Northern Ireland Electricity Networks

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INVESTING FOR THE FUTURE

NIE Networks RP6 business plan **2017-2024**


Northern Ireland
Electricity
Networks

NIE Networks' vision is to be a high performing electricity networks company that makes a positive contribution to the Northern Ireland community

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INTRODUCTION AND STRUCTURE OF DOCUMENT

a. Introduction

1.1 This document provides an overview of Northern Ireland Electricity Networks Limited's (NIE Networks) business plan for the six and a half year period from 1 October 2017 to 31 March 2024. This will be the sixth regulatory price control period (Regulatory Period 6 or RP6) since Northern Ireland Electricity plc was privatised in 1993. The current price control period (RP5) spans a five and a half year period from 1 April 2012 to 30 September 2017. Our RP6 plan includes details on what we intend to deliver during RP6, how much it will cost and the benefits provided to customers and stakeholders.

1.2 NIE Networks is the owner of the electricity transmission and distribution networks in Northern Ireland and the distribution network operator.

1.3 The Northern Ireland Utility Regulator (UR) will use this document together with more detailed supporting submissions which we will make to the UR to determine our allowed revenues for RP6.

1.4 The UR set out its overall approach to developing its RP6 determination in the Overall Approach document which it published in December 2015. The price control has been planned to develop over a number of stages as follows:

- **Stage 1** – NIE Networks plan submission (including actual data for previous years) submitted to UR on 29 June 2016.
- **Stage 2** – UR assessment of the plan and publication of draft determination for consultation on 20 January 2017.
- **Stage 3** – UR publication of final determination on 2 June 2017.

1.5 Our business plan has been developed and structured in a manner consistent with the guidance set out in the UR's overall approach. In addition to this RP6 plan overview document, we have submitted detailed workbooks and commentaries to the UR as a set of completed Business Plan Templates.

1.6 NIE Networks' vision is to be a high performing electricity networks company that makes a positive contribution to the Northern Ireland community. Our mission is to distribute electricity in a safe, reliable, efficient and environmentally aware manner.

1.7 We share responsibilities with SONI in respect of the transmission network. SONI is the System Operator for Northern Ireland and is responsible for the operation, design and planning of the transmission network. The sharing of functions meets the requirements of the European Union's Third Energy Package.

b. Structure of this document

1.8 We appreciate that the readers of this document will range from regulatory experts and well informed stakeholders through to new customers who may have little previous knowledge of NIE Networks. We have therefore set out to provide a simple overview of our plans and wherever possible have sought to avoid using acronyms or industry jargon. We include a glossary at the end of the document to help explain specific terms used.

1.9 The document is subdivided into the following chapters:

- **Chapter 2:** Executive Summary. This chapter provides an overview of the Business Plan.
- **Chapter 3:** Who We Are and What We Do. This chapter provides a simple description of our business.
- **Chapter 4:** Our Track Record. This chapter describes what we have achieved to date.
- **Chapter 5:** Developing the Plan for Our Business. This chapter sets out the key business objectives and long term strategy that drive our business.
- **Chapter 6:** What We Will Deliver for Customers. This chapter describes the key services and results we plan to deliver during RP6.
- **Chapter 7:** Distribution Expenditure. This chapter sets out the amount we propose to spend on the distribution network including business support activities and market operations.
- **Chapter 8:** Distribution Expenditure – Potential Additional Investment. This chapter describes potential investments which would enhance network performance and resilience.
- **Chapter 9:** Transmission Expenditure. This chapter sets out the amount we propose to spend on the transmission network.
- **Chapter 10:** Transmission Expenditure – Potential Additional Investment. This chapter describes projects which may be proposed by SONI during RP6 to enhance the capacity and capabilities of the transmission network. The UR will assess the relative merits of these projects on a case by case basis having regard to the project costs and benefits following submission by SONI.
- **Chapter 11:** Uncertainty and Incentive Mechanisms. This chapter provides details of where there is uncertainty that could affect the overall programme planned for RP6, the incentives which formed the basis of the RP5 regulatory framework and other potential incentives which could be introduced in RP6.
- **Chapter 12:** Connections. This chapter sets out the key business objectives and long term strategy that drive our connections business.
- **Chapter 13:** Financing the Business Plan. This chapter describes how we will finance the network investment through debt and equity.
- **Chapter 14:** Impact on Customers' Bills. This chapter illustrates how the electricity cost for customers will change as a consequence of the expenditure in the plan.
- **Chapter 15:** Glossary. This chapter provides an explanation of specific terms and acronyms.

1.10 All costs referred to in this document are in 2015/16 prices unless otherwise stated. Due to rounding, numbers presented in this document may not add up precisely to the totals provided.

EXECUTIVE SUMMARY

a. Introduction

2.1 NIE Networks is the owner of the electricity transmission and distribution networks in Northern Ireland and is the electricity distribution network operator, serving all 860,000 customers connected to the network.

2.2 Our role is:

- to operate our network of overhead lines, underground cables and substations effectively to 'keep the lights on' for our customers;
- to maintain our network so that it is in a condition to remain safe and reliable;
- to fix our network if it gets damaged or if it is faulty;
- to upgrade or extend the existing network to provide additional electricity supplies or capacity to our customers including the development of innovative solutions to manage the increasing level of renewables connections and the uptake of low carbon technologies;
- to provide electricity meters and provide metering data to suppliers and market operators. This is a key role in enabling wholesale and retail market competition; and
- to connect customers to the network, both for new electricity supplies and for new electricity generators.

2.3 NIE Networks is a regulated company and our business activities are overseen by the Utility Regulator (UR) in Northern Ireland. Our business plan for delivering our services to customers is approved for a number of years ahead in what are called "price control" periods. We are currently operating under the RP5 price control which runs from April 2012 to September 2017.

2.4 This business plan sets out the plans we have for the RP6 price control period, which will run from October 2017 to March 2024. It forms part of our detailed submission to the UR in June 2016. A detailed review will be carried out by the UR, followed by the publication of its Draft Determination in January 2017. Following a period of public consultation, a Final Determination will be published in June 2017 and NIE Networks will start to deliver the agreed plan from October 2017.

b. Plan development

2.5 Extensive planning, analysis and consultation have been used to ensure that the plan for RP6 delivers benefits for current customers and sets the foundations for the future. Maintaining, improving and expanding the network to meet customers' needs requires continuous attention, innovation and investment.

2.6 In developing the plan we have considered a range of factors.

- **Delivering the required services at least cost**. Throughout the process of developing the plan we have worked hard to ensure that the allowances we are seeking only include work which is strictly necessary to enable us to carry out our transmission and distribution functions to an appropriate standard and to provide a network which is fit for purpose for our customers.
- **Ensuring a safe and reliable network.** Our aim is not only to protect customers in respect of the cost of using our networks but also in respect of the safety and reliability of supply. The availability of a reliable electricity supply is important to business as well as domestic customers and enables Northern Ireland to compete effectively for inward investment.
- **Balancing the needs of current and future customers.** It is important to balance the interests of different generations of customers, not to defer works which ought properly to be undertaken now, and to balance the interests of different groups of today's customer (for example, rural and urban customers).
- **Utility Regulator guidance.** The UR published detailed guidance on the information it requires from NIE Networks to enable it to determinate the

appropriate work programmes and expenditure for our activities. Following this guidance has been central to our approach to preparing our business plan.

2.7 We have taken a detailed approach to preparing our RP6 plan. This has included reviewing the condition of the electricity network, carrying out detailed engineering studies, analysing costs, reviewing industry best practice, and importantly, considering the long term strategic issues facing the electricity network. The most important strategic issues are: ensuring the network is fit for purpose as the electricity sector faces the challenge of climate change through decarbonisation and how to manage an ageing network over the years ahead.

2.8 The NIE Networks Board of Directors has reviewed and approved the plan for submission to the UR.

c. Delivering for our customers

2.9 The most important services we provide to customers include maintaining public safety of the network, reliability and availability performance, impact on the environment, overall customer satisfaction with the work we do and the performance of our connections business. The targets we plan to deliver in our business plan are called "outputs" for customers and they are aligned to the most important services we provide.

Safety

2.10 NIE Networks' core value is safety and we will relentlessly target improvements in our overall health and safety performance. Our objective is to identify and minimise the risks posed by the electricity network to the general public, employees and contractors.

2.11 During RP6, we plan to spend £60 million to ensure our network complies with new safety legislation which will reduce the risk from interference, vandalism or unauthorised access to the network. Similar legislation has been implemented in Great Britain (GB) and the work we plan to undertake is in line with other electricity companies.

Network reliability and availability

2.12 Customer and stakeholder engagement indicates that customers are broadly content with the existing level of network reliability and availability. Therefore we propose to maintain these levels during RP6 through delivery of our asset replacement and maintenance plans.

2.13 Fast resolution of power cuts is important to customers. By the end of RP6, we will aim to have 90% of customers restored within 3 hours (currently an 87% standard) and 100% of customers restored within 18 hours (currently a 24 hour standard), excluding severe weather events.

2.14 In total we propose to spend £277m to replace assets that are no longer fit for purpose. Continual investment is required to deliver the network performance that customers expect.

2.15 We propose to spend £53m to reinforce network capacity in heavily stressed parts of the network in order to meet the growth in housing and business development. Our plan includes the cost of developing innovative solutions to manage the increasing level of renewables connections and the uptake of low carbon technologies (LCTs) such as solar panels, heat pumps, electric vehicles and wind generation. Our plan will also address the congestion problem on the 33kV network. Congestion in the electrical sense is a term used to describe when a network quickly reaches capacity thereby limiting headroom for further connections and potentially limiting the development of the electricity market. This is becoming an increasing problem on the 33kV network, driven by the increasing prevalence of embedded generation occurring in parallel with a reduction in electricity demand in particular areas of the network (which is referred to as 'load erosion').

2.16 Future network development will incorporate both traditional and innovative smart network reinforcement approaches. We will spend £10m to enhance the telecommunications network and to assess the benefits of smart grid technologies for the long term future. Our plans for innovation in RP6 are primarily focused on integrating suitably advanced smart solutions into business as usual. We plan to do this by undertaking a programme of five focused integration projects with the objective of developing cost effective alternatives to conventional network expenditure, minimising the impact on future customers.

Environment

2.17 We will minimise the impact of our business operations on the environment by reducing greenhouse gas emissions, limiting pollution, improving waste management and improving visual amenity.

2.18 We will continue to target improvement in our overall environmental performance using our internationally recognised ISO14001 accreditation.

2.19 By working with local communities and environmental organisations we will demonstrate our commitment to sustainable initiatives.

Customer satisfaction

2.20 The provision of a high level of service for our customers is a core business objective. We are committed to keeping our customers at the centre of our focus and aim to provide a safe, reliable and responsive electricity service which meets the standards our customers expect.

2.21 As part of our engagement with customers and stakeholders, we have been listening to what they have been telling us about our current service level and what they would like us to deliver in the future. We want to make it easier for our customers to communicate with us and improve our overall customer service delivery.

2.22 We will continue to use surveys to determine the level of service delivered to customers. This will include internal employee surveys to establish the perceived level of service to customers as well as external customer surveys to understand their views on the level of service provided. Feedback from these surveys will be used to develop customer service improvement plans.

2.23 We will continue to operate an enquiry and complaints system which makes it easy for customers to access the right people and to obtain responses in a timely and effective manner.

2.24 Whilst we endeavour to get things right first time, sometimes things can go wrong. When complaints are received they are treated with urgency and with an aim to resolve the matter to the customer's satisfaction quickly.

2.25 We will continue to inform and provide priority information services for public representatives or emergency services who are working on behalf of customers.

Connections

2.26 Very good progress has been made on connecting renewables so far in Northern Ireland. In 2010, the Northern Ireland Assembly set a target of achieving 40% of electricity consumption from renewable sources by 2020, including an interim target of 20% by 2015. At this point, we have helped deliver 880MW of renewable generation, which at 25%, is ahead of the 2015 government target.

2.27 We are facilitating a 'contestable market' for all types of new network connections. This provides customers with a choice of suppliers and drives service improvements and efficiencies. Historically, NIE Networks was the only party in Northern Ireland that could design and build connections. By the end of 2017 Independent Connection Providers may undertake elements of new connection provision.

2.28 During RP6 we will consider alternative methods of connection for customers who are impacted by constraints on the network.

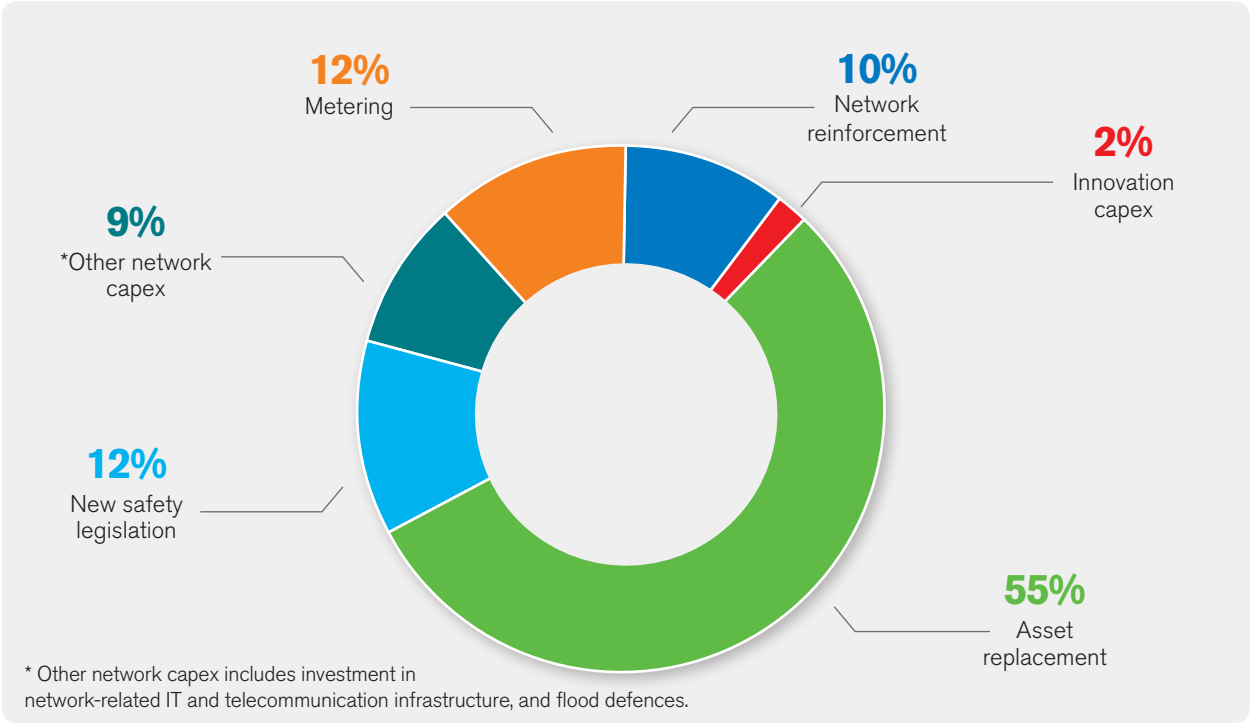
Very good progress has been made connecting renewables in Northern Ireland

d. Network investment

2.29 The RP5 price control spans a five and a half year period from 1 April 2012 to 30 September 2017. The price control prescribes specific projects which NIE Networks is required to deliver during RP5. We are on target to deliver these projects by 30 September 2017, although the work programme is back-ended to the second half of RP5 because the price control was not finally determined until April 2014. We expect our total expenditure during RP5 to be broadly in line with the price control allowances.

2.30 Total capital expenditure proposed for RP6 is £508m and would be spent across the main categories in our core programme as shown in Figure 1. This excludes optional investments on the distribution network that were considered as part of the customer and stakeholder engagement process, as these require specific consideration by the UR (see Chapter 8 for details). Also excluded are projects on the transmission network such as the North South Interconnector, which will be approved separately by the UR (see Chapter 10 for details).

Figure 1 – RP6 capital expenditure by category



* Other network capex includes investment in network-related IT and telecommunication infrastructure, and flood defences.

e. We will continue to operate efficiently

2.31 Since being privatised in 1993, we have implemented a series of initiatives and programmes designed to improve the efficiency of our cost base. These efficiencies are reflected in a 33% reduction in network charges since privatisation. We have also delivered a greater than 50% reduction in the average time customers are without electricity supply caused by faults on the network.

2.32 We plan to deliver further efficiency savings of £35m through:

- improvements to business processes supported by investment in new IT systems;
- improvements to operational working practices;
- effective procurement strategies;
- continued use of in-house resource to undertake core activities;
- design of the right engineering solutions to network problems i.e. no 'gold plating'; and
- learning from other distribution network operators (DNOs), utilities and large asset based organisations.

f. How we will finance our plan

2.33 We will fund our RP6 plan through operating cash flows from revenue receipts, raising of new debt and retention of earnings as required. We estimate that our borrowings will increase to around £950m by the end of RP6 and that we will need to raise an additional £500m of new debt.

2.34 To calculate our allowed revenues we have assumed a weighted average cost of capital (WACC) of 4.1%. This is the same WACC that applied in RP5 and is commensurate with the financial ratios and credit rating we need to raise new debt finance efficiently. A satisfactory overall price control incorporating a WACC at this level will support a strong investment grade rating over RP6 and allow NIE Networks to raise debt efficiently over the RP6 period. Our economic advisers have assessed the long term impact to customers of differing credit ratings and found that it is beneficial to customers as a whole to maintain a strong investment grade rating as it results in lower long term financing costs, which means lower bills for customers over the long term.

We plan to deliver further efficiency savings of £35 million

2.35 GB and European regulatory precedent indicates that a strong investment grade credit rating of A- / BBB+ is appropriate for a high-performing network operator. NIE Networks is currently rated by Fitch (BBB+) and Standard & Poor's (BBB+). Retention of at least a BBB+ credit rating is essential if NIE Networks is to compete effectively for new funding in the market.

g. Impact on customers' bills

2.36 NIE Networks derives its revenue principally through charges for use of the distribution system levied on electricity suppliers and charges for use of the transmission system levied on SONI. Our network charges were approximately 21% of the final electricity bill for the 2015/16 tariff year. This percentage will vary each year depending on electricity wholesale prices and other costs which make up the final bill.

2.37 Under the regulatory framework, the costs associated with network investment are paid for by customers over 40 years reflecting the long term value of network assets. Our tariff forecasts for RP6 reflect the cost of ongoing investment in the network and significant new programmes of work required to comply with new safety legislation and to manage the increasing level of renewables connections and the uptake of LCTs.

2.38 The expected impact in customers' bills is summarised in the table below.

Table 1 – RP6 average annual increase in network charges (2016/17 to 2023/24)

Customer group	Increase in network charges, £/annum	Increase in retail bill, %/annum
Domestic customers	1.5	0.28
Small businesses, max demand < 70kVA	7	0.25
Small and medium sized enterprises, max demand > 70 kVA	109	0.21
Large energy users connected at LV and HV, max demand > 1MW	855	0.12
Large energy users connected at 33kV, max demand > 1MW	2,293	0.07

2.39 The table below shows a comparison of average network charges at the end of RP6 (2023/24) compared to the last full year of RP5 (2016/17).

