will involve replacement of the conductor on the existing tower lines with new conductor of a higher rating. The estimated cost of this

project has increased from £5 million to £5.6 million due to inflation and updated costs from NIE Networks. **Estimated completion: 2026**

7.3.3 Load Related and Security of Supply

Coolkeeragh T1 Transformer Cabling Uprate

The driver for this project is security of supply. The increase in wind generation in the north-west of NI has resulted in an increase in power flows at Coolkeeragh. The project is to uprate the 110 kV cabling associated with Transformer 1 in order to accommodate these flows**. Estimated completion: Winter 2021**

East Tyrone Reinforcement Project

The driver for this project is security of supply. The driver of this project is security of supply. NIE Networks and SONI are jointly assessing the level of security of supply on the distribution system supplying Cookstown and the 110/33 kV substation at Dungannon. It is forecast that demand will exceed capacity at the existing Dungannon 110/33 kV substation. In addition there is a particular risk to supplies following a second circuit outage. Options being considered include:

- Installation of a 2nd Transformer at Tremoge as well a further distribution circuitry from Tremoge to Cookstown;
- Construction of a 2nd 110/33 kV substation at Dungannon;
- Establishing a new 110/33 kV substation at Cookstown with new 110 kV circuits from Dungannon, Tremoge or Tamnamore.

The estimated cost of this project has increased from £1.6 million to £1.7 million due to inflation. The estimated completion date of this project has changed due to reprioritisation of projects within existing resources.

Previous estimated completion: Winter 2022

New estimated completion: Winter 2023.

North West Special Protection Scheme Upgrade

The drivers of this project are security of supply and RES integration. This scheme was installed to protect the network in the north-west in the event of faults on the 275 kV network before the large-scale installation of wind generation in the north and west of NI. As wind generation capacity has increased, a need has been identified to replace and upgrade the existing special protection scheme.

The estimated cost of this project has decreased from £0.4 million to £0.3 million due to updated costs from NIE Networks. The estimated completion date of this project has changed due to availability of outages.

Previous estimated completion: Winter 2019

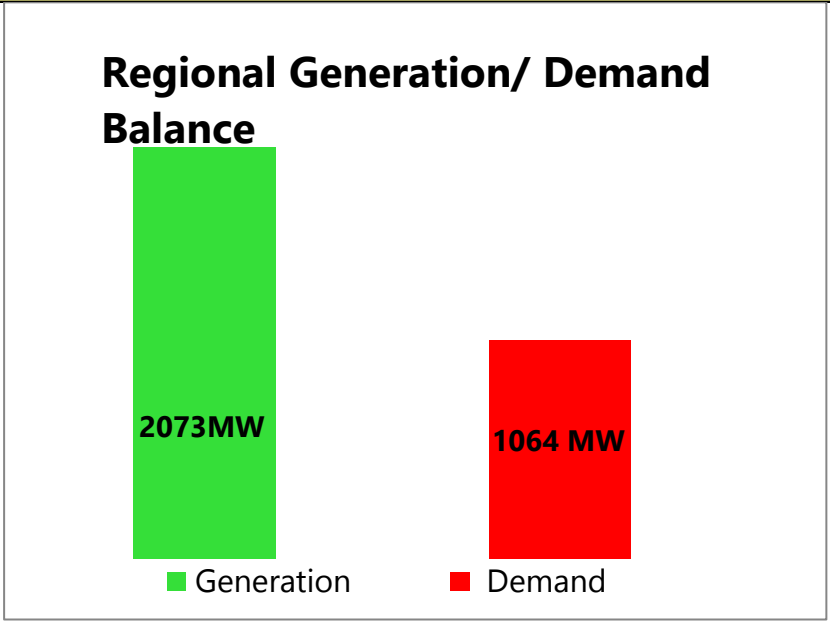
New estimated completion: Winter 2020.

7.4 The South-East Planning Area

The South-East Planning Area Overview

The South-East planning area comprises all areas within the 275 kV double circuit ring around Lough Neagh, as well as Greater Belfast, South Antrim and County Down.

2028 Forecast Regional Generation and Demand Balance



Summary of TDPNI Projects

TDPNI project category	No. of Projects
New Build	6
Uprate/Modify	7
Combined Uprate/Modify/ Refurbish/Replace	2
Total	15

Regional Description

This area is characterised by its relatively high demand, particularly in the Greater

Belfast area. There are two large conventional power stations; Ballylumford near Larne and Kilroot near Carrickfergus. Wind generation makes up a small proportion of installed capacity.