Table 2 – forecast average network charges in 2016/17 and 2023/24

Customer group	Number of customers	Average networks charges at the end of RP5			Average networks charges at the end of RP6		
		Distribution £/annum	Transmission £/annum	Total £/annum	Distribution £/annum	Transmission £/annum	Total £/annum
Domestic	790,000	115	15	**130**	123	17	**140**
Small business <70kVA	65,000	538	75	**614**	579	83	**663**
SME > 70kVA	5,000	8,187	1,343	**9,530**	8,807	1,485	**10,292**
LV & HV LEU > 1MW	172	54,248	17,789	**72,037**	58,358	19,667	**78,025**
33kV LEU>1 MW	18	96,584	82,711	**179,294**	103,902	91,441	**195,343**

h. Uncertainty and incentive mechanisms

2.40 Our proposals have been derived by using the most up-to-date information. However there are some areas of uncertainty, such as the uptake rate of low-carbon technologies or whether government will decide to install "smart" electricity meters across Northern Ireland. These uncertainties would require specific consideration during RP6, separate to the expenditure initially approved by the UR.

2.41 We welcome the continuation of the incentive mechanisms which drive service improvements for customers through business efficiencies. We propose widening the scope of the revenue protection incentive which protects customers from fraud and the introduction of a new incentive in relation to network reliability.

i. Our track record and our promise for RP6

2.42 NIE Networks is proud to serve Northern Ireland customers.

2.43 We have a strong track record of meeting our Guaranteed Standards for customers, restoring electricity to customers as quickly as possible when a fault occurs. We have substantially improved our safety, environmental and our network asset management, each of which is externally audited to internationally recognised standards. We are a leading company in restoring electricity to customers in the event of severe weather.

2.44 We demonstrate our responsibility to the communities in which we work through the proactive engagement of our employees with local schools, charities and community groups. We donate 2,000 hours of employee time each year to projects such as the promotion of engineering and science to young people and the provision of specialised skills to the boards of local charities. We also fund local charity initiatives through the NIE Networks Charity Fund.

2.45 We currently hold the Investors in People Gold Standard and our employee engagement has been recognised by the Chartered Institute of Personnel and Development. We are committed to training apprentices and our in-house training programme has been consistently assessed as 'excellent' by the formerly named Department of Employment and Learning. We are the first company in Northern Ireland to attain accreditation from the Institute of Engineering and Technology for our training and mentoring programme.

2.46 During RP6 all of our staff are committed to continuing to deliver improvements to meet the needs of customers, and we will continue to invest in the network in the long term interests of the economy and all customers in Northern Ireland.

WHO WE ARE AND WHAT WE DO

a. Transmission And Distribution Networks

3.1 NIE Networks is the owner of the electricity transmission and distribution networks in Northern Ireland and the distribution network operator.

3.2 Electricity transmission involves the bulk transfer of electricity across our high voltage network of overhead lines, underground cables and associated equipment mainly operating at 275kV and 110kV.

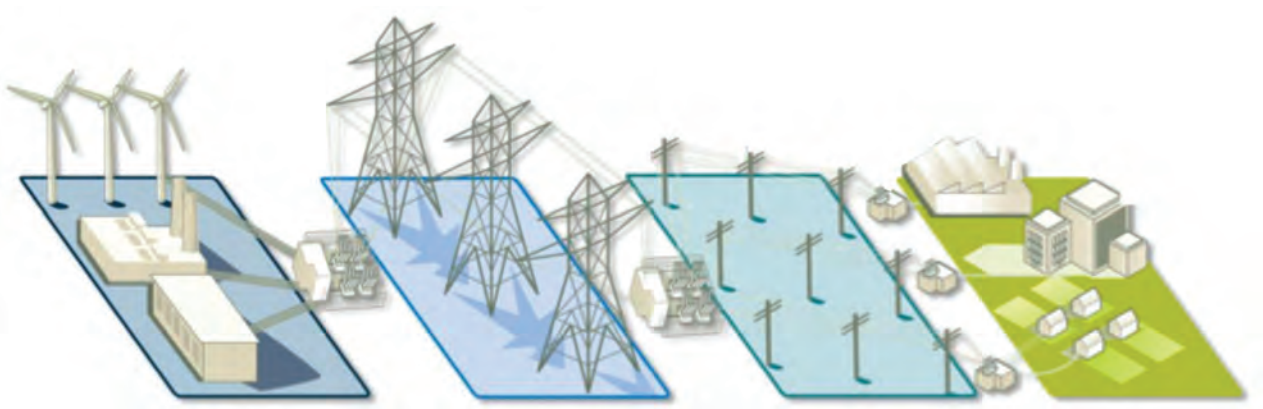
3.3 Electricity distribution involves the transfer of electricity from the high voltage transmission network and its delivery to consumers across a network of overhead lines and underground cables operating at 33kV, 11kV and lower voltages.

3.4 These networks enable the delivery of electricity from generators to customers.

3.5 We share responsibilities with SONI in respect of the transmission network. SONI is the System Operator for Northern Ireland and is responsible for the operation, design and planning of the transmission network.

3.6 Our vision is to be a high performing electricity networks company that makes a positive contribution to the Northern Ireland community. Our mission is to distribute electricity in a safe, reliable, efficient and environmentally aware manner. We work to our stated values concerning safety, employees, customer service, innovation, integrity, efficiency and community.

Figure 2: An overview of the electricity industry



3.7 Our key tasks are:

- ✔ to operate our network of overhead lines, underground cables and substations effectively to 'keep the lights on' for our customers;
- ✔ to maintain our network so that it is in a condition to remain safe and reliable;
- ✔ to fix our network if it gets damaged or if it is faulty;
- ✔ to upgrade or extend the existing network to provide additional electricity supplies or capacity to our customers including the development of innovative solutions to manage the increasing level of renewable connections and the uptake of low carbon technologies;
- ✔ to provide electricity meters and provide metering data to suppliers and market operators. This is a key role in enabling wholesale and retail market competition; and
- ✔ to connect customers to the network, both for new electricity supplies and for new electricity generators.

3.8 All of these tasks are carried out having the highest regard to levels of safety, whether that is to members of the public, contractors or our own staff.

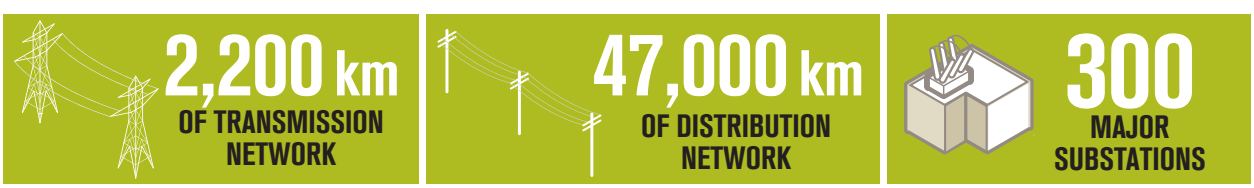
3.9 The transmission and distribution networks comprise a number of interconnected networks of overhead lines and underground cables which are used for the transfer of electricity to 860,000 customers via a number of substations. There are 2,200 km of transmission network, 47,000km of distribution network and 300 major substations, including 40 serving large wind farm sites. Our transmission network is connected to that of the Republic of Ireland (ROI) through a 275kV interconnector and to that in Scotland via the Moyle Interconnector. There are also two standby 110kV connections to ROI.

See the electricity network maps on pages 22 & 23

3.10 Our network covers every kind of geography and demography from densely populated residential areas to widely dispersed rural communities.

3.11 There are 860,000 customers connected to the network comprising 790,000 domestic and 70,000 commercial and industrial customers. The volume of electricity distributed to customers through the network is approximately 7800GWh per annum.

3.12 In addition to our network activities, we have a market operations team which provides meter reading, meter installation and certification services and metering data to support the retail and wholesale electricity markets. The arrangements in respect of metering and market operations in Northern Ireland are different from those in GB. In Northern Ireland, NIE Networks is the common service provider for all metering operational activities including meter reading, whereas in GB there are a variety of independent providers of metering services contracted directly to suppliers. Other activities carried out by our market operations team which are not carried out by the GB distribution network operators (DNOs) include the provision of metering data to support the retail and wholesale markets, maintenance of the market website and data communications infrastructure and retail market design and governance.



b. Connecting customers to the network

3.13 Customers who require a new electricity supply need to obtain a new connection to the network. These connections are called 'load' or 'demand' connections, and these terms are used interchangeably in the industry and have the same meaning. They are so called because these connections increase the electricity load on the network, which is the same as saying they increase electricity demand.

3.14 Also, generators who generate electricity and may need to export it into the network may need to connect to the network (generation connections).

3.15 The majority of connections work we undertake relates to demand / load connections. These can cover a range of services including:

- providing new connections to homes, businesses and farms, and housing developments;
- altering existing connections including replacing electrical equipment, installing new earthing or diverting equipment; and
- increasing or decreasing the load of electrical equipment to cater for new requirements, for example where new machinery at a farm requires more power to run it.

3.16 Generation connections fall into three broad categories – large scale, small scale and micro.

- Large scale generation (typically 5-40MW) mainly takes the form of wind farms but solar farms are likely to play a more significant part in the future. Large scale generation is connected to the transmission network (at 110kV) and the distribution network (typically at 33kV).
- Small scale generation (typically 20-500kW) takes the form of single wind turbines, anaerobic digesters and small solar installations. Small scale generation is connected to the distribution network normally to LV and 11kV lines fed from 33kV/11kV primary substations.
- Micro generation (4-12kW), typically photovoltaic (PV) panels on domestic rooftops, normally connects directly to customer premises.

Our vision

To be recognised as a high performing electricity network company that makes a positive contribution to the local community.

Our mission

To distribute electricity in a safe, reliable, efficient and environmentally sound manner.

Our values

Safety

We put the safety of our employees, contractors, customers and the general public first. By continually challenging and improving our safety leadership and behaviours, we will achieve zero harm.

Our people

We believe in our people - in developing and nurturing effective teams and high performing leaders to deliver our goals. Together we foster an environment of collaboration, diversity and professionalism where we are motivated, supported and valued.

Commercial

We plan and deliver all our work in the most cost effective and efficient manner for the benefit of our customers and shareholder.

Customer focus

We provide a safe, reliable and responsive electricity service, which endeavours to meet the standards our customers expect. We deal with customers professionally, courteously and we respect their individual needs.

Integrity & respect

We are honest, transparent and ethical in all our business dealings. We treat people fairly with dignity, integrity and respect. We take responsibility for our actions and hold ourselves accountable for all we do.

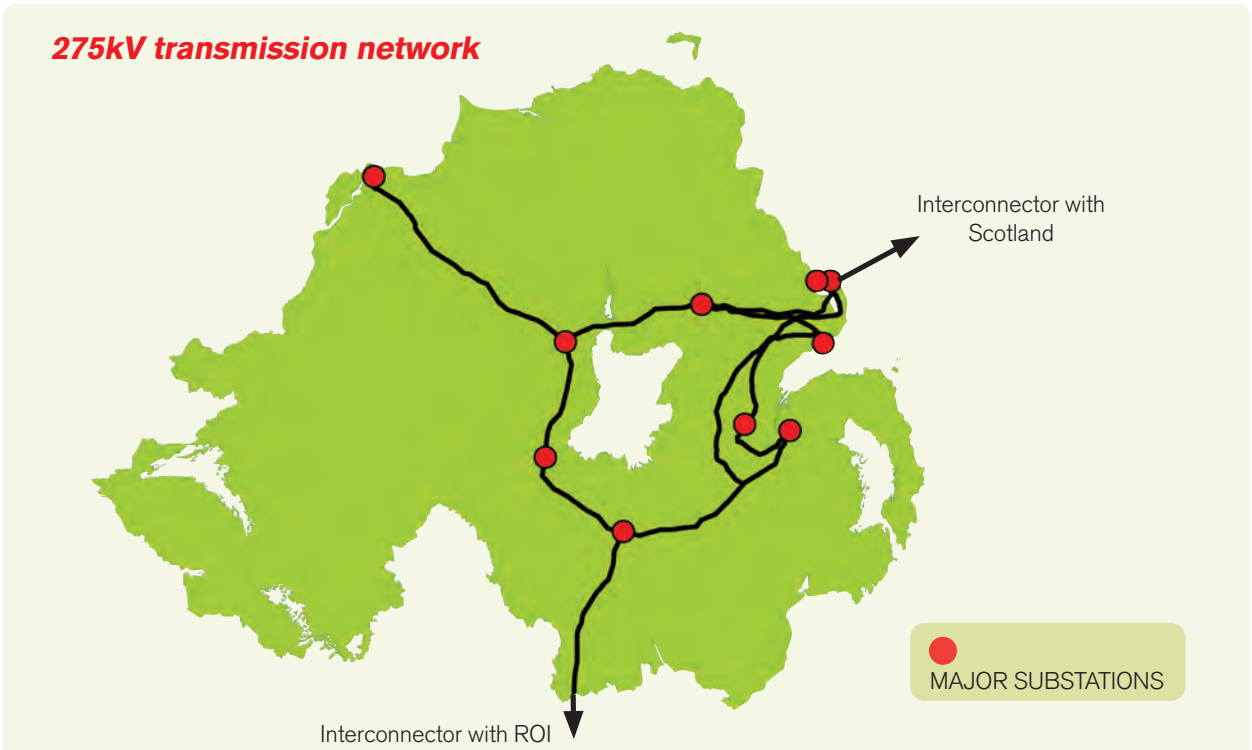
Sustainable innovation

We match the evolving pace of society, engineering and technology with innovative thinking and forward planning.

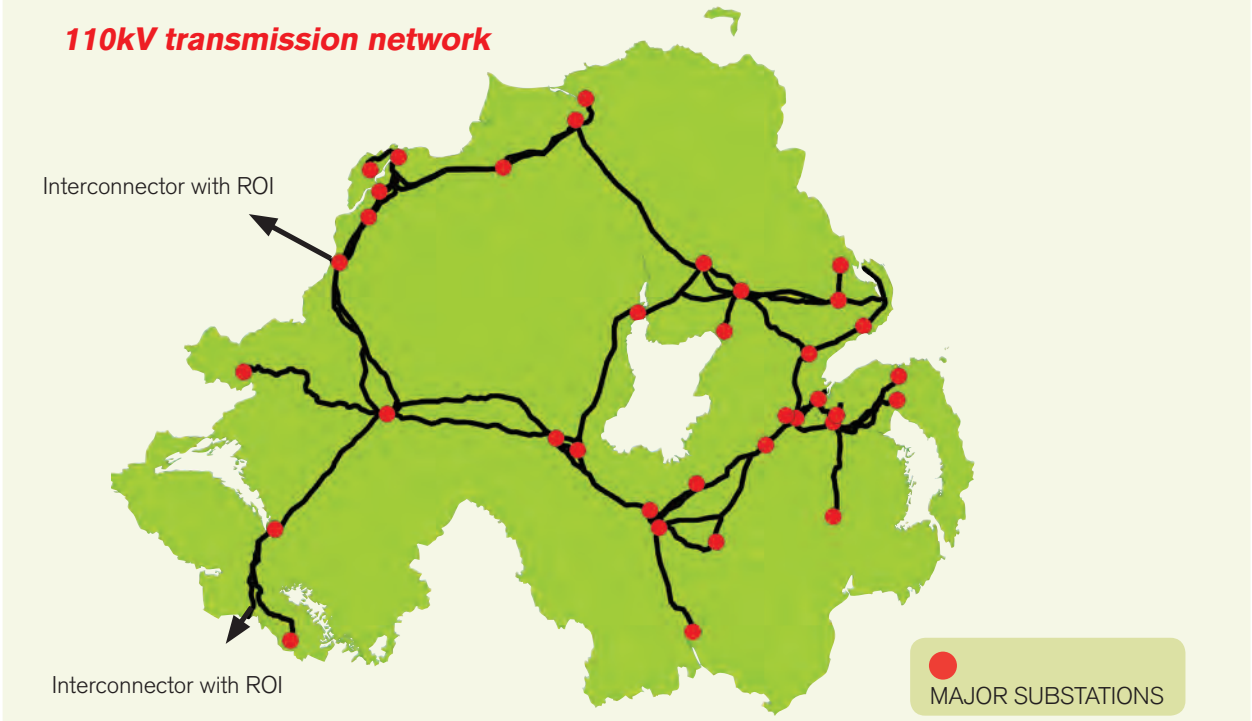
Community

We demonstrate our responsibility to the communities in which we work and live through sustainability initiatives and educational and charitable outreach programmes.

Figure 3: Network maps of Northern Ireland

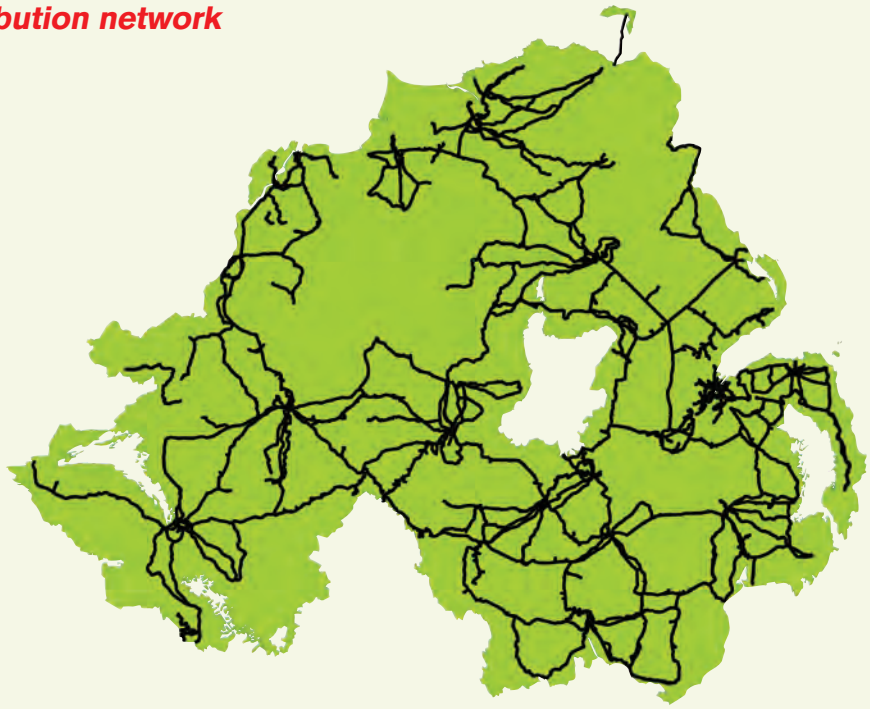


400 kilometres of double circuit overhead line carried on pylons or towers which transport electricity from Northen Ireland's three major power stations. This network also interconnects with the Republic of Ireland and Scotland.



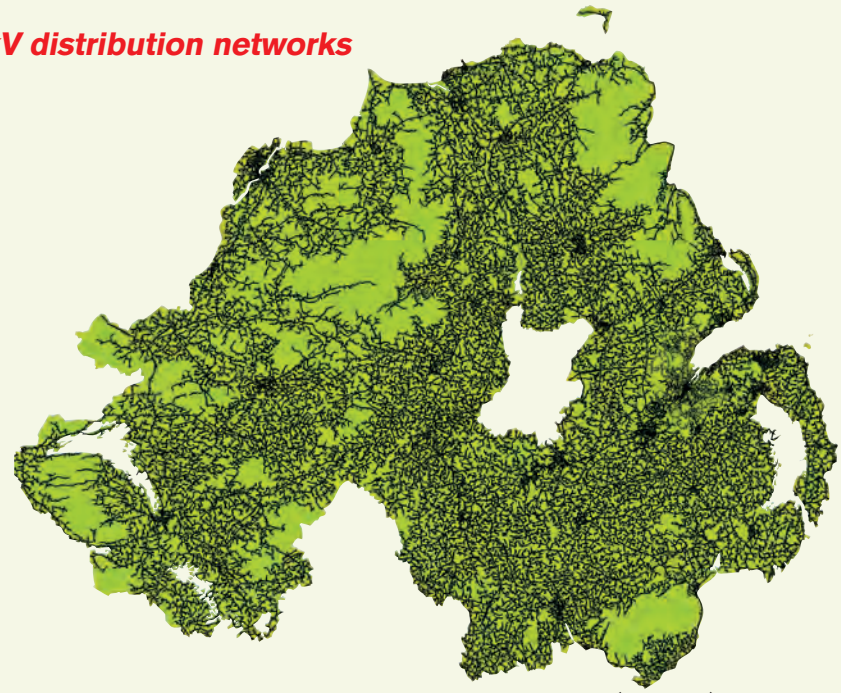
Substations transform electricity from 275,000 volts to 110,000 volts. This network has 1,290 kilometres of overhead line and 103 kilometres of underground cable. It has two interconnection points with the Republic of Ireland and picks up electricity from some large scale windfarms.

33kV distribution network



Substations transform electricity from 110,000 volts to 33,000 volts. This network has 3,000 kilometres of overhead line and 830 kilometres of underground cable. It picks up electricity from 38 large scale windfarms. Around 60 industrial customers connect directly to this network.

11kV & 6.6 kV distribution networks



Substations transform electricity from 33,000 volts to 11,000 volts or 6,600 volts (in Belfast). This network has 21,400 kilometres of overhead line and 4,175 kilometres of underground cable connected with over 8,500 ground mounted substations and almost 70,000 pole mounted transformers. It has around 400 industrial customers connected directly as well as hundreds of small scale renewable generators.

These networks connect to around 18,000 kilometres of low voltage network to distribute electricity to homes and businesses across Northern Ireland.

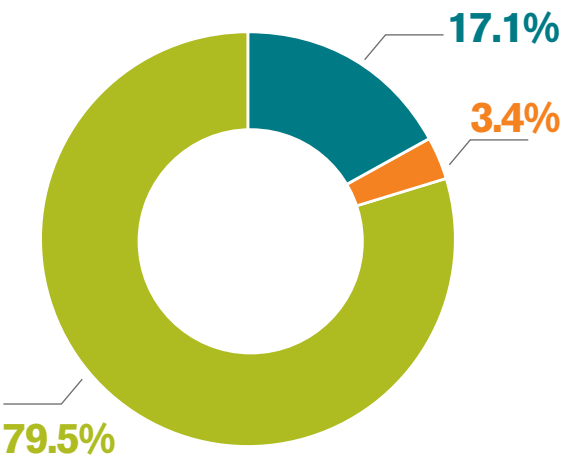
3.17 The cost of new demand and generation connections to the distribution network is payable directly by the customer in accordance with our Statement of Connection Charges (SoCC). We revise the SoCC every year with any changes being approved by the UR.

c. Cost of using the network

3.18 The UR scrutinises our business plans through a process known as a price control review. This determines how much we are allowed to charge in total per year for network investment, operating costs and allowed returns and ensures that the costs we incur provide good value for customers.

3.19 We derive our revenue principally through charges for use of the distribution system levied on electricity suppliers and charges for transmission services (mainly for use of the transmission system) levied on SONI. Our network charges represented approximately 21% of the final electricity bill, on average for the 2015/16 tariff year, as illustrated in Figure 4. The figures in the diagram have been calculated using information in a UR paper entitled, "Regulated Entitlement Values, 2015/16 Tariff Year", published in September 2015.

Figure 4 – NIE Networks costs as a % of the final bill 2015/16 tariff year



3.20 The other components of the bill mainly relate to the cost of generating electricity, and transmission system and supplier operating costs.

d. Corporate social responsibility

3.21 NIE Networks provides a vital service to every home, farm, school, hospital and business in Northern Ireland as part of its day to day work in delivering electricity supplies. Through our mainstream business activities and various specific initiatives we seek to make a positive impact on the communities in which we operate. For example, we annually donate 2,000 hours of our employees' time and skills to community organisations and projects and the NIE Networks Charity Fund makes quarterly funding donations to local charity initiatives and good causes.

3.22 We aim to provide a safe, reliable and responsive electricity service, which meets the standards customers expect.

3.23 We aim to continually heighten the awareness of the general public to the dangers of electricity and the risks of coming into contact with the electricity network. We are targeting information and awareness campaigns to 97,500 people over the RP6 period.

3.24 We engage proactively with students to consider engineering as a career, through a wide range of educational outreach initiatives. We have strong links with the education system in Northern Ireland, ranging from schools to local further educational colleges and local universities. Through these links, we seek to promote opportunities from taking Science, Technology, Engineering and Maths (STEM) subjects. We currently have 20

We annually donate 2,000 hours of our employees' time and skills to community organisations and projects

scholarship students at Queen's University Belfast and one at the University of Manchester.

3.25 We believe in our employees, in developing and creating effective teams and high performing leaders to deliver our goals. Our Investors in People (IIP) Gold standard accreditation reflects the quality and commitment of our employees and effective employee engagement processes. We were the first company in Northern Ireland to attain accreditation from the Institute of Engineering and Technology for our graduate training and mentoring programme.

3.26 Our environmental policy commits to protecting the environment and mitigating the impact of our activities upon the environment.

e. Risk management

3.27 Our risk management framework provides for the continuous identification, evaluation and management of our significant risks and includes appropriate structures to support risk management and the formal assignment of risk responsibilities to facilitate managing and reporting on individual risks.

3.28 The NIE Networks Board has overall responsibility for our approach to risk. Recognising that risk is an active element of the environment within which we operate, the Board is committed to successfully managing exposure to risk and to minimising the impact of risk on the achievement of business objectives.

OUR TRACK RECORD

4.1 This chapter provides an overview of NIE Networks' track record in relation to:

- health and safety;
- customer service;
- asset management processes;
- network reliability;
- restoration of supplies following a fault;
- environmental impact;
- innovation;
- our people;
- market operations;
- connection of renewable generation;
- network charges; and
- RP5 delivery.

a. Health and safety

4.2 Ensuring the safety of employees, contractors and the general public is a core value of the company. Our aim is to provide a zero harm working environment where risks to health and safety are assessed and controlled. This is achieved by the promotion of a positive health and safety culture and adherence to legislation and recognised safety standards.

4.3 Our health and safety management system is based on best practice guidance from the Health and Safety Executive for Northern Ireland (HSENI) and the Institute of Directors. Our safety management system is accredited to ISO Standard OHSAS 18001.

4.4 We engage with other utilities and relevant statutory organisations to share information and improve safety performance and learning.

4.5 The quality of our safety processes is reflected in the small number of lost time incidents experienced by our employees in recent years. A lost time incident is a work related injury or illness which prevents the injured or ill employee carrying out their work.

Table 3 – lost time incidents

	2008	2009	2010	2011	2012	2013	2014	2015
Lost time incidents	2	0	2	2	1	2	1	0

4.6 Our safety team provides support to all areas of our business with particular focus on site safety inspections, the reporting and investigation of 'near miss' incidents and ensuring that contractors adhere to the same safety rules and requirements as our own employees.

b. Customer service

4.7 The Utility Regulator (UR) sets overall and guaranteed standards of performance for NIE Networks. We have an excellent record of meeting these standards, as demonstrated in the table below.

Table 4 – performance against standards

	2008	2009	2010	2011	2012	2013	2014	2015
Defaults against overall standards	0	0	0	0	0	0	0	0
Defaults against guaranteed standards	0	0	0	0	0	1	0	0

4.8 Our focus continues to be on reducing the number of avoidable complaints and the number of instances when customers are dissatisfied to the extent that they refer a complaint to the Consumer Council for Northern Ireland (CCNI).

c. Asset management processes

4.9 Our asset management processes are accredited under Publicly Available Specification (PAS) 55. PAS 55 has been developed by the Institute of Asset Management as a standard for the optimised management of physical infrastructure assets. It covers 28 elements of asset management including the specification of objectives, risk management, performance and condition monitoring, development of work plans, progress monitoring, and continuous improvement, underpinned by the commitment of senior management.

d. Network reliability

4.10 We aim to provide a safe, reliable and responsive electricity service, which meets the standards customers expect.

4.11 Our primary measure of network performance is the time customers are off supply due to faults on the network. We measure this in terms of Customer Minutes Lost (fault CML), which is the average number of unplanned minutes customers are off supply per annum due to network faults. The diagram below shows that, averaged on a 10 year rolling basis, we have delivered a substantial reduction in fault CML.

4.12 Whilst over the period since 1991 the longer term average CML has decreased, the trend for the last number of years has been broadly flat, with an average of approximately

Figure 5 – 10 year average fault CML

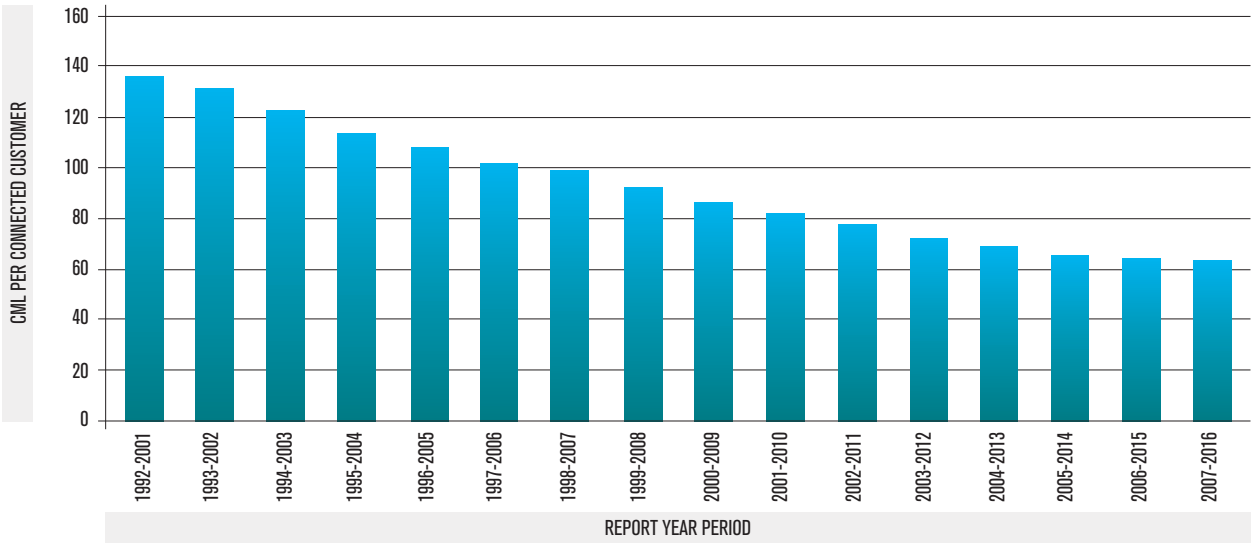
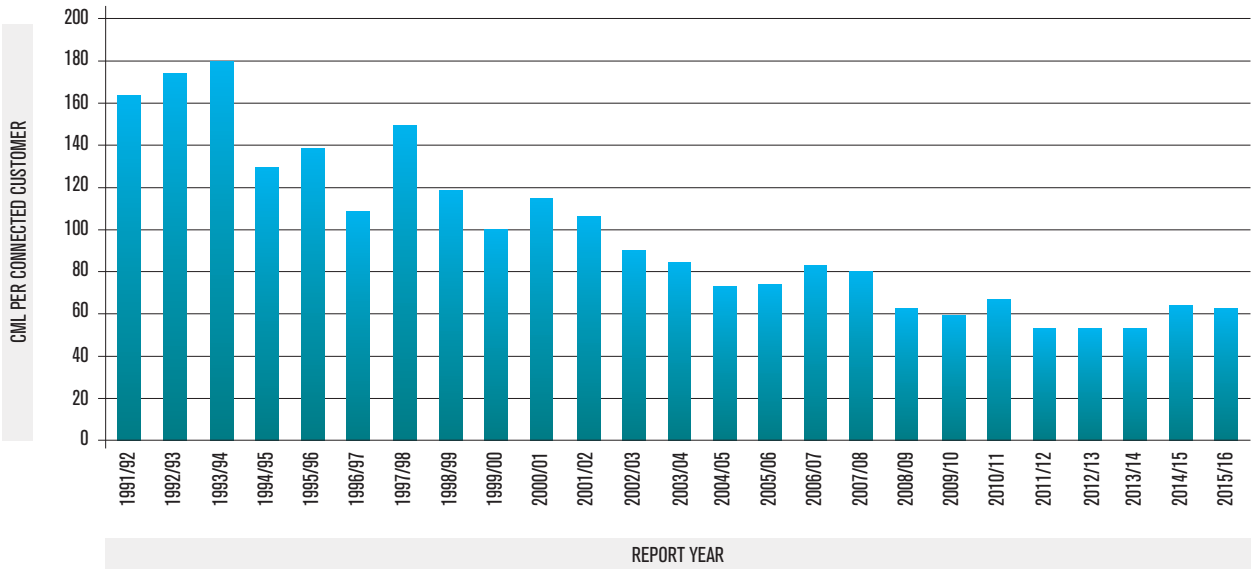


Figure 6 – fault CML per annum



60 CML. Year to year variation is mainly driven by weather patterns.

4.13 Another measure of network performance is the number of times customers are off supply. We measure this as fault Customer Interruptions (CIs), by reference to the number of times customers experience supply interruptions of more than one minute duration per 100 connected customers. The diagram below shows that, averaged on a 10 year rolling basis, we have delivered a substantial reduction in fault CIs.

4.14 Similar to fault CML, whilst over the period since 1991 the longer term average fault CI has decreased, the trend for the last number of years has been broadly flat, with an average of approximately 63 fault CIs. Year to year variation, as shown in the diagram below, is mainly driven by weather patterns.

Figure 7 – 10 year average fault CI

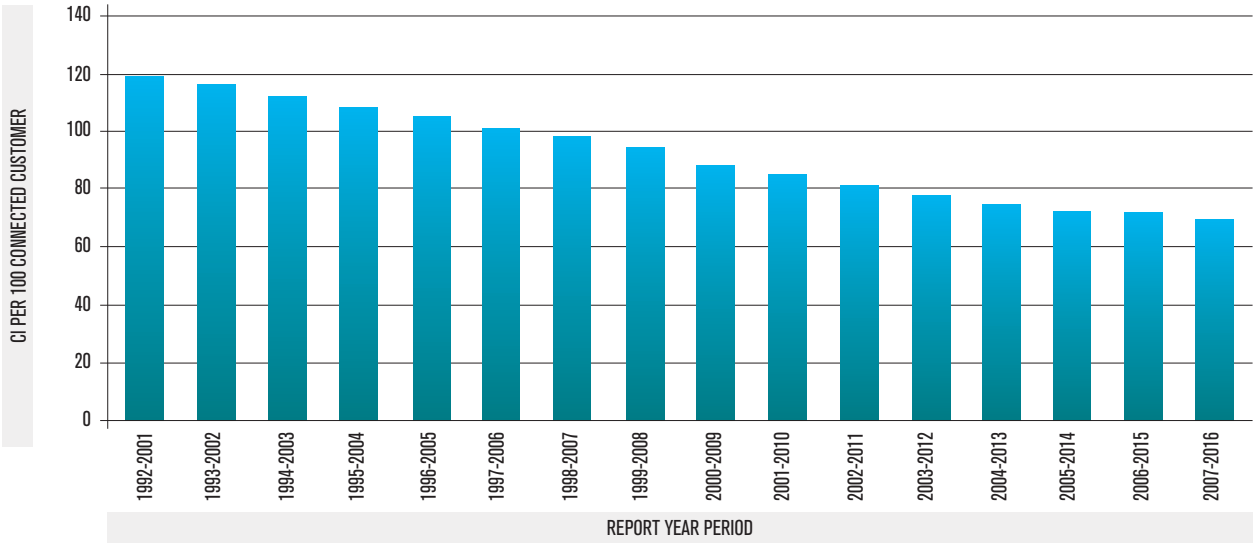
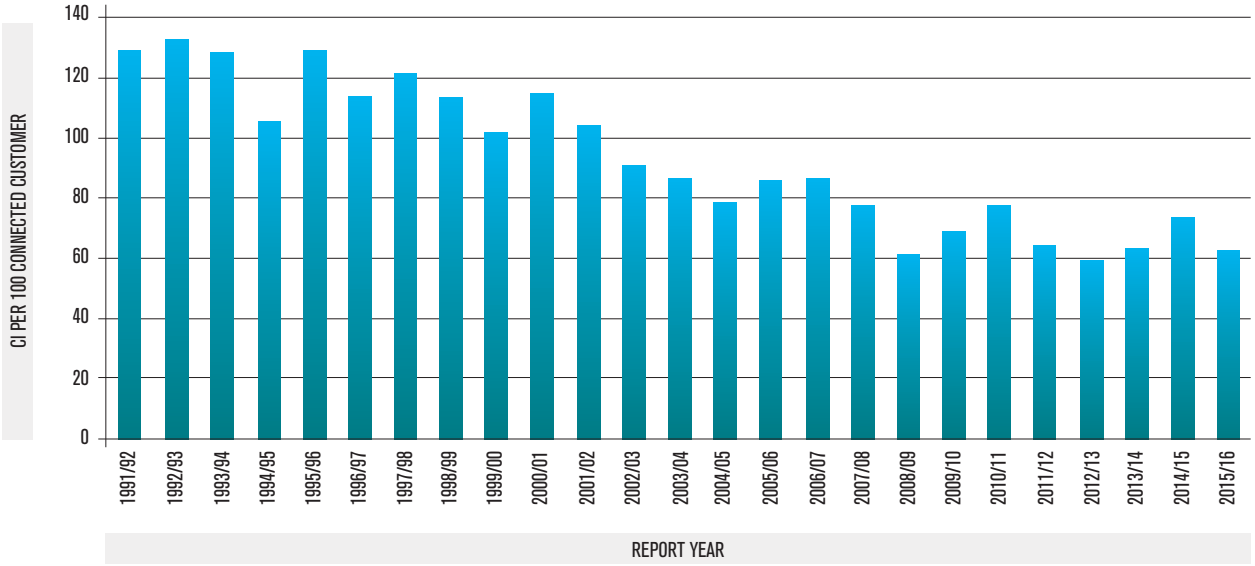


Figure 8 – fault CI per annum



e. Restoration of supplies following a fault

4.15 Our distribution network is predominantly an overhead line network and is therefore vulnerable to adverse weather conditions such as lightning, gales and ice storms. When bad weather occurs, we aim to restore power to affected customers as quickly as possible.

4.16 We have a well rehearsed emergency plan and have arrangements in place with the councils, emergency planners, health trusts, and other organisations to respond to wider community needs in the event of customers being without electricity for an extended period of time. We also provide a critical care information service which assists customers who rely on electricity for their healthcare needs with a specific team dedicated to communicating with these customers during power outages.