There is one cross-border connection on the 275 kV system, connecting Tandragee with Louth. The Moyle HVDC interconnector provides a connection between the 275 kV system near Ballylumford with the power system of Great Britain, via Scotland.

There is strong 275 kV infrastructure in this area, with significant spare capacity for generation and demand. In contrast to the North and West area, demand is greater than generation in the South-East.

The development of the transmission network in the area is characterised by the need to meet increasing demand and improve system resilience and flexibility. Investment is required to increase transmission of wind power from the North and West as well as cross-border interconnection.

There are also reinforcement needs due to:

- Local constraints related to a shortage of transmission capacity and voltage support;
- Accommodate further market integration with 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. This project list is not definitive and will be updated in future TDPs to reflect the changing nature and understanding of the needs of the power system. 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 15 development projects in the South-East planning area are discussed in more detail below. The status of the network development projects is noted in Appendix B.

Please refer to Figures 6-1 and 6-2 for locational information of planned Network Developments in the South-East Area in Parts 2 & 3.

7.4.1 Dual Asset Replacement/ Load Related and Security of Supply Projects

Belfast Metropolitan Redevelopment Project

Part 1 - Castlereagh - Hannahstown 110 kV Reinforcement

Formerly known as 'Carnmoney-Castlereagh 110 kV Circuit Uprate/Reconfiguration'. The driver for this project is security of supply. The existing conductor on the Castlereagh – Carnmoney 110 kV double circuit is due for replacement due to the age of the assets. SONI is currently considering options for this work. The preliminary preferred option is to install a 4th interbus transformer at Castlereagh and establish a 110 kV cable connection between Hannahstown and Castlereagh substations through Belfast city centre. This will enable removal of the existing 110 kV double circuit between Carnmoney and Castlereagh. SONI is currently preparing a request for funding for this option, which will be considered by the Utility Regulator. We will undertake full stakeholder engagement as part of our work to finalise the choice of preferred solution and subsequent process to obtain any consents that are required. We anticipate that this will be a phased project and that elements will be completed before the final completion of the project. The estimated cost of this project has increased from £28.5 million to £37.4 million due to inflation and an increase in the scope of the project. The estimated completion date of this project has changed due to the increase in scope.

Previous estimated completion: Winter 2024

New estimated completion: Winter 2028

Part 2 - Eden-Carnmoney 110 kV Circuit Uprate/Reconfiguration

The driver for this project is security of supply. The existing conductor is due for replacement due to the age of the assets. This project may involve reconfiguration of the circuits but the full scope will be determined in due course. The estimated cost of this project has increased from £7.9 million to £22.6 million due to

inflation and an improved understanding of project scope. It is expected that several sections of this circuit will be undergrounded. The estimated completion date of this project has changed due to the change in scope and reprioritisation of projects within existing resources.

Previous estimated completion: Winter 2023

New estimated completion: Winter 2026

7.4.2 Renewable Generation Cluster Substations

Kells 110/33 kV Cluster

The driver of this project is RES integration. It is planned to establish a 110/33 kV cluster substation near to the existing Kells 275/110 kV substation to connect new renewable generation to the transmission system. This will be connected to the existing Kells 110 kV station via an underground cable. The estimated completion date of this project has changed due to a delay in obtaining planning permission.

Previous estimated completion: Winter 2020

New estimated completion: Winter 2023

7.4.3 Renewable Integration Developments

Tamnamore - Turleenan 275 kV Uprate

The drivers of this project are security of supply and RES integration. Pending the establishment of Turleenan substation it is planned to uprate the conductors between Turleenan and Tamnamore 275 kV substation in order to improve inter-region power flow. The estimated cost of this project has increased from £4.3 million to £4.6 million due to inflation and updated costs from NIE Networks. The estimated completion date of this project has changed due to the delay in the completion of the North – South Interconnector project.

Previous estimated completion: Winter 2023

New estimated completion: Winter 2024

7.4.4 Load Related and Security of Supply

Tandragee 275 kV Second Bus Coupling Circuit Breaker

The driver of this project is security of supply. This project is to install a second busbar coupler onto the existing 275 kV double busbar. This project will improve resilience and redundancy of the protection at Tandragee. The estimated completion date of this project has changed due to reprioritisation of projects within existing resources.

Previous estimated completion: Winter 2022

New estimated completion: Winter 2023

Tamnamore – Drumnakelly 110 kV Uprate

The driver of this project is security of supply. These circuits may be subject to overload under high wind generation conditions and are operated out of service. This project is to replace the conductor on these circuits with higher capacity conductor. This will allow these circuits to fully return to service. **Estimated completion: 2027**

Airport Road 110/33 kV substation

The driver of this project is security of supply. It is planned to construct a new 110/33 kV substation in the Belfast Harbour Estate, close to the existing Airport Road 33/6.6 kV substation. The substation will be connected to the existing Rosebank substation via the existing 110 kV tower line (currently operated at 33 kV) from Rosebank to Sydenham Road. The need for this project arises from the increasing load in the Belfast Harbour and city centre area. Planning permission has been received for this substation. The estimated cost of this project has

decreased from £6.8 million to £6.1 million due to an improved understanding of costs arising from project development. **Estimated completion: Winter 2022.**

Castlereagh, Tandragee and Tamnamore Reactors

The driver of this project is security of supply. Further shunt reactors are planned to be installed at Castlereagh, Tandragee and Tamnamore substations in order to improve voltage regulation when the network is lightly loaded. The estimated cost of this project has increased from £3.6 million to £4 million due to inflation and an improved understanding of scope and costs arising from development of the project. **Estimated completion: 2022**

Drumnakelly and Armagh Reinforcement

The driver of this project is security of supply. There is a need to reinforce the distribution system supplying Armagh city and the surrounding area due to increasing demand. It is also forecast that demand will exceed capacity at the existing Drumnakelly 110/33 kV substation. Options being considered include:

- Establishing a new 110/33 kV substation adjacent to the existing Drumnakelly Main along with associated 33 kV reinforcements to the Armagh area; and
- Establishing a new 110/33 kV substation at Armagh with new 110 kV circuits from Tandragee or Drumnakelly.

The estimated cost of this project has increased from £24.9 million to £25.2 million due to inflation.

Estimate completion: 2026

7.4.5 Fault Level Replacements

Castlereagh 110 kV Switchgear Replacement

The driver for this project is safety. Due to increasing fault levels it is planned,

subject to detailed study, to replace 110 kV circuit breakers and current transformers at Castlereagh. The estimated completion of this project has been delayed due to the availability of outages and reprioritisation of projects within existing resources.

Previous estimated completion: Summer 2021

New estimated completion: Summer 2022

Castlereagh – Knock 110 kV Cables Uprate

The driver for this project is safety. The protection on this circuit will be replaced and uprated as well as the cable sealing ends and a section of cabling. This project is necessary due to the fault level exceeding the short circuit rating of the cable under certain conditions. The estimated completion of this project has been delayed due to the availability of outages.

Previous estimated completion: Summer 2020

New estimated completion: Summer 2021

Cregagh Transformer B Realignment and Switchgear Replacement

The driver of this project is security of supply. This project is to replace and uprate the 110 kV switchgear on Tx B at Cregagh and to increase the clearance between the two transformers. This project is needed as there is potential for the fault level to exceed the short circuit rating of the equipment under certain conditions. The estimated completion of this project has been brought forward due to reprioritisation.

Previous estimated completion: after 2024

New estimated **completion: Winter 2022**

Tandragee 110 kV Switchgear Replacement

The driver for this project is safety. Due to increasing fault levels it is planned, subject to detailed study, to replace 110 kV circuit breakers and current transformers at Tandragee. The estimated completion of this project has been delayed due to

the availability of outages and reprioritisation of projects within existing resources. The estimated cost has increased from £3.2 million to £3.3 million due to inflation. Previous estimated completion: Summer 2021

New estimated completion: Summer 2022

7.4.6 Interconnection

North-South Interconnector

The drivers for this project are market integration, security of supply and RES integration. This project involves construction of a new 400 kV circuit from existing Woodland 400 kV station in County Meath (Ireland) to a proposed 400/275 kV station at Turleenan in County Tyrone (Northern Ireland). This project is needed to remove constraints within the single electricity market, improve security of supply and facilitate safe and secure operation of the power system with high renewable penetration levels. The estimated completion of this project has been delayed due to a delay in obtaining planning permission. The estimated cost has increased from £116.3 million to £117.5 million due to inflation. Estimated completion: **Winter 2023**[38]