4.17 Excluding severe weather events we work to restore 100% of customers who lose power supply within 24 hours, and 87% of customers within 3 hours, in line with our guaranteed standards of performance.

f. Environmental impact

4.18 We have an accredited ISO14001 Environmental Management System which covers all of our business activities and locations. As part of the accreditation process, the British Standards Institution (BSI) completes a six monthly assessment, to ensure that we continue to meet the internationally recognised standard and that we are also compliant with legislation. BSI has a three year programme where all relevant activities are reviewed at least once, or more regularly as required. The visits include reviewing central office records and interviewing staff about their specialist topic and visiting sites to see how processes are managed.

4.19 We strive to set challenging targets year on year to continually improve our approach to environmental management whilst aiming to reduce the impact we have on the environment through our day to day activities.

4.20 As part of our ISO14001 accreditation we prepare an annual environmental action plan. This plan provides the key environmental objectives we aim to achieve and covers six main high level areas:

- minimise the risk of air pollution;
- minimise our impact on the local community;
- minimise the risk of land contamination;
- enhance waste management;
- minimise the risk of water pollution; and
- ensure appropriate environmental management.

4.21 Each area has several objectives contained within it that are carefully selected after scoring our environmental impacts that may arise throughout the business. Some examples of practices implemented through the plan include:

- introducing alternative methods of waste disposal including alternative disposal methods for wooden pallets & cable drums, which are now being re-used and so reducing the amount of waste going through our waste contractor;
- testing our site interceptors to determine their level of contamination allowing us to decide if they require emptying and/or cleaning rather than this happening automatically;
- introducing bunded containers for storing oil barrels and returned defective transformers which safely captures any leakage that may occur;
- installing at all pole storage site locations protective absorbent matting to prevent creosote leaching into the ground;
- introducing more energy efficient equipment on to the network to reduce network losses and reviewing equipment sizing; and
- commissioning Invest NI to complete energy audits across the company, so that we can identify areas where savings can be made.

Technical innovation speeds up processes and improves network performance for our customers

Smart network fuses deployed in a Coleraine substation.

4.22 To help us monitor our progress against the environmental action plan, key activities are measured and collated centrally allowing us to track trends and to review performance across locations and also against historical data. This includes monitoring our energy and fuel usage, waste recycling performance and our participation in an annual Northern Ireland environmental benchmarking survey.

g. Innovation

4.23 Technical innovation enhances working methods, speeds up processes and improves network performance for our customers. We have a history of developing and implementing a number of technical and operational innovations such as –

- engaging in collaborative research with technology companies to develop innovative ways to find faults on the LV network and speed up restoration times;
- using smart technologies to monitor the condition of assets and improve our ability to manage risks associated with asset failures, which in turn potentially extends the life of assets;
- trialling new technologies; for example, we undertook a combined smart meter and smart grid trial in Coleraine between 2012 and 2014 which successfully demonstrated that smart meters can be used to help shift peak demands on the distribution network and thus defer the need for further network investment;
- using special protection schemes at substations to enable more generation capacity to be connected to the network. These schemes comprise smart controllers that monitor power flows on the network and automatically initiate a series of actions to prevent the overload of circuits after an unplanned event on the network;

Converting a DeLorean car to electric-powered for use in educational outreach

- carrying out research and development activities aimed at identifying the best options for the operation and development of the transmission and distribution networks. For example through the Sustainable Networks Programme during RP4, we successfully developed a novel approach to applying dynamic ratings to 110kV transmission lines. This research highlighted the potential to reduce network investment requirements. Following our research operational trials have been completed in GB. We believe there is merit in integrating this approach into our plan and a specific project is proposed during RP6;
- using hand-held devices for substation and overhead line inspections to record site and equipment defects, which are then automatically uploaded into our asset management database, and scheduled for maintenance or replacement;
- using technology from the gas industry to develop cable fault location equipment that detects the gas produced when a cable fails rather than only using the electrical characteristic of the cable. The new technology identifies the position of the fault more quickly without the need for more specialist electrical testing. The accuracy of the method reduces the size and number of excavations required when repairing faults and speeds up restoration times for customers;
- using helicopter mounted thermal imaging for the detection of hot spots on overhead lines and in substations that shows where faults or failures are likely to occur;
- trialling the use of drones to assist with inspecting the condition of overhead line towers;
- using 'hot glove' techniques that allow certain overhead line activities to be done live at 11kV reducing the need to turn off supplies to customers; and
- using mobile generation for quicker restoration of customer supplies.

4.24 We continue to seek innovative solutions to problems. For example, through the "Project 40" initiative which commenced in May 2014, we have been exploring alternative connection arrangements whereby the output of a generator is controlled to avoid local network capacity limits being reached. As part of this initiative, we are carrying out research to determine the feasibility of a so called "managed connection" which, if successful, will allow more capacity to be squeezed out of the existing network and thus allow more generation to connect than would otherwise be the case without further network investment.

h. Our people

4.25 We seek to attract, develop and retain highly skilled people mainly through our apprenticeship, graduate, apprentice-to-graduate, scholarship and sponsorship programmes.

4.26 It remains a challenge however to ensure we have access to a large enough pool of potential candidates to join our workforce. For the majority of our skilled roles including finance, HR, IT and experienced administrative roles there is often an issue attracting the right calibre of individual in the local market place. For example, on the labour supply side there are fewer students choosing science and technology, which in turn limits the number of future engineering trainees. By contrast, on the labour demand side, there is an increasing requirement for engineers to deliver much needed investment in network renewal across the UK and beyond.

4.27 This potential supply-demand mismatch means the electricity industry faces a significant skills shortage now and in to the future. We therefore engage proactively with students to consider engineering as a career, through a wide range of educational outreach initiatives. Some recent examples include:

- linking with over 60 schools, most of the local further educational colleges and the two local universities to promote opportunities from taking Science, Technology, Engineering and Maths (STEM) subjects;
- providing Electrical Engineering scholarships at Queen's University Belfast and sponsoring Electrical and Electronic Engineering students through their studies as part of the Institute of Engineering and Technology Power Academy Council. In 2014/15 NIE Networks had a total of 21 scholarship students at Queen's University;
- providing work experience for A-Level students including involvement in research and development work;
- providing a two day 'Insight into Engineering' placement for female students;
- sponsoring the first Lego League, a global robotics programme, and the Young Innovators Award for Innovation with Electricity;
- providing mentoring services to school children participating in the Institute of Engineering and Technology 'SMART Energy' project and 'Team R&D'; and
- providing financial support for Queen's University Belfast for a project to enable students to convert a DeLorean car to electric-powered and for use by both NIE Networks and Queen's University in educational outreach work.

...linking with over 60 schools, most of the local further educational colleges and the two local universities to promote opportunities from taking Science, Technology, Engineering and Maths (STEM) subjects...

4.28 We have the ability to train our staff for all key operational roles mainly through the apprentice and graduate schemes within our training school. The ability to train our own staff is all the more important to us given the much more limited pool of skilled labour from which to draw from in Northern Ireland – in contrast to the GB distribution network operators who all draw from the same pool and from each other.

4.29 With six internal instructors delivering training across a number of disciplines who use on-site classrooms, workshops and formal on-site training to train our staff, we are self-sufficient for the training of new starters, for the training of refresher courses for existing staff and for the upskilling of existing staff. Many of our operational staff are multi-skilled, resulting in more effective and flexible service delivery to meet customers' needs.

4.30 We are committed to a working environment which enables employees to realise their maximum potential and to be appropriately challenged and fully engaged in the business, with opportunities for skills enhancement and personal development. Human Resources policies are aligned with key business drivers including: performance and productivity improvement; maximising the effectiveness of the working week; clearly defined values and behaviours; a robust performance management process; and a strong commitment to employee development, all of which are underpinned by competitive market-based terms and conditions that are efficient and effective.

4.31 The focus on development means that each year a high percentage of employees are involved in skills development, pursuit of formal qualifications, role enhancement, role changes, team development initiatives, coaching or mentoring. In 2016 we won the CIPD NI award for the best employee engagement strategy.

i. Market operations

4.32 We carry out approximately three million visits per annum to customer properties to take meter readings. Under our overall standards of performance, we are required to obtain a meter reading from 99.5% of customers once per year. We continue to consistently achieve compliance with this standard.

4.33 We are responsible for managing all market processes and the provision and maintenance of accurate data to support the operation of the competitive retail and wholesale electricity markets. Our Market Registrations and Change of Supplier processes facilitate customer switching suppliers in a timely manner in accordance with retail market rules.

4.34 We also provide aggregated data to the Single Electricity Market Operator (SEMO) on a daily basis for settlement of the wholesale market in accordance with our responsibilities as a meter data provider under the Trading and Settlement Code. We have consistently achieved 100% compliance with these requirements since the Single Electricity Market (SEM) was introduced in 2007.

j. Connection of renewable generation

4.35 In 2010, the Northern Ireland Assembly set a target of achieving 40% of electricity consumption from renewable sources by 2020, including an interim target of 20% by 2015.

4.36 The interim target has been achieved with 880MW (25%) of renewable generation currently connected.

4.37 We expect in excess of 30% of electricity consumption will come from renewable sources by March 2017.

4.38 Having achieved the 2015 renewables target, NIE Networks and SONI faced a new challenge in August 2015 following a determination by the UR that planning permission was not required

by developers prior to the submission of a grid application. This led to a very large (900 MW) influx of new connection applications immediately following a policy change to reflect this UR determination.

4.39 During the period from August 2015 to June 2016 the total capacity of new applications increased further to more than 1200MW. This very large volume of applications, in addition to the total of 1580MW already connected or committed to connect, poses particular challenges given capacity limitations on the transmission system. It was clear that an alternative approach to connections was required and SONI initiated a detailed review of the transmission system.

4.40 A joint consultation was undertaken by SONI and NIE Networks from Dec 2015 to May 2016, with a decision paper to reflect the alternative approach being issued on 31 May 2016. The approach adopted in the paper entails two phases: Phase 1 being to release remaining capacity identified by SONI in its studies (amounting to an order of some 20% of that applied for) and to allow a number of offers to be issued in the shorter term. This Phase 1 release will include offers for 'export' projects and also some offers for 'zero export' and 'over-install' projects (where customers are seeking to add additional generation but not impact on capacity).

4.41 Moving forward on this complex issue is a demonstration of the commitment of both SONI and NIE Networks to maximise the potential of the grid to connect further projects. Phase 2 will consider how any further capacity might be made available beyond Phase 1. This is dependent on policy direction from both the Department for the Economy and the UR.

k. Network charges

4.42 Since being privatised in 1993 we have implemented a series of initiatives and programmes designed to improve the efficiency of our cost base. This is evidenced by the reduction in employee numbers from approximately 3,000 employees at privatisation to approximately 1,250 today.

4.43 These efficiencies are reflected in a 33% reduction in network charges since privatisation.

l. RP5 delivery

4.44 The RP5 price control spans a five and a half year period from 1 April 2012 to 30 September 2017. The price control prescribes specific projects which NIE Networks is required to deliver during RP5. We are on target to deliver these projects by 30 September 2017, although the work programme is back-ended to the second half of RP5 because the price control was not finally determined until April 2014. We expect our total expenditure during RP5 to be broadly in line with the price control allowances.

We have the ability to train our staff for all key operational roles through the apprentice and graduate schemes within our training school

DEVELOPING THE PLAN FOR OUR BUSINESS

a. Introduction

5.1 This chapter sets out our strategic objectives, the policy context in which we operate and how we have approached the development of the RP6 plan.

5.2 Our strategic objectives are:

- to safeguard the health and safety of employees, contractors and the general public;
- to continue investment in Northern Ireland's electricity infrastructure to replace worn assets; facilitate increased customer demand; strengthen the reliability of the rural network in severe weather events; and facilitate the connection of further renewable generation;
- to achieve high performance through our people by ensuring a working environment that maximises the potential of employees;
- to achieve value growth incorporating a competitive and transparent cost base; and
- to maintain a strong investment grade credit rating.

5.3 Extensive planning, analysis and consultation have been used to ensure that the plan for RP6 delivers benefits for current customers and sets the foundations for the future. Our aim is not only to protect customers in respect of the cost of using our networks but also in respect of the safety and reliability of supply. The availability of a reliable electricity supply is important to business as well as domestic customers and enables Northern Ireland to compete effectively for inward investment. It is also important to balance the interests of different generations of customers, not to defer works which ought properly to be undertaken now, and to balance the interests of different groups of today's customer (for example, rural and urban customers).

5.4 Expenditure forecasts have been derived by considering many sources of information such as:

- forecasts of future energy demand;
- detailed analysis by independent expert organisations;
- comprehensive modelling using specially developed third party tools;
- bespoke in-house forecasting models;
- customer and stakeholder views and requirements;
- extensive detailed asset condition and network performance data;
- our specialist teams with expert knowledge; and
- feedback from local teams on the observed state of the network.

5.5 Many investment programmes continue those developed for RP5, with refinements made for changes in the business environment and stakeholder requirements. However some very significant new programmes of work driven largely by legislation and government policy are required including:

- ESQCR compliance;
- addressing 33kV network congestion;
- low carbon technologies uptake; and
- innovative integration projects.

b. The Utility Regulator's approach to RP6

5.6 The Utility Regulator (UR) set out its overall approach to developing its RP6 determination in the Overall Approach document which it published in December 2015. The price control has been planned to develop over a number stages as follows:

- **Stage 1** – NIE Networks plan submission (including actual data for previous years) submitted to UR on 29 June 2016.
- **Stage 2** – UR assessment of the plan and publication of draft determination for consultation on 20 January 2017.
- **Stage 3** – UR publication of final determination on 2 June 2017.

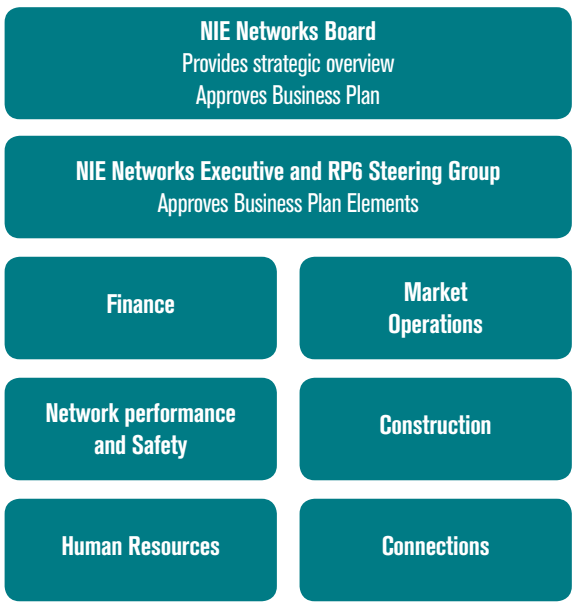
5.7 RP6 will commence on 1 October 2017 and will run for a six and a half year period to 31 March 2024.

5.8 In addition to this RP6 plan overview document, we have submitted detailed workbooks and commentaries to the UR as a set of completed Business Plan Templates. One of the main changes in our RP6 plan compared to our RP5 plan is that the RP6 plan has been prepared in a format consistent with the plans submitted by the GB network operators to Ofgem which will facilitate the benchmarking of our costs.

c. Governance of business plan development

5.9 The RP6 project governance structure was set up to ensure clarity of roles and responsibilities along with a formal and accountable reporting structure. An overview of the project structure is illustrated below.

Figure 9 – RP6 project governance structure



5.10 We have made a number of improvements to our planning processes to support our RP6 expenditure plan including:

- consideration of sustainability, innovation and longer term asset replacement requirements;
- more cost benefit analysis to support investment decisions;
- more robust justification in relation to managing network risk to quantify the asset replacement requirements in respect of plant and equipment; and
- the quantification of safety and environmental impacts in addition to the customer impact when calculating consequences of asset failure.

5.11 In developing the plan, we have been very conscious of the importance of the cost of using the network. Throughout the process of developing the plan we have worked hard to ensure that the allowances we are seeking only include work which is strictly necessary to enable us to carry out our transmission and distribution functions to an appropriate standard and to provide a network which is fit for purpose for our customers.

d. Energy policy

5.12 A number of policies at European, national, devolved and regulatory governance levels make up the policy context in which we operate.

European energy policy

5.13 Northern Ireland participates in the cross border (NI and ROI) wholesale market for electricity. Such collaborative markets are what were envisaged by the EU's drive for an 'internal' market in energy between the EU member states.

5.14 The European Commission has established a 2030 climate and energy framework with three key targets for the year 2030:

- to cut greenhouse gas emissions from 1990 levels, by at least 40%;
- for the share of energy from renewable sources to reach at least 27%; and
- to improve energy efficiency, by at least 27%.

5.15 This framework establishes the parameters within which UK and Northern Ireland energy policy must operate.

UK energy policy

5.16 Energy policy in the UK is led by the Department of Energy and Climate Change (DECC).

The Department has four objectives:

- ensuring the UK has a secure and resilient energy system;
- keeping energy bills as low as possible for households and businesses;
- securing ambitious international action on climate change and the cost effective reduction of carbon emissions; and
- managing the UK's energy legacy safely and responsibly.

Northern Ireland energy policy

5.17 Energy policy in Northern Ireland is devolved to the Northern Ireland Assembly and led by the recently formed Department for the Economy which encompasses the functions of the former Department of Enterprise, Trade and Investment (DETI) and the former functions of Department of Employment and Learning (DEL) with the exception of the Employment Service.

5.18 The key piece of legislation under which NIE Networks operates is the Electricity (NI) Order 1992, which established the legal framework for the privatisation of the electricity industry in Northern Ireland. The 1992 Order requires NIE Networks to:

- be licenced in relation to distribution and participation in transmission;
- be certified for participation in transmission on the basis that one out of four certification grounds applies (IME3);
- develop and maintain an efficient, co-ordinated and economical system of electricity distribution; and
- facilitate competition in the supply and generation of electricity.