Moyle 275 kV Reinforcement

The drivers for this project are market integration, security of supply and RES integration. At present, full utilisation of the 500 MW export capability of the Moyle Interconnector is prevented by the potential for network overloads in the event of the loss of the 275 kV double circuit between the Moyle converter station at Ballycronan More and the nearby Ballylumford substation. This project involves works to allow reconfiguration of the connection to Moyle to address this

[38] To be reviewed following recent receipt of planning permission

contingency. It will be subject to cost-benefit analysis before proceeding. The estimated completion of this project has been brought forward due to reprioritisation. The project cost has increased from £4.1 million to £4.7 million due to an improved understanding of project scope.

Previous estimated completion: 2028

New estimated completion: 2024

7.5 Projects in Both Planning Areas

Enhancement to the Low Frequency Load Disconnection Scheme

It is planned to modify existing under-frequency automatic load shedding schemes to prevent tripping of distribution-connected windfarms.

Previous estimated completion: Summer 2022

New estimated completion: 2023

CVT Upgrade for Harmonic Measurement

It is planned to replace Capacitor Voltage Transformers (CVTs) at a number of sites with models capable of power quality monitoring, in order to improve monitoring of power system harmonics. **Estimated completion: Summer 2022**

Filter Tuning/Replacement

The driver of this project is security of supply. With increasing use of cable on the transmission system as well as an increase in non-linear load and generation, harmonic levels on the transmission system are increasing. This project will analyse the requirement for harmonic filters and re-tune/augment these accordingly. The estimated cost of this project has increased from £2.2 million to £2.3 million due to inflation.

Estimated completion: 2025

22 kV Switchgear Uprates

It is planned to uprate the 22 kV switchgear on the tertiary windings of a number of 275/110 kV transformers. The exact number of sites and scope of the work is yet to be determined. The estimated completion of this project has been brought forward due to reprioritisation arising from the Castlereagh, Tandragee and Hannahstown Reactors project.

Previous estimated completion: 2024

New estimated completion: 2022

8 ENVIRONMENTAL APPRAISAL REPORT OF TDPNI 2019-2028

An Environmental Appraisal Report (EAR) has been prepared as an accompanying document to this TDPNI. The purpose of the EAR is to ensure the TDPNI 2020-2029 is in line with committed strategic environmental objectives (SEOs). These objectives were set out in the Strategic Environmental Assessment (SEA) prepared for TDPNI 2018-2027 and integrated into the overall approach to grid development. A series of environmental, planning, social and technical policies and objectives guide sustainable Grid development.

As outlined in the earlier sections, this TDPNI includes 37 reinforcement projects. Of these, 1 project is new to TDPNI 2020 and therefore was not considered in the environmental appraisal carried out for TDPNI 2018-2027 or as part of the SEA process.

This project is examined in the EAR and evaluated against the SEOs. Following the implementation of mitigation measures (where necessary) the SEOs will be achieved.

Therefore we consider TDPNI 2020-2029 to be in accordance with the provisions of the Strategic Environmental Obligations as set out in TDPNI 2018-2027 and associated SEA.

APPENDIX A: PROJECT TERMS

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

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.

Project Capex: The anticipated capital expenditure associated with a project, comprising the combined total of the TSO （SONI） and TAO （NIE Networks） costs.

Stage: the stage the project has progressed to on the data freeze date. The SONI approach to project development consists of three parts, namely:

Part 1 – Planning

Part 2 – Outline Design

Part 3 – Consents

Once projects have progressed beyond Part 3, they are handed over to NIE Networks for construction. These projects are marked as **NIE Networks** within the tables below.

Asset replacement projects are carried out by NIE Networks outside SONI's Grid Development Process.

APPENDIX B: PLANNED NETWORK DEVELOPMENTS

This appendix details active TDPNI 2018 projects and their driver(s), need(s), location, stage and ECD, as at the data freeze date 01 January 2018. Projects are categorised by planning area[39]. Also shown are changes in project cost estimates (where applicable) since TDPNI 2019-2028.

Please note the following label:

- "  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 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 C; and
- "*" included with a project's length signifies that the circuit length is an estimate at this time.