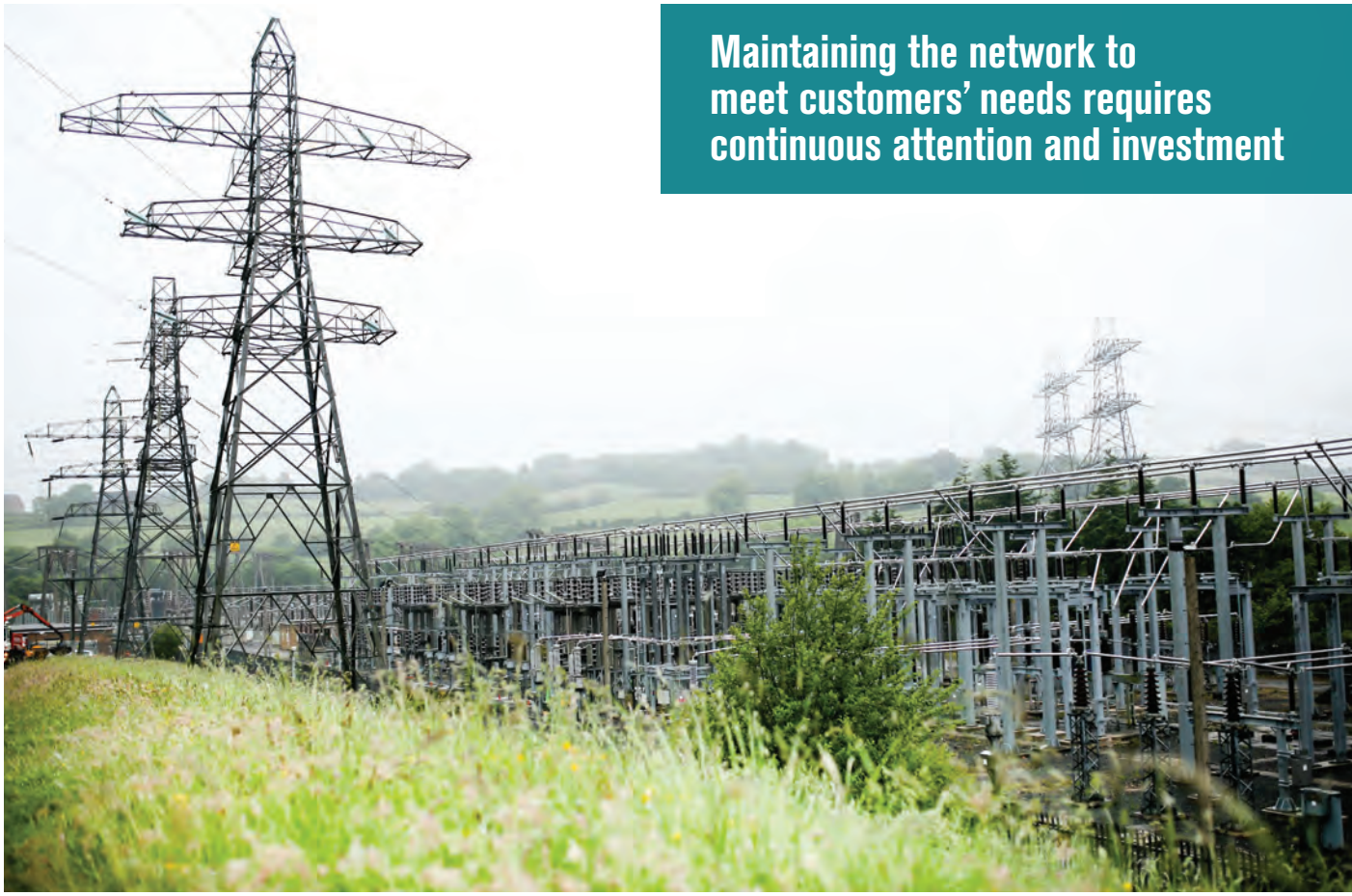
5.19 The Department for the Economy has responsibility for determining policy regarding security of supply, development of energy infrastructure and energy efficiency, including smart metering.

5.20 In 2010, DETI produced a Strategic Energy Framework (SEF), setting out the strategic direction for energy policy in Northern Ireland for the 10 year period ahead. Under the SEF, the Northern Ireland Assembly set a target of achieving 40% of electricity consumption from renewable sources by 2020. Also included was an interim target of 20% by 2015. This interim target has been achieved with in excess of 30% of expected electricity consumption from renewables by March 2017. Government support through the Northern Ireland Renewable Obligation (NIRO) scheme was a key enabler of this achievement. A mid-term review of the SEF is currently in progress.

5.21 In December 2012, the Electricity Safety, Quality and Continuity Regulations (ESQCR) were introduced, mirroring similar legislation in GB. These regulations impose obligations on NIE Networks to protect the public from harm including requirements to assess overhead lines for foreseeable risk of danger from interference, vandalism or unauthorised access and to take safeguarding measures appropriate to the risk.

5.22 In February 2014, the Committee for Enterprise, Trade and Investment (the ETI Committee) published a report in relation to electricity policy and pricing in Northern Ireland. The ETI Committee published a further report in November 2014 in relation to grid connections. Our plans in relation to grid connections are set out in Chapter 12, including the introduction of contestability as recommended by the ETI Committee. The cost of connections for business customers is discussed in section g of this chapter.

5.23 In December 2015, an energy and manufacturing advisory group (EMAG), chaired by Dr David Dobbin, was formed to make recommendations regarding Northern Ireland's economic strategy and strategic energy framework.



Maintaining the network to meet customers' needs requires continuous attention and investment

The group published its first report in March 2016 making a number of recommendations aimed at ensuring that:

- local energy costs for all consumers, especially LEU's and energy intensive manufacturing users, are competitive in an EU context;
- the market design and operation is based on the application of economic principles that deliver the most efficient management of resources in network management, power generation and demand management in order to meet future demand and deliver the lowest cost outcome to all; and
- government policy avoids unnecessary management, incentive costs and levies and encourages the most efficient operation of the market.

e. Investment strategy

Asset management

5.24 The transmission and distribution of electricity is a capital intensive business. Maintaining, improving and expanding the network to meet customers' needs requires continuous attention and investment.

5.25 The key overarching drivers for investment are:

- Maintenance: of the existing asset base with the broad objective of maintaining safety for staff and the public and the level of service provided to customers in the medium to long term. This involves replacing, refurbishing and maintaining existing equipment on the network. This is the largest part of our work programme.
- Compliance: with new legislation or policy requirements (for example ESQCR legislation or sustainable policy objectives).

- Growth: in demand (or potential reduction in demand) due to change in consumption by existing customers, new customers (or customers leaving) and demand for generation connections.
- Service: improvement in existing services where this delivers clear benefits that customers are willing to pay for (for example addressing the needs of worst served customers).

5.26 Any single investment might meet one or more of these drivers to achieve overall service objectives and we consider them together and seek synergies between them to optimise the investment plan.

Understanding the long term needs of the network

5.27 Consideration has to be given to longer term investment in the network to ensure that today's investments are set in context of the anticipated asset replacement and demand requirements into the future. In developing our plans for the future, we take a strategic view of the network to ensure that investment is optimised over the long term for the benefit of customers.

5.28 There are a number of models that are now in common use in the industry to predict future expenditure requirements. Our approach is as follows:

- condition and risk based models are used primarily to assess short to medium term asset replacement needs i.e. during RP6;
- age-related asset replacement models are used purely to provide a sense check for the short term (RP6) asset replacement needs and as a proxy to forecast the medium and longer term asset replacement needs for RP7 and beyond and;
- the Transform model (as developed for GB distribution network operators in preparation for the RIIO-ED1 price control) is used to assess near and long term needs relating to changes in electricity demand including the likely impact of low carbon technologies (LCT) on network reinforcement.

5.29 The following sections regarding 'longer term asset replacement trends' and 'the Transform model' both conclude that, when projected out to 2050, indications are that an increase in network investment will be required to address the risk associated with the ageing asset base and to develop network capacity to cater for the uptake of LCTs.

5.30 The approach taken in this business plan for RP6, is to ensure that the plan:

- delivers benefits for current customers;
- lays the foundations to prepare for the future and meet these challenges;
- maintains the levels of service currently enjoyed by Northern Ireland customers;
- considers the interests of different consumer groups – rural, urban, domestic, business; and
- considers the cost between current and future customers.

Longer term asset replacement trends

5.31 The 'Survivor' Age Related Asset Replacement Model has been accepted and used by distribution network operators (DNOs), transmission system operators (TSOs) and Ofgem since around year 2000 for forecasting longer term asset replacement volumes and expenditure requirements.

5.32 The model indicates that over a 25 year period following RP6, there is a significant increase in the volume of assets reaching end of life. In particular the transmission overhead line network and the distribution overhead line and cable networks will require higher levels of investment.

5.33 The increase in assets reaching the end of life is also as a result of original asset investments being made prior to the 1960s and 1970s. Thus

In developing our plans for the future, we take a strategic view to ensure investment is optimised over the long term

Assets are only replaced when condition and risk dictate

are currently being maintained on the network beyond normal asset lives.

5.34 In practice the actual asset lives that can potentially be achieved in each asset class are being continually reviewed in light of more informed condition information resulting from technological advances in monitoring equipment and techniques. This means assets are only replaced when condition and risk dictate.

5.35 The challenge for the industry and for us, is to develop innovative solutions consistent with the changing nature of the network, to address this future challenge at minimum cost to customers.

The Transform model

5.36 The demand for electricity on the distribution network is changing as LCTs become an integral part of electricity consumers' lifestyles and behaviours. LCTs are products that reduce the amount of carbon being used for heating, transport and generation, and include electric vehicles, heat pumps and photovoltaic generation.

5.37 To enable a fuller understanding of the impact of these new technologies on network demand and hence investment levels, we commissioned EA Technology to develop a Transform model for Northern Ireland.

5.38 The Transform model is a comprehensive model that is designed to assist key stakeholders in the evaluation of options to address LCT uncertainties and to allow exploration and quantification of many 'what if' scenarios with regard to future network demands.

5.39 The model was originally conceived through a project carried out for the Smart Grid Forum in GB. This forum, chaired by DECC and Ofgem, has a number of work streams that seek to determine how to make the transition to a smarter grid across the entire electricity sector.

5.40 A key conclusion from the work undertaken was that the area of the value chain that would experience the greatest level of impact was likely to be the distribution sector and, as a consequence, a model was created to determine how distribution networks would need to respond to the likely increased levels of LCTs connecting over the medium to longer term.

5.41 Further work was then undertaken to create instances of the model for each of the 14 individual DNOs in GB. This provided the DNOs with a tool to be able to forecast the necessary investment to accommodate LCT growth over any given timeframe, something which then lent itself to strategic business planning.

5.42 As an input to the NI Transform model, EA Technology produced three scenarios based on the potential uptake of four individual low carbon technologies (heat pumps, electric vehicles, solar photovoltaic and on-shore wind) in Northern Ireland, out to 2060.

5.43 For each of these three uptake scenarios (low, central and high), a number of factors were considered such as technology costs and performance, evolution of fuel prices and policy and government objectives (in particular, incentives and regulatory support). The model is then able to determine the electrical impact on the distribution network.

5.44 In general, the higher the level of LCTs prevalent on the network, the greater the reduction in thermal, voltage and fault-level headroom. This, in turn, requires investment in the network to alleviate constraints and release headroom to ensure security and quality of supply.

5.45 The model also considers the investment options available to distribution networks to

accommodate an increasing prevalence of LCTs. One option is investment in conventional solutions including traditional reinforcement such as laying new cables, replacing transformers etc. Another option is to deploy "smart" solutions such as installing equipment to allow more active network management, and/or using more demand-side management.

5.46 The final step in the model is to consider which type of investment solution, or combination of solutions, will accommodate the increasing prevalence of LCTs on the network in the most economic manner.

5.47 Figure 10 below shows the cumulative expenditure anticipated for the LCT related reinforcement based on current uptake projections.

5.48 This chart shows the level of expenditure to accommodate LCTs is expected to rise during RP6 continuing into RP7. For RP8 and beyond, lower levels of expenditure are anticipated. It can be seen clearly that the majority of this investment will be required at the HV level. We have used the findings from the Transform model to inform our investment planning over the RP6 period.

5.49 We will continue to update the inputs to the Transform model on an annual basis and use the revised outputs to help understand the longer term needs of the distribution network up to 2050.

Innovation

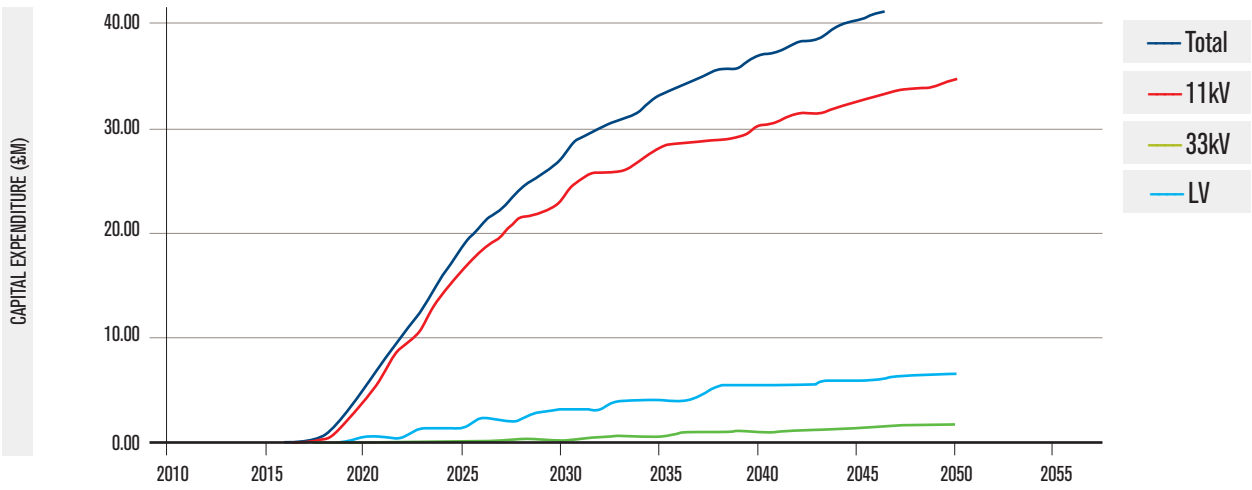
5.50 Over the past decade there has been a plethora of innovation projects undertaken by GB DNOs facilitated through various regulatory mechanisms.

5.51 This began initially in 2005 as part of the Innovation Funding Incentive which was established to encourage DNOs to conduct research and development. In Distribution Price Control Review 5 (DPCR5), which ran from 2010 to 2015, Ofgem introduced a new £500m fund, the Low Carbon Networks Fund, to stimulate a culture change, innovation and trialling of new technologies.

5.52 In the current GB distribution price control (RIIO-ED1), which runs from 2015 to 2023, additional funding allowances were made available through the Network Innovation Competition and the Network Innovation Allowance.

5.53 We have access to the key findings from these innovation projects through the Energy Networks Association (ENA) Smart Portal. In

Figure 10 – Low-carbon technology related reinforcement projections



addition, we commissioned EA Technology to undertake a comprehensive review of key projects carried out in GB. This review made a number of recommendations for further focus.

5.54 These recommendations – which are considered most suitable for the Northern Ireland context – focused on areas where the development of smart solutions is more advanced for wide scale deployment. These areas for further focus align with those solutions that are most frequently selected in the NI Transform model.

5.55 We recognise that significant progress has been made by our GB counterparts who, through their regulatory frameworks, have received funding and been able to absorb the risks associated with pioneering R&D activities. We are well placed to leverage the learning from these activities to the betterment of NI customers, however, it should be noted that these significant strides forward in GB are not directly transferrable and require tailoring to integrate smart solutions into business as usual activities on our network.

5.56 With that in mind, our plans for innovation in RP6 are primarily focussed on integrating suitably advanced smart solutions into business as usual. We plan to do this by undertaking a programme of focused pilots with the objective of developing cost effective alternatives to conventional network investment.

5.57 In particular, the purpose of the pilot projects that we have developed and proposed are to help facilitate the connection of low carbon technologies and to release network headroom.

5.58 It is envisaged that each of the solutions under development will be available for deployment towards the end of RP6.

5.59 We have also undertaken an assessment of our communications infrastructure to identify any forward investment that is required during RP6 to enable a wider roll-out of smart solutions in RP7 and beyond.

f. Customer and stakeholder engagement

5.60 As part of the development for this business plan, we sought to understand the views and opinions of our stakeholders regarding the type and level of service they expect, and the prioritisation of delivery of these services within reasonable funding limits.

5.61 A group called the Consumer Engagement Advisory Panel (CEAP) was formed which included NIE Networks and representatives from the UR, the Consumer Council for Northern Ireland (CCNI) and DETI.

5.62 The CEAP established terms of reference and provided advice on, and agreed the scope of, works for the procurement of expert market research advice to deliver a robust, statistically representative sample of consumers and a set of focus groups of domestic, industrial and commercial users (existing and potential future consumers).

5.63 Perceptive Insight Market Research was appointed to advise the CEAP, along with academic input from Queen's University, Belfast. The latter was felt necessary to ensure the 'Willingness to Pay' element of the domestic customer survey questionnaire would produce actionable data and research findings to help both ourselves and the UR inform our respective views and decisions on customer priorities.

5.64 The outputs from the customer and stakeholder engagement exercise included reports detailing all stages of the research (both qualitative and quantitative). These reports outline customer views and preferences in relation to current and future service levels. The full reports are available on the NIE Networks website. These outputs have helped inform the investment proposals in this plan.

5.65 In July and August 2015 we conducted a customer survey seeking views and opinions on current performance and a range of potential service improvements. In Table 5 we summarise the areas that we have taken forward and included as part of

our core plan. This includes a number of innovation trial projects that we believe are in the long term interests of customers and therefore should be carried out during RP6.

5.66 Table 5 also sets out a number of projects that we propose as additional options for consideration, and these are discussed further in Chapter 8.

g. Connection costs for business customers

5.67 During the customer and stakeholder engagement process some business customers highlighted a concern about the cost and time required for new connections to the network.

5.68 Under the regulatory framework in Northern Ireland, all connecting customers must pay the cost of the connection and for the work required to reinforce the network at one voltage level up, should such reinforcement be necessary. This is often required for large business connections, particularly in more rural areas, where there is insufficient capacity on the grid without this work. The electricity network in rural areas has been developed with a focus on supplying electricity to rural communities at low cost. Our investment has been targeted so that underlying load growth is catered for. This has ensured that we can comply with our statutory and licence requirements. However, we have not invested on a network-wide basis to create large amounts of capacity headroom.

Table 5 – projects considered and taken forward following customer and stakeholder engagement

		Service Improvement / Investment	Core Plan	Optional Plan
Resilience	Ice and Snow	Upgrade 20% of the 11kV network over a 15 year period to increase resilience to ice accretion.		√
	Resilience Tree Cutting	Cut trees back on a 25 year programme to reduce the likelihood of power cuts during storms. This is a mandatory activity to meet new legislative requirements (ESQCR), and it is necessary to maintain network reliability during storms.	√	
		Cut trees back on an accelerated 20 year programme to improve network reliability during storms.		√
	Substation Flooding	Protect 9 major substations and 200 smaller substations to reduce the risk of power cuts caused by substation flooding for 53,000 homes and businesses.	√	
		Protect 9 major substations and 400 smaller substations to reduce the risk of power cuts caused by substation flooding for 73,000 homes and businesses.		√
Reducing Power Cuts	Long Duration Power Cuts	Reduce the number of customers per year who experience power cuts over 10 hours in duration by 25%.		√
	Frequent Power Cuts	Reduce the number of customers per year who experience six or more power cuts in an 18 month period by approximately 20%.		√
	Communication	Provide real-time information on network faults via the NIE Networks' website plus text messages to provide information updates.	√	
Sustainability	Smart network technology	Five innovation projects to integrate new technologies and approaches into business as usual. The focus of these trials is to facilitate new low carbon technologies (Solar PV, electric vehicles, heat pumps) connecting to the LV network, reduce congestion caused on the 33kV network caused by distributed generators and alleviate the constraints associated with traditional load growth.	√	

We plan to address underlying electricity load growth

5.69 The cost for new connections is driven by the volume of work required to connect a customer. Where reinforcement of the network is required it adds to the cost. It also adds to the time required due to the increased complexity of the work and the need to obtain planning consents and third party land access rights. For large rural connections for businesses, there could be as much as 10-20 km of overhead line works required and some connections can take in the region of 18 months to two years to complete.

5.70 One approach to deal with this problem, which would reduce the cost to businesses and would reduce the time to connect, is if there was wide scale investment to upgrade the electricity network in rural areas. The cost of this approach would be very high for the general customer base, increasing electricity tariffs, and would risk over-investing in the network and creating stranded infrastructure that may not be fully utilised.

5.71 An alternative approach would be to target investment in a discrete list of areas that would seek to cluster infrastructure and economic growth in certain areas. This would have the benefit of reducing the risk of having stranded investment and would optimise the cost overall. The disadvantage is that the status quo would remain for businesses operating outside of these clusters. This general approach has been previously raised by NIE Networks as an idea in a submission to the ETI Committee in April 2015 and has been the subject of discussion with various stakeholders including DETI (now the Department for the Economy).

5.72 The Energy and Manufacturing Advisory Group's report in March 2016 included a recommendation that the Department for the Economy should commission a long term strategic plan for the grid. The report recommended that a review should be carried out to consider whether strategic grid investment is needed, beyond what would normally be approved by the UR, particularly in the west of Northern Ireland to support regional economic development and facilitate the deployment of renewable energy.

5.73 Selecting areas of the grid for investment ahead of the routine investment for underlying load growth is a matter for the Department for the Economy and is part of a wider economic strategy for Northern Ireland. NIE Networks is committed to playing its part in supporting government as this strategy evolves.

5.74 In the meantime, NIE Networks will continue to charge customers for the cost of connection, including grid reinforcement costs, in line with regulatory policy. We are also planning to continue to invest to address underlying load growth. We have not included the cost of any wider strategic investment to create capacity headroom in the grid as part of our business plan submission.

h. The efficiency of the business plan

5.75 We commissioned NERA Economic Consulting (NERA) to assess the efficiency of our current and forecast levels of expenditure by benchmarking ourselves against the GB DNOs. To perform this assessment, NERA drew on the methods used by Ofgem at the recent RIIO-ED1 price control review.

Indirect and IMFT costs

5.76 NERA benchmarked our indirect and inspections, maintenance, fault and tree cutting (IMF&T) costs between 2012/13 and 2014/15 against the costs incurred by the GB DNOs, using cost data provided by NIE Networks and the same cost data and models developed by Ofgem during the recent RIIO-ED1 price control review. NERA found that we performed in the top quartile over this period, which means we are amongst the four lowest cost DNOs in the UK.

5.77 NERA validated this conclusion by conducting a range of sensitivity analysis, all of which supports the conclusion that we are among the most efficient DNOs in the UK.

Capex unit costs

5.78 NERA also performed unit cost benchmarking to assess the efficiency of our distribution capex programme between 2012/13 and 2014/15. This involved comparing the unit costs of all the distribution capex we undertook in this period, to the unit costs of similar projects undertaken by the GB DNOs. This has been possible for this period following the implementation of the Regulatory Instruction Guidance (RIGs) resulting from the RP5 determination.

5.79 NERA's analysis shows that, based on the work undertaken during this period, NIE Networks is efficient with lower average unit costs than the majority of the GB DNOs.

5.80 In addition, to supplement the benchmarking performed by NERA on outturn RP5 costs, we commissioned WSP Parsons Brinckerhoff to benchmark our proposed network investment unit costs for the RP6 submission. This involved comparing unit costs proposed for a range of asset replacement categories with WSP Parsons Brinckerhoff's database of costs based on publically available GB costs and in-house costs ensuring comparison on a like-for-like basis.

5.81 WSP Parsons Brinckerhoff's analysis supports that of NERA and shows that the cost base for the asset replacement programme is efficient when compared to the benchmarks.

Efficiency target

5.82 Notwithstanding the finding from the benchmarking that shows we are amongst the most efficient DNOs in the UK, we plan to continue to operate efficiently through improvements in technology and working practices.

5.83 Our business plan assumes we will achieve annual efficiency savings of 0.7% per annum, in line with advice received from NERA. NERA has estimated an efficiency factor of 0.7% per annum would be consistent with data on long term productivity trends. These long term trends have been widely used by regulators when setting efficiency targets for utilities, including the CMA at RP5 and Ofgem at RIIO-GD1/T1.

5.84 We will achieve these annual efficiency savings through a range of measures, including:

- improvements to business processes supported by investment in new IT systems;
- improvements to operational working practices;
- effective procurement strategies;
- continued use of in-house resource to undertake core activities;
- design of the right engineering solutions to network problems i.e. no 'gold plating'; and
- learning from other DNOs, utilities and large asset based organisations.

WHAT WE WILL DELIVER FOR CUSTOMERS

6.1 This chapter describes the key services and results ("the outputs") we plan to deliver during RP6 through our investment programmes, network management decisions and customer service initiatives.

6.2 These outputs are aligned to the most important services we provide to customers and have been grouped into five categories as follows:

- safety – minimise the safety risks associated with operating the network;
- reliability and availability – maintain a reliable supply of electricity through a more resilient network;
- environment – reduce our own impact on the environment;
- customer satisfaction – provide a high level of customer service; and
- connections – provide an excellent service for customers connecting to the network.

6.3 Each category and the outputs we will deliver during RP6 are described in more detail in the following sections.

a. Safety

6.4 NIE Networks core value is safety and we will relentlessly target improvements in our overall health and safety performance.

6.5 Our objective is to identify and minimise risks to people by ensuring the health, safety and wellbeing of our employees, contractors, customers and the general public while aiming to protect our environment.
During RP6, we will deliver the following safety outputs:

Public Safety
Compliance with Health and Safety Law
▪ Target zero improvement notices, prohibition notices and prosecutions from the Health and Safety Executive Northern Ireland (HSENI).
▪ Complete all requirements regarding safety signs, stays and anti-climbing devices and commence a programme of work to address the other requirements outlined in the Electricity Safety Quality and Continuity Regulations (ESQCR) to improve the safety of the electricity network for the public.
▪ Continue to operate a Safety Management System accredited to ISO Standard OHSAS 18001.
▪ Complete inspection and maintenance programmes every year.
Educating the public
▪ Organise and deliver information and learning sessions for 65,000 schoolchildren and members of the public regarding the potential dangers from the electricity distribution network.
▪ Target to provide information to 97,500 people from government departments, utilities, the farming community and contractors to ensure the risks associated with working near our equipment are communicated and controlled.
Staff and Contractor Safety
Reduce safety incidents
▪ Investigate all incidents involving employees, contractors and members of the public.
▪ Aim to provide a 'Zero Harm' working environment where risks are identified, assessed and controlled.
▪ Reduce our incident frequency rate by 10%.
▪ Continue to organise and provide training for our staff and contractors.
▪ Generate 5,500 near miss and good catch reports to help avoid future incidents.
Implement occupational health and wellbeing initiatives
▪ Organise and deliver proactive employee health and wellbeing initiatives.

Compliance with Health and Safety Law

6.6 An extensive range of health and safety law exists in Northern Ireland and GB which seeks to ensure the right safety behaviour of organisations and people. HSENI has the responsibility of enforcing health and safety legislation and its inspectors work with the industry to prevent incidents.

6.7 We have created a strong safety value and culture throughout NIE Networks. Our safety rules, policies and procedures will continue to be refined in line with current knowledge and best practice to improve upon the existing safety performance to minimise the requirement for intervention by the HSENI.

6.8 We will work cooperatively with the HSENI to ensure our practices and policies continue to be compliant with health and safety legislation but also to seek out and apply best practice in the management of safety. We have had no formal improvement notices, prohibition notices or prosecutions during the RP5 period.

6.9 We will continue to report qualifying incidents as required by ESQCR and Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR).

6.10 ESQCR legislation was introduced in December 2012 and specifies the safety standards which are aimed at protecting the general public and consumers from danger. In addition the legislation specifies power quality and supply continuity requirements.

6.11 The ESQCR legislation has more onerous requirements than previous legislation and increased investment in the network is required as a result. We are obliged to assess overhead lines for foreseeable risk of danger from interference, vandalism or unauthorised access, record risk classification and take safeguarding measures appropriate to the risk. In RP6, our ESQCR work programmes will focus on addressing safety signs, stays and anti-climbing devices, whilst commencing a programme of work to address other ESQCR requirements.

6.12 To provide a high level of assurance, we will continue to operate our safety management system to ISO Standard OHSAS 18001. This standard requires annual external audits and establishes a legal register to ensure compliance with new and existing legislation.

Educating the public

6.13 Children and other members of the public may not always be aware of the potential dangers from the electricity distribution network. This lack of awareness can lead to them becoming exposed to more risk during certain play, leisure or work activities.

6.14 For many years we have developed and provided safety information to children. This has predominantly been delivered through practical demonstrations and explanations in schools of what our equipment looks like, what it does, and how to stay safe.

6.15 Through our safety outreach programme we will speak to 65,000 children in Northern Ireland. This will be through a mixture of engagement at events, school visits and through the Risk Avoidance Danger Awareness Resource safety centre where NIE Networks has set up a bespoke electricity substation scenario.

6.16 The Kidzsafe programme aims to talk to the 8-11 age group; however we also use our website to engage younger and older children and young people through the use of animated characters and interactive games. We believe that by promoting a student's understanding of electricity and how it works, we can help make them aware of the dangers.

6.17 We produce a range of information leaflets describing the dangers from overhead lines, substations and underground cables. We have also identified those work or leisure activities that are more likely to give rise to potential risks when occurring in the vicinity of our assets. This information provides an explanation of our equipment and how safety can be ensured for those involved in the work or leisure activities taking place around it.

6.18 We will work closely with government departments, utilities, the farming community and contractors to ensure the risks associated with working near our equipment are communicated and controlled.

Reduce safety incidents

6.19 By utilising a safety model of leadership, compliance, competence and engagement, we will aim to maintain the value of 'zero harm'. We will focus on human and behavioural issues with an emphasis on using leading indicators to identify and prevent potential incidents. This will be supported by the implementation of Electricity Networks Association Powering Improvement strategy and themes to ensure industry best practice and consistency are achieved.

6.20 Whilst the electricity network is inherently designed to be safe, work upon it can introduce potential hazards, however, the design standards, operational processes, working methods and bespoke training adopted by NIE Networks minimise the risk of injury to staff, contractors and the public.

6.21 We will seek to reduce the safety incident frequency rate involving our own staff by 10%. This will be achieved by working with staff and the industry to understand the causes of incidents. We will continue to promote near miss and good catch reporting to allow analysis of potential causes and minimise the risk of incidents.

6.22 Whilst incidents involving members of the public or contractors are rare, when they do occur we will continue to investigate the causes and ensure any appropriate action is undertaken to help prevent recurrence.

6.23 We will continue to work with Trade Unions and their appointed safety representatives within the business to ensure that industry best practices are shared and applied. We will look to further enhance the safety of our staff through additional training that focusses on the understanding of behavioural safety.

NIE Networks hosted the Energy Networks Association's Safety Health & Environment conference in Belfast in 2016.

6.24 Our contractors are required to comply with the same rules and procedures as employees. Contractors are required to establish and operate their own general safety monitoring processes as appropriate to their work activity and are required to report all safety related incidents, near miss incidents or issues. This extends the culture of safety and enables additional learning to be shared.

6.25 The systems for managing safety are annually audited against the requirements of the international specification Occupational Health and Safety Assessment Series 18001.

Occupational health and wellbeing initiatives

6.26 We will continue to monitor the physical and mental wellbeing of employees and support internal health and wellbeing forums and fairs. Wellbeing is a central part of our employee engagement process which is at the heart of our HR strategy.

6.27 We will complete work-related health screening for risks associated with specified tasks in line with HSENI, Electricity Networks Association and general healthcare guidance.

6.28 We will continue to host events attended by healthcare professionals and agencies such as NI Chest Heart and Stroke, Action Cancer and nutrition advisors.

We foster an environment of collaboration, diversity and professionalism where we are motivated, supported and valued

6.29 We will continue to participate in the Electricity Networks Association Occupational Health Committee and provide quarterly reports to the NIE Networks Health and Safety Management Committee.

6.30 Both our HR and Health & Safety departments, in conjunction with line management, will support employees who acknowledge that they have encountered problems due to stress – whether work related or not.

Network performance
- Maintain planned Customer Minutes Lost (CML) at 58 and Customer Interruptions (CIs) at 18.
- Maintain unplanned CML at 61 and CIs at 68.

Restoration times
- Restore 90% of customers within 3 hours by end of RP6 (currently an 87% standard).
- Restore 100% of customers within 18 hours by end of RP6 (currently a 24 hour standard).

Enhancing network resilience
- Increase flood defences in substations: nine major substations and 200 local substations will be protected from flooding to reduce the risk of supply interruptions to 53,000 customers.
- Cut 1,600km of trees on our 33kV network to reduce the risk of supply interruptions due to trees falling on overhead lines during storm events.

Worst served customers
- Ensure the number of customers off supply more than six times in 18 months due to faults is not more than 8,000 (circa 1% of customers).
- Ensure the number of customers off supply for more than 10 hours is not more than 5,000 (circa 0.6% of customers).

Low carbon technologies (LCTs) and innovation
- Develop and provide innovative grid solutions to support growth in LCTs.
- Reinforce the 33kV network to ease congestion and increase capacity for LCTs.
- Roll out five innovation trials to assess the benefits of smart grid technology.

b. Reliability and availability

6.31 During RP6, we will deliver the following: reliability and availability outputs:

Network performance

6.32 NIE Networks monitors the performance of the distribution system (in terms of reliability and availability of supply) using a number of measures including Customer Minutes Lost (CML), Customer Interruptions (CIs) and Restoration times.

93% of households and 84% of business customers told us that they want our current level of service to be maintained

6.33 The unplanned CML and CI average during RP4 and RP5 was 61 and 68 respectively. Within any given year these figures can fluctuate by up to 20% depending on weather events. Stakeholder engagement indicates that customers are broadly happy with these levels which we propose to maintain during RP6 through delivery of our investment plan. Setting higher targets would require more expenditure on the network which is not considered necessary having regard to the stakeholder feedback received.

6.34 Planned interruptions are when we notify customers about interrupting their electricity supplies to allow us to maintain or replace our network infrastructure, for example, lines and poles, or to allow the connection of new customers. The planned CML and CIs average during RP4 and RP5 was 58 and 18 respectively. We anticipate that in RP6 there will be an increase in the number of outages required to deliver the investment plan and where possible we will minimise the impact on planned CI and CML.

6.35 We will maintain the current levels of performance by reconfiguring the network, using

live line working or mobile generation where it is practicable and cost effective. However, there are occasions where a planned interruption to the electricity supply is needed to allow the work to be carried out safely. We will continue to notify customers in advance to give them to time to minimise any impact on them.

Restoration times

6.36 Excluding severe weather events we currently restore 100% of customers who lose power supply within 24 hours, and 87% of customers within three hours. By the end of RP6, we will aim to have 90% of customers restored within three hours and 100% of customers restored within 18 hours.

Enhancing network resilience

6.37 In the last six years Northern Ireland has experienced severe ice, snow, winds and floods, all of which have affected the electricity network and left thousands of customers without power. In some cases, businesses and domestic customers have been left without power for several days.

As a top priority, customers told us that they value electricity the most during periods of severe weather as they rely on it for heating and lighting

6.38 Climate change predictions suggest that widespread flooding will become a more regular occurrence. If flooding affects a substation, it can cause supply interruptions to all surrounding properties.

6.39 In some cases, the level of contingency available will accommodate the subsequent re-supply of homes and businesses, however, the time taken to repair flood damage to switchboards and transformers can pose a significant risk to security of supply.

6.40 In the last three years flooding has affected more than 15 major substations and put tens of thousands of customers at risk of long term power cuts.

6.41 In RP6, we propose to put flood defences in nine major substations and 200 local substations which have been identified as being susceptible to flooding. Customers have indicated their support for this investment through the stakeholder engagement programme.

6.42 Although we cut back vegetation growing close to electricity lines for safety reasons, when there are strong winds trees often fall down onto overhead lines.

6.43 To help minimise the impact of this, we clear trees within falling distance of the lines. We will continue to operate a 25 year resilience programme in RP6. This programme includes 2,000km of tree cutting on our 33kV network and 500km on the 11kV network.

Worst-served customers

6.44 Many of our 860,000 customers do not suffer any fault interruptions from one year to the next, especially if they live in urban areas where the underground networks are less affected by weather conditions. However, there are a number of our customers (those generally in rural areas who are supplied by overhead networks) who suffer from significant numbers of interruptions each year.

Customers indicated they would like to see a reduction in power cuts for those who experience them more frequently or those who are without power for longer

6.45 Currently we monitor our Worst-Served Customers (WSCs) based on a rolling 18 month period with those customers experiencing six or more interruptions within this 18 month period being

identified as 'worst served'. During RP6, we will aim to ensure that the number of customers off supply more than six times in 18 months due to faults is not more than 8,000 (circa 1% of customers).

6.46 We will also measure the number of customers off supply on a fault outage for greater than ten hours and we will aim to ensure that the number of customers off supply for more than 10 hours is not more than 5000 per year (circa 0.6% of customers).

Low-carbon technologies (LCTs) and innovation

6.47 Northern Ireland, in common with the rest of the UK and many other countries, is facing significant uncertainty with regard to the potential uptake of new LCTs, which are technologies and products that reduce the amount of carbon being used for heating, transport and generation. Examples of LCTs include solar photovoltaic generation, heat pumps, electric vehicles and wind generation.

6.48 We will invest in our network to safeguard security and quality of supply as Northern Ireland moves towards becoming a low-carbon economy. We will develop and provide innovative grid solutions to support the growth of LCTs.

6.49 During RP6, we will invest in our 33kV network to release additional capacity and enable further connection of LCTs.

6.50 Future network development will incorporate both traditional and smart network reinforcement approaches. We will develop five innovation trials to assess the benefits of smart grid technology and how to incorporate these solutions into our business.

c. Environment

6.51 Our environmental outputs have the objective to reduce the impact of our business operations on the environment by reducing greenhouse gas emissions, limiting pollution, improving waste management and improving visual amenity. During RP6, we will deliver the following environmental outputs:

Comply with environmental law

6.52 An extensive range of environmental law

Comply with environmental law
- We will comply with the legislative framework regulated by the NI Environment Agency (NIEA) by aiming to reduce incidents and minimise the impact of incidents if they do occur.
- Aim for zero formal intervention from NIEA in the form of notices or prosecutions.

Excellence in environmental management
- We will continue to target improvement in our overall environmental performance using our internationally recognised ISO14001 accreditation.

Reduce the carbon footprint of the business
- Ensure all 'like-for-like' replacement vehicles have lower CO_2 emissions than those they are replacing.
- Minimise the amount of waste sent to landfill.

Reduce the environmental risk of leaks from equipment
- No significant land contamination incidents arising from Fluid Filled Cables.
- Measure SF6 gas usage with a target to maintain losses at below 5% of the total volume of SF6 gas contained in equipment across the network.
- Install effective oil containment 'bunds' around plant containing high volumes of oil.

Energy efficiency
- Replace network assets with lower loss modern equivalents.

exists in Northern Ireland and the UK which seeks to ensure the right behaviour of organisations and people. The NIEA has the responsibility of enforcing environmental legislation and its inspectors work with the industry to prevent incidents.

6.53 We will aim for zero formal intervention from the NIEA in the form of warning letters or prosecutions.

Excellence in environmental management

6.54 We will continue to target improvement in our overall environmental performance using our internationally recognised ISO14001 accreditation. This standard specifies the requirements for continual improvement.

6.55 We will continue to benchmark against local industry by submitting applications annually to NI Business in the Community's ARENA survey.

6.56 We will continue to work with local communities to promote our corporate social responsibility values through promoting environmental improvement and sustainable actions. Staff will continue to be trained in environmental aspects relevant to their job role.