[39] Some projects are in, or have the potential to be in, both planning areas.

NIE Networks Asset Replacement Projects

There are 43 projects in NIE Networks' Asset Replacement Plan; these projects are listed in Table B-1 below.

Table B-1 NIE Networks Asset Replacement Projects (43 Projects)

Project Title	Type	km	DRIVERS			NEEDS					Project Capex	Capex Changes since 2019	ECD
			Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition			
Ballylumford-Eden 110 kV Circuit Uprate	Refurbish/Replace/Uprate/Modify	15	✓			✓	✓			✓	£15.5M	+£6M	2022
Ballylumford 275 kV CVT Replacement	Refurbish/ Replace	0	✓							✓	£0.16M	-£0.04M	2024
Ballylumford Switchgear Replacement	Uprate/ Modify	0	✓				✓			✓	£17.4M	0	2023
Ballymena Transformer 3 and 4 replacement	Refurbish/ Replace	0	✓							✓	£1.99M	0	2020
Castlereagh and Tandragee Capacitor Bank Replacement (NEW)	Refurbish/ Replace	0	✓							✓	£0.25M	n/a	2024
Castlereagh inter-bus Transformer 3 replacement	Refurbish/ Replace	0	✓							✓	£2.77M	-£0.77M	2024
Coolkeeragh - Magherafelt 275 kV Circuits Refurbishment	Refurbish/ Replace	56	✓			✓				✓	£41M	+£11M	2022
Donegall Main (North) transformer replacement	Uprate/ Modify	0	✓				✓			✓	£1.0M	0	2021
Enniskillen Main Transformer 1 and 2 replacement	Refurbish/ Replace	0	✓							✓	£2.1M	0	2024
Glengormley Main Transformer B Replacement	Refurbish/ Replace	0	✓							✓	£1.2M	0	2021
Hannahstown 110 kV Disconnectors Replacement	Refurbish/ Replace	0	✓							✓	£0.9M	0	2024
Hannahstown inter-bus transformer 1 and 2 replacement	Refurbish/ Replace	0	✓							✓	£5.5M	-£1.5M	2024
Kells and Tandragee Shunt Reactor Replacement	Refurbish/ Replace	0	✓							✓	£1.4M	0	2024
Kilroot 275 kV CT Replacement	Refurbish/ Replace	0	✓							✓	£0.87M	+£0.67M	2024

Project Title	Type	km	DRIVERS			NEEDS					Project Capex	Capex Changes since 2019	ECD
			Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition			
Limavady Main 110 kV refurbishment	Refurbish/ Replace	0	✓							✓	£1.47M	0	2024
Strabane Main 110 kV refurbishment	Refurbish/ Replace	0	✓							✓	£2.55M	0	2024
Tandragee Transformer Replacement	Refurbish/ Replace	0	✓							✓	£2.8M	-£4.2M	2024
RP6 275 kV Tower Maintenance	Refurbish/ Replace	0	✓							✓	£7M	-£1.3M[40]	2024
RP6 110 kV Tower and Overhead Line Maintenance	Refurbish/ Replace	-	✓							✓	£7M	-2.4M[43]	2024
RP6 110 kV Cable Maintenance	Refurbish/ Replace	-	✓							✓	£0.7M	-£0.3M[43]	2024
RP6 110 kV Protection	Refurbish/ Replace	0	✓							✓	£1.7M	+£0.3M	2024
RP6 275 kV Protection	Refurbish/ Replace	0	✓							✓	£2.8M	+£0.1M	2024
RP6 22 kV Transmission Protection	Refurbish/ Replace	0	✓							✓	£0.1M	n/a	2024
Miscellaneous RP6 Works	Refurbish/ Replace	0	✓							✓	£3.4M	-£1.4M[43]	2024
Banbridge Main Transformer 1, 2, 3 and 4 replacement	Refurbish/ Replace	0	✓							✓	£2.2M	+0.26M	>2024
Castlereagh 275 kV Structures, Busbars and Disconnectors Replacement	Refurbish/ Replace	0	✓							✓	£10M	+£6.25M	>2024
Castlereagh inter-bus Transformer 1 Replacement	Refurbish/ Replace	0	✓							✓	£2.7M	+£1.4M	>2024

[40] The decrease in these costs partially reflect work that has been carried out since TDPNI 2019-2028