Customers want to be able to contact us on the phone, online, and in writing and by social media and they want us to provide timely and useful answers. They would like us to keep them up-to-date with changes to their electricity service

Reduce the carbon footprint of the business

6.57 We will continue to use energy efficiently in our buildings, fleet and business processes with the aim of reducing this where possible. The network is spread over Northern Ireland so we need to operate a large fleet of vehicles. When these vehicles reach the end of their useful lives they are replaced with modern vehicles with more fuel efficient engines. The cumulative effect of this fleet replacement is a progressive reduction in carbon and gas emissions.

6.58 We will manage our waste whilst aiming to divert as much as possible from landfill and aim to re-use equipment wherever possible.

Reduce the environmental risk of leaks from equipment

6.59 Our objectives to minimise pollution will be driven by reducing the percentage of SF6 gas and oil released through replacement and repair of leaking units and cables. We will introduce new technologies to assist in environmental improvement in any field thought suitable (e.g. fluid-filled cables, fleet and network assets).

6.60 SF6 gas is used throughout the industry as an insulating medium in switchgear. Whilst it provides many benefits, it is a potent greenhouse gas. We will measure our SF6 gas usage and carry out work to maintain our SF6 losses at less than 5% of the total network volume. Significant SF6 gas leaks will be managed through specific asset replacement and repair programmes while ensuring robust SF6 leakage monitoring controls are in place.

6.61 Large transformers contain significant volumes of oil posing a risk of contamination should a leak arise. Containment walls or 'bunds' can be constructed around the equipment to prevent oil leaking into the environment. During RP6, all transformers at 33kV and higher voltages that are being replaced will have an effective bund installed. We will also carry out refurbishment work to selected transformer bunds on our transmission network.

Energy efficiency

6.62 During RP6 we will continue to invest in energy efficient equipment when replacing existing assets. When procuring power transformers we comply with the Ecodesign Directive 2009/125/EC which recommends the minimum efficiency performance standards for medium and large power transformers. The Ecodesign Directive defines a framework for the requirements for the environmentally-friendly design of transformers. The objectives include improved energy efficiency and a general environmental compatibility and thus the reduction of CO_2 emissions.

d. Customer satisfaction

6.63 The provision of a high level of service for our customers is a core business objective. We are committed to keeping our customers at the centre of our focus and aim to provide a safe, reliable and responsive electricity service, which meets the standards our customers expect.

6.64 As part of our engagement with customers and stakeholders, we have been listening to what they have been telling us about our current service level and what they would like us to deliver in the future. We want to make it easier for our customers to communicate with us and improve our overall customer service delivery.

6.65 During RP6, we will deliver the following customer satisfaction outputs:

Customer service
- Customer standards:
  (i) Zero defaults on Guaranteed Standards of Performance.
  (ii) Zero failures on Overall Standards of Performance.
- Our 'Think Customer' initiative will continue to promote and improve our customer focus and customer service delivery across all aspects of our business.

Telephone response
- Respond to telephone calls quickly, answering 93% within 20 seconds.
- Ensure 99% of all calls are answered.

Supporting vulnerable customers
- Continue to provide an effective priority information service to all customers on our Critical Care Register who depend on electricity for life saving equipment.

Complaints
- Respond to at least 80% of complaints within two days and 100% within five days.
- Reduce the overall number of complaints each year.
- Continue to have a target of zero complaints where the Consumer Council for Northern Ireland has to get involved.

Keeping the public informed
- Respond promptly and effectively to enquiries received by phone, social media, email or letter; 80% within two days and 100% within five days.
- Provide a new multi-channel communication approach that will enhance engagement with customers.

Customer service

6.66 NIE Networks is subject to the Electricity (Standards of Performance) Regulations (Northern Ireland) 1993. These regulations set out the minimum standards of performance that NIE Networks is obliged to meet. These standards protect customers and provide for payments to be made to individual customers if set levels of performance are not met.

6.67 Since 2008, there has been one default against the Guaranteed Standard and zero failures on the Overall Standards. During RP6, we will aim to have zero defaults on our Guaranteed Standards and zero failures on our Overall Standards. We have assumed that there will be no changes to the Guaranteed Standards and Overall Standards during RP6.

6.68 We will continue to use surveys to determine the level of service delivered to customers. This includes internal employee surveys to establish the perceived level of service to customers as well as external customer surveys to understand their views on the level of service provided. Feedback from these surveys will be used to develop customer service improvement plans.

6.69 We will continue to make presentations to local councils on the role of NIE Networks and the key aspects of its customer service and work delivery programmes.

6.70 We will continue to operate an enquiry and complaints system which makes it easy for customers to access the right people and to obtain responses in a timely and effective manner.

Telephone response

6.71 Allowing customers to speak to someone is an essential part of good customer service and we are proud of the telephone response that we already provide.

6.72 We will continue to operate an efficient contact centre with well trained staff to talk to customers as well as using the latest technology to provide automated messaging during power cuts. We will answer 93% of calls within twenty seconds and ensure that 99% of all calls are answered.

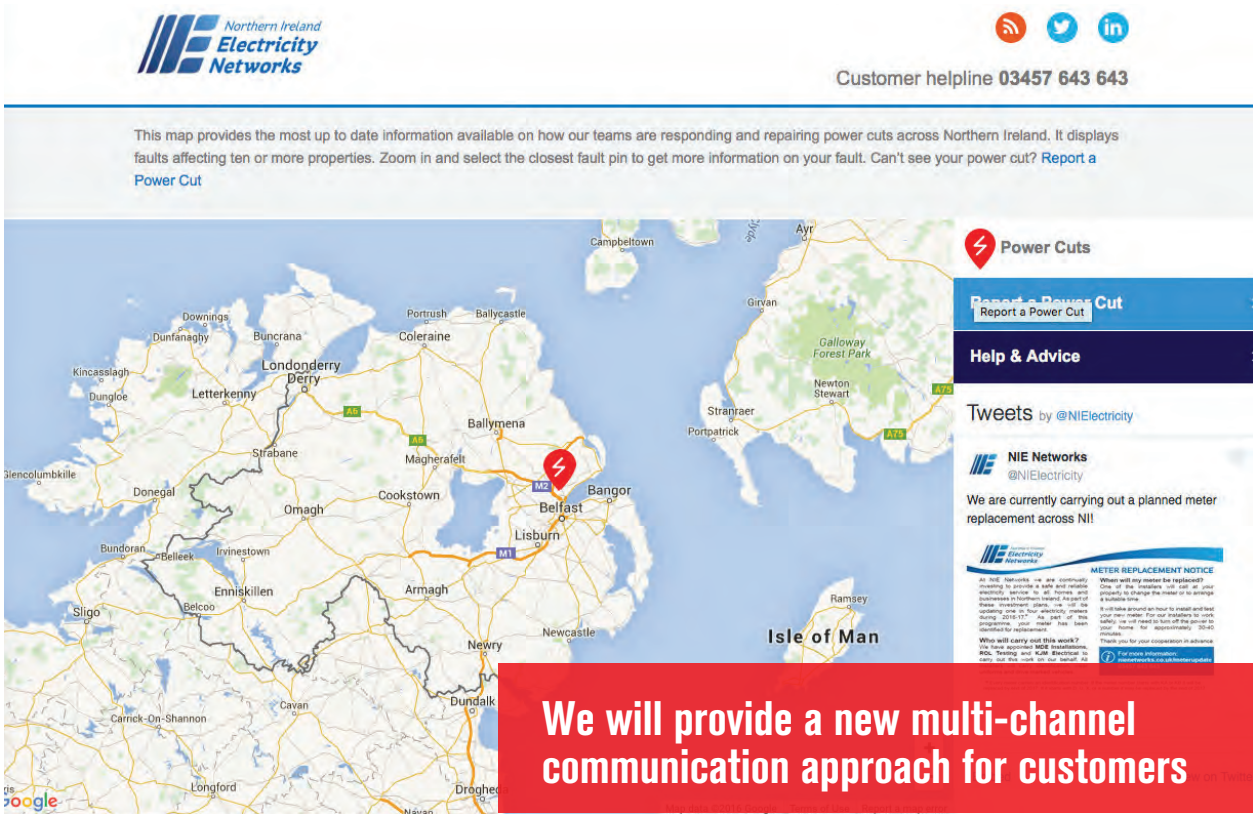
Supporting vulnerable customers

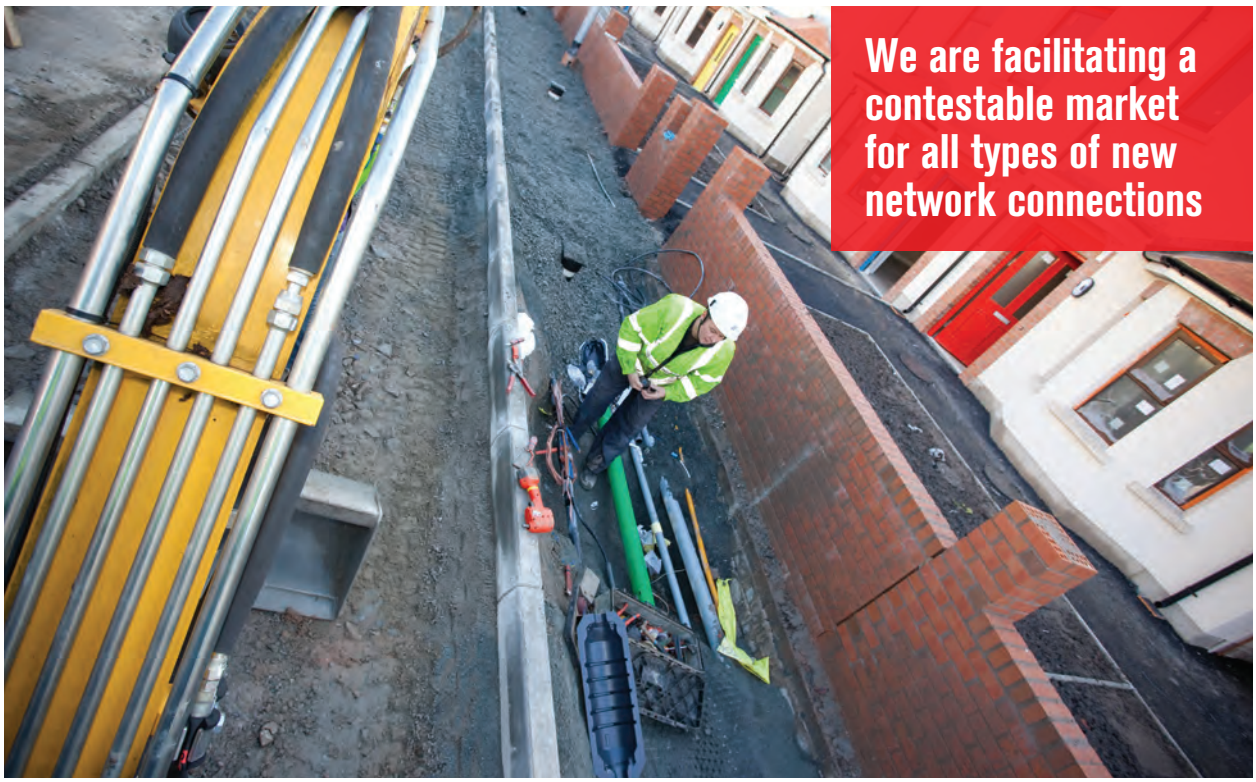
6.73 We are committed to providing the best possible service for all of our customers. We run a number of schemes to support and help more vulnerable people living in our community. Schemes include:

- Critical Care Register – a priority information service for customers who rely on electricity for their healthcare needs. When registered, these customers or their carers will receive prioritised information on faults or on planned work on the network. We also share information with other agencies where this is in the interests of the customer and has been agreed in advance with the customer. We provide bespoke training to our front line staff.
- Password scheme – working with electricity suppliers, we will deliver a pre-agreed password to the customer before being allowed to enter a property. This reassures customers that our employee is a genuine caller.
- QuickCheck scheme – working with the PSNI, we are part of the QuickCheck scheme which provides an independent telephone check to ensure our employees are genuine.

Complaints

6.74 Whilst we endeavour to get things right first time, sometimes things can go wrong. When complaints are received they are treated with urgency and with an aim to resolve the matter to the customer's satisfaction quickly. Local managers are responsible for dealing with complaints, visiting





We are facilitating a contestable market for all types of new network connections

customers where necessary to understand what can be done to put things right.

6.75 We will respond to at least 80% of complaints within two days and 100% within five days whilst ensuring that the response provided to all complaints minimises the number being investigated by the Consumer Council for Northern Ireland.

6.76 We are aiming to reduce the number of complaints by 20% by the end of RP6. The number of complaints is reported monthly and compared with the corresponding period of the previous year.

Keeping the public informed

6.77 Traditionally customers have either written or called on the telephone, but advances in technology mean that there are more direct communication methods available online; via email or social media. We will continue to respond to contacts received through these channels.

6.78 We recognise that substantial technological developments have been made in relation to communication technologies and understand that customers want a variety of options for how they contact us and receive information.

6.79 During RP6, we will provide a new multi-channel communication approach that will allow customers to report power cuts and receive up to date information on the progress of our repair teams, receive notifications about planned work on our network, submit meter readings and receive up to date information about connection applications. We will extend our current hours of Twitter to include evening and weekend working. We will also update our website to include a web chat function to allow customers to engage with us online in real time.

e. Connections

6.80 The objective of connections outputs is to provide an excellent service to customers connecting to the network whilst introducing and facilitating competition in the connections market.

Connection timelines
- Improve the overall time to deliver a demand connection by 20%.

Enhance the capability of the distribution network for generation connections
- Reinforce 33kV network to ease congestion and remove constraints associated with zero export connections, Demand Side Units (DSUs) and LCTs.
- Complete trials to assess the viability of 'managed connections' to facilitate additional network access for customers.

Enhance engagement with customers
- Work with major customers to identify where processes can be improved and quickly implement changes.
- Strengthen our customer service and account management for project developers seeking connections to the electricity network.
- Take feedback from customers through open engagement, surveys and connection surgeries.

Improve processes and customer service
- Ensure information provided in documentation and online meets the needs of our customers.
- Improve information sharing on the website including the amount of available capacity on the network.
- Enhance feasibility study and budget quote options for load connections.
- Create a job 'illustrator' online to allow customers to estimate costs and network access.
- Introduce an online system to allow customers to track jobs and get status updates.
- Create a facility for customers to make online payments for jobs.

Contestability in connections
- Facilitate contestability in connections for all connections types.

During RP6, we will deliver the following outputs:

Connection timelines

6.81 As we move into RP6 the Northern Ireland Renewables Obligation (NIRO) will end however the demand for generation connections is likely to continue albeit the level of demand along with any future incentive arrangements are not yet clear. There also remains a considerable level of work to deliver before the early part of 2018.

Business customers across Northern Ireland told us that we should simplify the process for connecting to the electricity network and speed it up significantly

6.82 We will continue to develop cluster substations which are designed for connecting groups of large scale generators that are located in the same vicinity, and which allow the transfer of generation capacity directly up to the transmission network. We will deliver cluster connections across Northern Ireland and will work to expedite the delivery timelines for clusters.

6.83 For demand connections, in RP6 we intend to reduce the timelines to get connections delivered and physical works completed by 20% through process improvements and system changes.

Enhance the capability of the distribution network for generation connections

6.84 We expect that customers generally will seek improved energy efficiency on site through a combination of load reduction and the smarter technology approach. This also will lead to more customers seeking zero export connection arrangements for renewables. We are proposing the reinforcement of the 33kV primary network to

Customers told us that trying out and testing new equipment which could support the rising levels of renewable technology connecting to the electricity network is important to them

ease existing congestion limits allowing greater access for existing customer load reductions / energy efficiency schemes and participation in ancillary services markets such as Demand Side Units (DSUs). DSUs can be called upon to remove load from the network.

6.85 Considerable work has already been completed by NIE Networks on trialling a new method of connecting generation customers called 'managed connections'. We will continue to develop work on this and will assess the commercial and technical viability for allowing further generation access to the network.

Enhance engagement with customers

6.86 We recognise that major connection customers in particular have a requirement for more detailed interactions with us. We intend to introduce customer account managers for customers with large or complex jobs or those who have multiple jobs. We believe this will improve the information provided to these customers and ultimately create a better more streamlined customer experience when applying for a connection.

Improve processes and customer service

6.87 We will endeavour to improve our communication with customers through providing more frequent and timely updates to customers on their jobs' progress. We intend to introduce an online tracking system for jobs which will allow customers to apply for connection, and to check online the current status of their job. In addition to this we are looking at ways that we can provide a facility for customers to make online payments for jobs.

6.88 Continuous feedback is important so that we can identify what customer priorities are and highlight areas where we can do better. We will continue to work with customers and stakeholders to improve our communications about the connection process and improve the information we have in our application forms and on our website.

6.89 We will continue to develop our policies for connecting customers and will consult with the industry to make sure we can deal efficiently and consistently with the increased demands on scarce capacity and how that remaining capacity can best be utilised.

6.90 We recognise that demand connections is an area where we can continue to improve the service we deliver to customers and we have therefore developed a number of key improvements that we intend to deliver during RP6 including enhancing the facility for load customers to apply for a budget cost or a feasibility study in advance of applying for a formal connection offer. We understand that there are times when customers are unsure about the requirements for their connection or about the best way to connect. We believe this service will allow customers to become better informed when they come to apply for a connection, which will mean a quicker application process for customers and ultimately reduce the time to provide connection offers.

Contestability in connections

6.91 We are working to facilitate the introduction of contestability in connections in Northern Ireland. In RP6, we will open up all types of connection to be constructed contestably. We will also provide a portal for Independent Connection Providers (ICPs) to access all the necessary information relating to design and build of contestable network connections.


APPRENTICE
Northern Ireland
Electricity
Networks

DISTRIBUTION EXPENDITURE

a. Summary

7.1 This chapter describes forecast expenditure in respect of the distribution network. In total £1,086.2m will be required in RP6; £869.4m for core expenditure and £216.8m on other costs.