Project Title	Type	km	DRIVERS			NEEDS					Project Capex	Capex Changes since 2019	ECD
			Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition			
Coolkeeragh 275 kV Structures, Busbars and Disconnectors Replacement	Refurbish/ Replace	0	✓							✓	£10M	+6.5M	>2024
Coolkeeragh 110 kV Disconnectors Replacement	Refurbish/ Replace	0	✓							✓	£1.3M	0	>2024
Hannahstown 275 kV Structures, Busbars and Disconnectors Replacement	Refurbish/ Replace	0	✓							✓	£6M	+£4.8M	>2024
Kells and Hannahstown Shunt Reactor Replacement	Refurbish/ Replace	0	✓							✓	£1.53M	n/a	>2024
Kells 275 kV Structures, Busbars and Disconnectors Replacement	Refurbish/ Replace	0	✓							✓	£10M	+£6.75M	>2024
Kells Inter-bus Transformer Replacement	Refurbish/ Replace	0	✓							✓	£2.8M	n/a	2025
Magherafelt 275 kV Structures, Busbars and Disconnectors Replacement	Refurbish/ Replace	0	✓							✓	£10M	+£6.5M	>2024
Rathgael 110 kV Structures and Disconnectors Replacement	Refurbish/ Replace	0	✓							✓	£0.25M	0	>2024
Tandragee inter-bus Transformer replacement	Refurbish/ Replace	0	✓							✓	£2.7M	-£4.3M	>2024
Tandragee 275 kV Structures and Disconnectors Replacement	Refurbish/ Replace	0	✓							✓	£10M	+£6.5M	>2024
RP7 275 kV Tower and Overhead Line Maintenance	Refurbish/ Replace	0	✓							✓	£8M[41]	0	>2024
RP7 110 kV Tower and Overhead Line Maintenance	Refurbish/ Replace		✓							✓	£9M[39]	0	>2024

[41] These figures are estimates based on RP6

Project Title	Type	km	DRIVERS			NEEDS					Project Capex	Capex Changes since 2019	ECD
			Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition			
RP7 110 kV Cable Maintenance	Refurbish/ Replace		✓							✓	£1.4M[39]	+£0.4M	>2024
RP7 110 kV Protection	Refurbish/ Replace	0	✓							✓	£1.4M[39]	0	>2024
RP7 275 kV Protection	Refurbish/ Replace	0	✓							✓	£2.7M[39]	0	>2024
Miscellaneous RP7 works	Refurbish/ Replace	0	✓							✓	£2.7M[39]	-£0.5M	>2024

Projects in the North and West Planning Area

There are 17 development projects in the North and West Planning Area; these projects are listed in Table B-2 below.

Table B-2 Planned Projects in the North and West Planning Area (17 Projects)

Project Title	Type	km	DRIVERS				NEEDS					Stage (Part)	Project Capex	Capex change since 2019	ECD
			New Connection	Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition				
Agivey 110/33 kV Cluster	New Build	0	✓		✓				✓			3	n/a[42]	n/a	2022
Gort 110/33 kV 2nd Transformer	New Build	0			✓			✓	✓			3	£1.3M	-£0.2M	2022
Rasharkin Cluster 110/33 kV 2nd Transformer	New Build	0		✓	✓			✓				1	£1.5M	-£0.2M	2025
Coolkeeragh Reactive Compensation	New Build	0		✓	✓		✓	✓				2	£21M	+£0.13M	2025
Coolkeeragh – Killymallaght - Strabane 110 kV Uprate	Uprate/ Modify	15		✓	✓		✓	✓				1	£6.1M	n/a	2027
Coolkeeragh – Magherafelt 275 kV Switchgear	Uprate/ Modify	0		✓	✓		✓					1	£2.1M	0	2024
Coolkeeragh – Trillick new 110 kV Circuit	New Build	16		✓	✓	✓	✓	✓				1	£9.8M	+£0.9M	2027

[42] Cluster substation projects are funded according to the NIE Networks "Statement of Charges For Connection to Northern Ireland Electricity Networks' Distribution System" - http://www.nienetworks.co.uk/documents/connections/statement-of-charges

Project Title	Type	km	DRIVERS				NEEDS					Stage (Part)	Project Capex	Capex change since 2019	ECD
			New Connection	Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition				
Creagh/Kells-Rasharkin New 110 kV Circuit	New Build	0		✓	✓			✓	✓			1	£23.6M	+£1.8M	2026
Limavady Transformer Replacement (NEW)	Uprate/ Modify	0		✓	✓			✓			✓	1	£2.8M	n/a	2023
North West of NI 110 kV Reinforcement	New Build	-		✓	✓		✓	✓				1	£32M	+£2M	>2026
North West of NI Large-scale Reinforcement	New Build	-		✓	✓		✓	✓				1	£175M	+£5M	>2026
Omagh Main – Dromore Uprate	Uprate/ Modify	9	✓		✓		✓	✓			✓	3	£4.2M	-£0.2M	2022
Omagh Main – Dromore Third Circuit	New Build	9		✓	✓			✓				1	£11.6M	n/a	2029
Strabane – Omagh 110 kV Uprate	Uprate/Modify	36		✓	✓			✓				1	£5.6M	+£0.6M	2026
Coolkeeragh T1 Transformer cabling uprate	Uprate/ Modify	0		✓				✓				1	£0.6M	0	2021
East Tyrone Reinforcement Project	New Build	TBC		✓				✓	✓			1	£1.7M	+£0.1M	2023
North West Special Protection Scheme upgrade	Uprate/ Modify	0		✓	✓			✓				NIE Networks	£0.3M	-£0.1M	2020

Projects in the South-East Planning Area

There are 15 development projects in the South-East Planning Area; these projects are listed in Table B-3 below.

Table B-3 Planned Projects in the South-East Planning Area (15 Projects)

			DRIVERS				NEEDS								
Project Title	Type	km	New Connection	Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition	Stage (Part)	Project Capex	Capex Change Since 2019	ECD
Castlereagh – Hannahstown 110 kV Reinforcement [43]	Refurbish/Replace/New Build	25		✓			✓				✓	1	£37.4M	+£8.9M	2028
Eden-Carnmoney 110 kV Circuit Uprate/Reconfiguration	Refurbish/Replace/Uprate/Modify	12		✓			✓				✓	1	£22.6M	+£14.7M	2026

[43] Formerly Castlereagh – Carnmoney 110 kV Circuit Uprate/Reconfiguration

			DRIVERS				NEEDS								
Project Title	Type	km	New Connection	Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition	Stage (Part)	Project Capex	Capex Change Since 2019	ECD
Kells 110/33 kV Cluster	New Build	0			✓			✓	✓			3	N/A[44]	N/A	2023
Tamnamore – Turleenan 275 kV Uprate	Uprate/ Modify	5		✓	✓		✓					1	£4.6M	+£0.3M	2024
Tandragee 275 kV second bus coupling circuit breaker	Uprate/ Modify	0		✓			✓	✓				1	£2.1M	0	2023
Tamnamore – Drumnakelly 110 kV Uprate	Uprate/ Modify	22		✓	✓		✓	✓				1	£3.7M	N/A	2027
Airport Road Main 110/33 kV substation	New Build	0		✓				✓	✓			3	£6.1M	-£0.7M	2022
Castlereagh, Tandragee and Tamnamore Reactors	New Build	0		✓				✓				3	£4M	+£0.4M	2022
Drumnakelly and Armagh Reinforcement	New Build	17		✓				✓	✓			1	£25.2M	+£0.3M	2026

[44] Cluster substation projects are funded according to the NIE Networks "Statement of Charges For Connection to Northern Ireland Electricity Networks' Distribution System" – http://www.nienetworks.co.uk/documents/connections/statement-of-charges

Project Title	Type	km	DRIVERS				NEEDS					Stage (Part)	Project Capex	Capex Change Since 2019	ECD
			New Connection	Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition				
Castlereagh 110 kV Switchgear replacement	Uprate/ Modify	0		✓				✓				1	£3.9M	+£0.1M	2022
Castlereagh – Knock 110 kV cables uprate	Uprate/ Modify	5		✓				✓			✓	NIE Networks	£1.1M	-£0.1M	2021
Cregagh Transformer B Realignment and Switchgear Replacement	Uprate/ Modify	0		✓				✓			✓	1	£1.3M	0	2022
Tandragee 110 kV Switchgear replacement	Uprate/ Modify	0		✓				✓				1	£3.3M	+£0.1M	2022
North South 400 kV Interconnection Development (TYNDP/ 81)	New Build	137 (34)[45]		✓	✓	✓	✓	✓		✓		3	£117.5M[46]	+£1.2M	2023[47]

[45] The total length is 137 km: 103 km in Ireland and 34 km in Northern Ireland

[46] Included in this amount are the costs associated with obtaining planning consent plus the cost of developing the new substation at Turleenan and the cost of looping the existing 275 kV double circuit overhead line into that new substation. The cost increase since 2019 is due to inflation. Final costs may change following NIE Networks procurement.

[47] To be reviewed following recent receipt of planning permission

			DRIVERS				NEEDS								
Project Title	Type	km	New Connection	Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition	Stage (Part)	Project Capex	Capex Change Since 2019	ECD
Moyle 275 kV Reinforcement	New Build	1		✓	✓	✓	✓	✓		✓		1	£4.7M	+£0.6M	2024

Projects in Both Planning Areas:

There are 4 development projects that are in multiple Planning Areas; these projects are listed in Table B-4 below.

Table B-4 Planned Projects that are in Both Planning Areas (4 Projects)

Project Title	Type	km	DRIVERS			NEEDS					Stage (Part)	Project Capex	Capex Changes Since 2019	ECD
			Security of Supply	RES Integration	Market Integration	Inter-Regional Power Flow	Local Constraints	Connection	Inter-connection	Asset Condition				
Enhancement to the low frequency load disconnection scheme	Uprate/Modify	0	✓				✓				1	£0.9M	0	2023
CVT Upgrade for Harmonic Measurement	Uprate/Modify	0	✓			✓	✓				3	£1.1M	0	2022
Filter Tuning/Replacement	Uprate/Modify	0	✓			✓	✓		✓		1	£2.3M	+£0.1M	2025
22 kV Switchgear Uprates	Uprate/Modify	0	✓				✓			✓	1	£2.1M	0	2022

APPENDIX C: NORTHERN IRELAND PROJECTS IN EUROPEAN PLANS[48]

How are Northern Ireland 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[49] or at its borders[50];
- 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

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

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

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

- 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.

SONI Projects in TYNDP 2018 and RegIP NS 2015

Table C-1 below lists the Northern Ireland projects we proposed, that are in ENTSO-E's most recent final versions of TYNDP and RegIP NS. These were issued in 2018 and 2015 respectively.

Table C-1 Our projects in European TYNDP 2018

TYNDP No.	Project Title
81	North South 400 kV Interconnection Development
82	Renewable Integration Development Project (RIDP)

Northern Ireland Projects of Common Interest (PCIs)[51]

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 C-2 below lists the Northern Ireland Projects of Common Interest.

Table C-2 Northern Ireland 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)

Northern Ireland e-Highway 2050 projects

The e-Highway 2050 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 C-3 below lists the Northern Ireland projects included in the e-Highway 2050 plan.

Table C-3 Northern Ireland projects in e-Highway 2050 plan

TYNDP No.	Project Title
81	North South 400 kV Interconnection Development
82	Renewable Integration Development Project (RIDP)

[51] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0540&from=EN

How are Northern Ireland and European Plans related?

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

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 C-1 Relationship between Northern Ireland and European Plans

APPENDIX D: REFERENCES

Our Published Documents

I. SONI Transmission System Security and Planning Standards, September 2015

II. All Island Ten Year Transmission Forecast Statement 2018-2027

III. All Island Generation Capacity Statement 2019 - 2028

ENTSO-E Published Documents

IV. TYNDP 2018

V. RegIP North Sea, 2017

Local Legislation

VI. The Electricity Order (Northern Ireland) 1992 No. 231

VII. The Electricity Safety, Quality and Continuity Regulations (Northern Ireland) 2012

European Legislation

VIII. Birds and Natural Habitats Regulations, 2011

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

X. Environmental Impact Assessment Directive

XI. Habitats Directive

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

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

XIV. Energy Efficiency Directive 2012/ 27/ EC

Utility Regulator Published Documents

XV. TSO Licence granted to SONI

XVI. Transmission Licence granted to NIE Networks

XVII. NIE Networks RP6 Regulatory price Control, Utility Regulator, 2017

Government Published Documents

XVIII. Strategic Energy Framework, 2010

Other Published Documents

XIX. Grant Thornton: "Powering Northern Ireland A report exploring SONI's role in the economy", October 2016