7.2 The elements of the core expenditure are shown in the table below.

Table 6 – summary of core distribution expenditure, £m

	RP5 average per year	RP6 average per year	RP6							
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	Total
Distribution network capex	39.4	52.6	29.1	52.1	52.2	52.2	52.2	52.3	52.3	342.1
Inspections, Maintenance, Faults & Tree cutting (IMF&T)	18.0	18.2	9.1	18.2	18.2	18.2	18.2	18.2	18.2	118.4
Indirects	39.3	42.3	21.1	42.0	42.0	42.2	42.2	43.1	42.2	274.8
Non Network IT	2.7	3.3	3.7	4.1	4.6	2.8	2.3	1.4	2.9	21.7
Market Operations	21.8	22.0	14.1	24.9	21.6	20.7	20.0	20.4	21.6	143.3
RP6 Productivity savings *	-	-4.8	-1.0	-2.8	-3.7	-4.5	-5.4	-6.3	-7.3	-31.0
Total	**121.1**	**133.7**	**76.0**	**138.4**	**134.9**	**131.6**	**129.5**	**129.1**	**129.9**	**869.4**

** As noted in Chapter 5, our business plan assumes we will achieve annual efficiency savings of 0.7% per annum during RP6. Efficiency savings achieved during RP5 are reflected within the RP5 actual costs.*

7.3 Other expenditure, including the cost of rates, pensions and real price effects (RPEs), is shown in the following table:

Table 7 – summary of other distribution expenditure, £m

	RP5 average per year	RP6 average per year	RP6							
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	Total
RP6 Real price effects*	-	8.2	1.6	4.3	5.5	6.8	9.2	11.7	14.2	53.2
Rates	12.7	13.9	6.9	13.9	13.9	14.0	13.9	14.0	14.0	90.5
Licence fees	1.4	1.3	0.7	1.3	1.3	1.3	1.3	1.3	1.3	8.6
Pension deficit contributions	13.4	13.5	6.7	13.5	13.5	13.5	13.5	13.5	13.6	87.9
Pension ERDC disallowance	-3.7	-3.6	-1.8	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6	-23.4
Other	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	24.3	33.4	14.1	29.4	30.6	32.0	34.3	36.9	39.5	216.8

** NIE Networks' price control is set by the UR in constant prices (i.e. in "real terms") and then indexed to changes in the Retail Price Index (RPI) that occur over the period. In reality however the company will be subject to RPEs which is the standard regulatory term used to describe how a firm's costs will differ from RPI over a period. The RPEs for RP5 are reflected within the RP5 actual costs.*

7.4 A more detailed analysis of core expenditure is shown in the table below.

Table 8 – summary of core distribution expenditure, £m

Costs excluding RPEs (£m at 2015/16 prices)	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Distribution Reinforcement	5.8	9.5	4.8	9.5	9.5	9.5	9.5	9.5	9.5	62.1
Distribution Asset Replacement	26.5	26.9	13.4	26.9	26.9	26.9	26.9	26.9	26.9	174.6
ESQCR	1.9	9.2	7.4	8.7	8.8	8.8	8.8	8.9	8.9	60.0
Other Non Load	3.7	5.7	2.8	5.7	5.7	5.7	5.7	5.7	5.7	36.8
Network access and commissioning	1.5	1.3	0.7	1.3	1.3	1.3	1.3	1.3	1.3	8.7
Total distribution capex	39.4	52.6	29.1	52.1	52.2	52.2	52.2	52.3	52.3	342.1
Inspections	1.0	0.9	0.4	0.9	0.9	0.9	0.9	0.9	0.9	5.7
Maintenance	3.5	3.2	1.6	3.2	3.2	3.2	3.2	3.2	3.2	20.9
Fault and Emergency	6.5	6.4	3.2	6.4	6.4	6.4	6.4	6.4	6.4	41.5
Tree Cutting	4.9	5.1	2.5	5.1	5.1	5.1	5.1	5.1	5.1	32.8
Severe Weather	0.5	0.7	0.4	0.7	0.7	0.7	0.7	0.7	0.7	4.6
Network Access & Commissioning	2.5	2.6	1.3	2.6	2.6	2.6	2.6	2.6	2.6	17.2
Income	-0.9	-0.7	-0.3	-0.7	-0.7	-0.7	-0.7	-0.7	-0.6	-4.3
IMF&T	18.0	18.2	9.1	18.2	18.2	18.2	18.2	18.2	18.2	118.4
Engineering management	17.9	19.9	10.0	19.9	19.9	19.9	19.8	19.8	19.8	129.1
Vehicles, IT, property & engineering equipment	8.7	9.6	4.7	9.3	9.4	9.6	9.7	9.7	9.7	62.1
Corporate and business support	7.2	6.8	3.3	6.6	6.6	6.6	6.6	7.5	6.6	44.1
Wayleaves	4.8	5.1	2.5	5.1	5.1	5.1	5.1	5.1	5.1	32.9
Operational training	0.6	0.7	0.4	0.7	0.7	0.7	0.7	0.7	0.7	4.6
Non Operational Premises	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	2.2
Less Income relating to Indirect activities	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3
Indirects	39.3	42.3	21.1	42.0	42.0	42.2	42.2	43.1	42.2	274.8
Non Network IT	2.7	3.3	3.7	4.1	4.6	2.8	2.3	1.4	2.9	21.7
Total core costs	99.4	116.5	62.9	116.4	117.0	115.4	114.8	115.0	115.6	757.0
Market Operations										
Installs, Recertification, Non network IT	8.3	9.4	7.7	12.3	8.9	8.1	7.4	7.6	9.0	61.1
Meter Reading	3.6	3.8	1.8	3.7	3.8	3.8	3.8	3.8	3.9	24.6
Enduring Solution opex	6.2	5.3	2.7	5.4	5.3	5.2	5.2	5.2	5.1	34.1
Other	3.6	3.6	1.7	3.5	3.6	3.6	3.6	3.8	3.6	23.4
Total Market Operations	21.8	22.0	14.1	24.9	21.6	20.7	20.0	20.4	21.6	143.3
RP6 Productivity savings	-	-4.8	-1.0	-2.8	-3.7	-4.5	-5.4	-6.3	-7.3	-31.0
Total	121.1	133.7	76.0	138.4	134.9	131.6	129.5	129.1	129.9	869.4

b. Distribution capex summary

7.5 Planned capex in respect of the distribution network falls into five main categories:

- **Distribution reinforcement** covers expenditure necessary to increase network capacity in heavily stressed parts of the network in order to:
  - meet demand growth;
  - manage the effects caused by the uptake of low carbon technologies (LCTs);
  - manage the effects caused by the increasing level of renewables connections; and
  - fund innovation projects that are likely to help facilitate the connection of low carbon technologies, and to release network headroom at a much lower cost than traditional reinforcement.
- **Asset replacement** covers expenditure necessary to replace assets that are no longer fit for purpose in order to manage network reliability and safety.
- **ESQCR** is a new mandatory investment stream required to meet the requirements of the Electricity Safety, Quality and Continuity Regulations (Northern Ireland) 2012.
- **Other non-load expenditure** comprises expenditure on telecommunication systems, flood defences for substations, alterations to the network to accommodate road works and other developments which are only part recoverable and expenditure needed to connect customers, some of which is not recoverable.
- **Network access and commissioning** relates to activities required to facilitate project and programme work to be completed and connected to the network and thereafter to maintain, test and fault find.

7.6 Expenditure across these five categories is shown in the table below. As can be seen in the table, we have assumed an even spread of the work from year to year during RP6. In practice, actual expenditure levels may be higher or lower in any particular year but this is not expected to affect the overall level of expenditure.

Table 9 – summary of distribution core capex expenditure, £m

	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Distribution Reinforcement	5.8	9.5	4.8	9.5	9.5	9.5	9.5	9.5	9.5	62.1
Distribution Asset Replacement	26.5	26.9	13.4	26.9	26.9	26.9	26.9	26.9	26.9	174.6
ESQCR	1.9	9.2	7.4	8.7	8.8	8.8	8.8	8.9	8.9	60.0
Other Non Load	3.7	5.7	2.8	5.7	5.7	5.7	5.7	5.7	5.7	36.8
Network access and commissioning	1.5	1.3	0.7	1.3	1.3	1.3	1.3	1.3	1.3	8.7
Total distribution capex	39.4	52.6	29.1	52.1	52.2	52.2	52.2	52.3	52.3	342.1

c. Distribution reinforcement

Background

7.7 The statutory requirements for the amount of available capacity that must be provided on the distribution network to meet customer demand are set out in our Licence (requiring compliance with a National Standard on Security of Supply – P2/6) and the Electricity Safety, Quality and Continuity Regulations (ESQCR), which encompass requirements on adequacy of equipment connected to the network, maximum and minimum voltage levels, disturbing loads, etc.

7.8 The following sections provide an overview of our planned distribution reinforcement expenditure required to ensure the capability of the distribution network to meet the developing needs of existing and future customers in Northern Ireland over the RP6 period. This assessment is based on our

best view of the future through tried and tested forecast methodologies and including some alternative scenarios developed by the Department of Environment and Climate Change (DECC) which have been further developed into a regionalised model by the research company EA Technology. This model, known as the Transform Model, was accepted by Ofgem and used by the GB distribution network operators (DNOs) in their recent regulatory price control review (RIIO-ED1).

Expenditure drivers

7.9 There are a number of factors that drive expenditure requirements on the electricity network. These are summarised in the table below.

Forecasting overall load growth and expenditure

7.10 Based on a number of sources of economic data including population growth, NIE Networks and the System Operator for Northern Ireland

Table 10 – drivers of expenditure

External driver	Change anticipated	Likely impact on peak demand	Effected voltage level
Government policy	The UK targets for reducing carbon dioxide emissions require a reduction of 80% by 2050. This target will be met through the decarbonisation of heating, power and transport, and from improvements in energy efficiency. This will influence the speed of uptake of low carbon technologies, the drive for energy efficiency measures, and the funding made available for local improvement schemes, e.g. Public Realms. Demands on the electricity network are likely to increase in line with the uptake of technologies such as electric cars. However this may be partially off-set somewhat by improvements in energy efficiency in buildings and appliances.	↑ ↓	33kV, 11kV, 6.6kV and LV
Low-Carbon Technology	There is likely to be an increased uptake in low carbon technologies such as solar panels, heat pumps and electric cars. This will require network investment to facilitate the development of these technologies on the Northern Ireland distribution network.	↑	11kV, 6.6kV and LV
Distributed generation, including zero export sites and DSUs	Zero export sites is where customers look to increase their own generation on site, reducing their requirement to consume electricity from the network to meet their demand. Demand Side Units (DSUs) is where customers agree to demand reduction in response to transmission system signals. The increasing prevalence of embedded generation may reduce peak demands in some areas of the network thereby off-setting investment. However, in many sections of network, the level of local generation and DSU operation will result in load erosion leading to thermal overload and voltage rise issues at periods of low demand. Investment will be required on the network to manage this.	↓ ↑	
Customer connections	There will be approximately 7,000 connections per year requiring deep reinforcement that has to be funded through the regulatory allowance.	↑	33kV
Incremental economic growth	At the local network level, while some sites show negative growth, a significant number of sites show a relatively high level of demand growth.	↑	33kV, 11kV, 6.6kV and LV
Consumer behaviour	The adoption of low carbon technologies will put an increasing demand on the electricity network, although this may be partially off-set by more energy efficient devices and appliances in consumers' homes.	↑	11kV, 6.6kV and LV

(SONI) are predicting a conservative rate of demand growth across Northern Ireland of 0.7% per annum. However, this can range up to 1.5% annual demand growth at a number of individual bulk supply substations. The transmission forecast information is published in the SONI/Eirgrid 10 Year Transmission Statement and the overall forecast is shown below. See Figure 11.

Energy efficiency – moving towards a low carbon society

7.11 The anticipated uptake of LCTs (heat pumps, electric vehicles and solar PV) during RP6 will have a positive impact on the energy efficiency of individual households and businesses. In RP6, we are planning to invest in the distribution network to accommodate the connection of LCTs.

7.12 We have also outlined some investment specifically focused on alleviating problems caused by the high volumes of renewable generators already connected to the distribution network. This investment would help to remove many of the constraints associated with renewable energy.

7.13 Both of these investments will help to facilitate the move towards a low-carbon society.

Improving the energy efficiency of the distribution network

7.14 We have identified a number of measures that could be undertaken to improve the energy efficiency of the distribution network. These include:

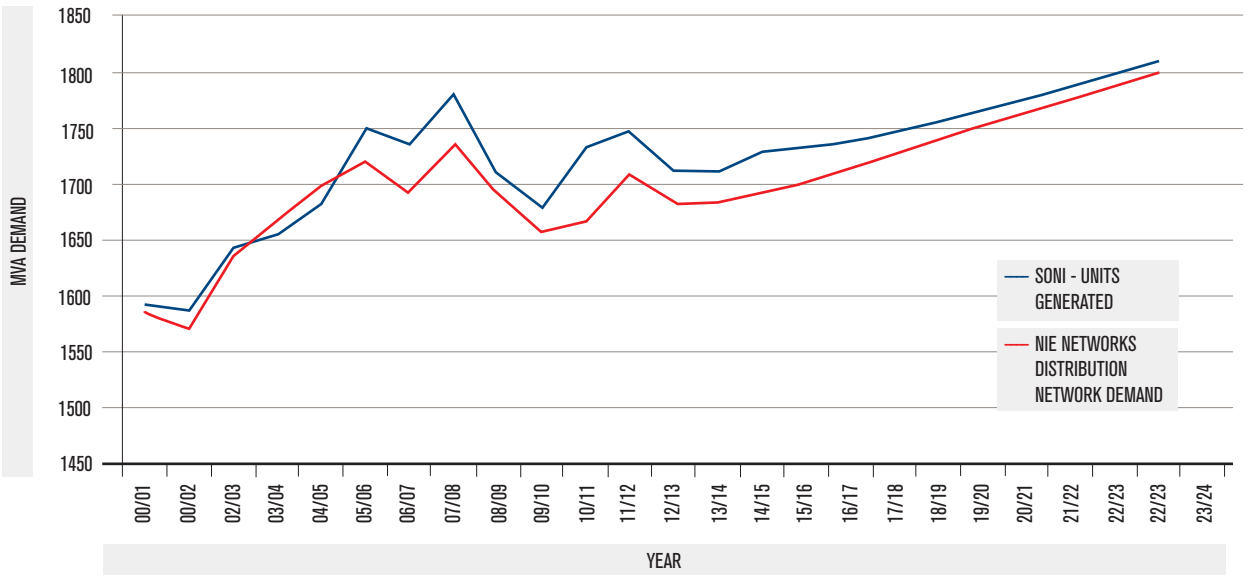
- introducing eco-design transformers; and
- testing the performance and reliability of a voltage reduction solution which may help to reduce network losses and also benefit individual customers who could see increased device efficiency due to voltage optimisation.

7.15 We will continue to invest to accommodate new customer-side low-carbon technologies which have wider societal energy efficiency benefits and we will seek to integrate other approaches that reduce network losses into 'business as usual' investments.

Impact of low-carbon technologies

7.16 Our prediction of future overall system maximum demand will initially be impacted by EU driven energy efficiency initiatives and more latterly over RP6, by the potential uptake of LCTs across the province. While the drive for energy efficiency will create a downward pressure on electricity demand, many of the LCTs are designed to reduce

Figure 11 – historic and forecast electricity demand



the use of carbon fuels through the increased use of electricity for heating and transport, e.g. heat pumps and electric vehicles. Consequently, the additional cost of network reinforcement to cater for this development must be included in our forecast for distribution expenditure.

7.17 EA Technology has developed an industry accepted parametric model to forecast various uptake scenarios for LCTs and the corresponding impact this will have on distribution networks in terms of capacity and investment needs. This is known as the Transform model and NIE Networks has engaged EA Technology to develop a similar model specifically for the Northern Ireland economy and its distribution network. We have therefore used the Transform model to consider annual growth rates at individual lower voltage levels (11kV, 6.6kV and LV) taking account of the impact of energy efficiency in the short term, but primarily sensitivities to the uptake of LCT towards the end of RP6. The model incorporates load growth associated with LCTs in new properties, the retro-fitting of LCTs in existing properties and the predicted overall developments in energy efficiency.

7.18 The Transform model has been used to generate secondary network requirements and provide LCT growth rates at the primary network level. Therefore consistent growth forecasts have been applied across all voltage levels. However, we have adjusted the primary network requirement to account for the impact of forecast significant localised development identified through our normal planning process.

7.19 The generic networks and typical loading characteristics within the Transform model make it inappropriate for the identification of specific 33kV requirements. As such, only the 11kV, 6.6kV and LV elements have been taken from this model, with 33kV requirements identified through the development of load indices derived from detailed network analysis.

7.20 The overall expected distribution load-related reinforcement expenditure during the RP6 period for traditional load growth and LCT related reinforcement is shown in the table below.
See Table 11.

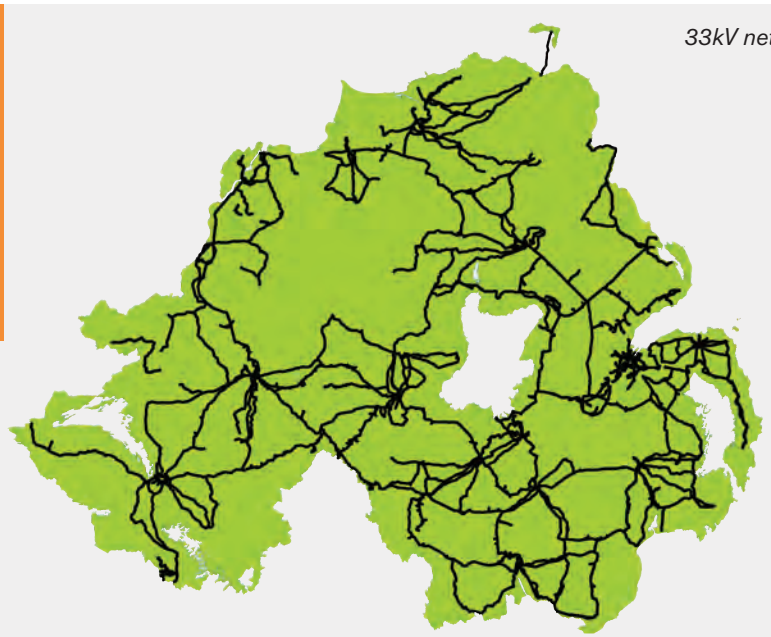
7.21 While there is a reduction in 33kV network reinforcement expenditure compared to RP5, the effects of government policy driving the uptake of LCT and embedded generation are to cause an increase in expenditure at the lower voltage levels and in resolving 33kV connection-related congestion problems.

7.22 Some innovation expenditure is also required to develop lower cost solutions to reduce the cost of meeting these requirements later in the RP6 period and in following regulatory periods.

Table 11 – summary of distribution load related expenditure, £m

	RP5 Average per Year	RP6 Average per Year	RP6							Total
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Distribution Reinforcement:										
Primary network (33kV)	3.8	2.7	1.4	2.7	2.7	2.7	2.7	2.7	2.7	17.9
Secondary network (11kV, 6.6kV, LV & LCT)	1.5	3.3	1.7	3.3	3.3	3.3	3.3	3.3	3.3	21.5
Fault Level	0.0	0.3	0.1	0.3	0.3	0.3	0.3	0.3	0.3	1.8
33kV Congestion	0.5	1.6	0.8	1.6	1.6	1.6	1.6	1.6	1.6	10.4
Investing for the Future										
Integration Projects	0.0	1.0	0.5	1.0	1.0	1.0	1.0	1.0	1.0	6.6
Telecommunication Infrastructure	0.0	0.6	0.3	0.6	0.6	0.6	0.6	0.6	0.6	3.9
Total	5.8	9.5	4.8	9.5	9.5	9.5	9.5	9.5	9.5	62.1

Investment in the 33kV network has been separately assessed to take account of localised changes in demand



Primary network (33kV)

7.23 The term 'primary' refers to the 33kV distribution network comprising equipment, overhead lines and cables.

7.24 Investment in the 33kV network has been separately assessed to take account of localised changes in demand. At the 33kV level, there is a wide range of demand growth rates among individual primary substations with some sites still experiencing negative growth since the 2007 downturn. Growth rates at individual sites range from around -7% to +4% per annum depending on local economic conditions and levels of investment.

7.25 However, our distribution forecast indicates a level of recovery with the majority of sites now showing positive growth. The average annual growth rate between the aggregated actual demands recorded in 2014/15 and the demands forecast for 2023/24 is still relatively low at 0.8%. This is in line with the ten year transmission forecast average growth rate of 0.7% per annum.

7.26 The main driver for investment in reinforcing the distribution network is to ensure compliance with both statutory and licence obligations regarding performance and capability. Network utilisation is used as an indicator of the level of risk associated with a heavily loaded network and is measured using Load Indices (LI).

7.27 Load indices are a measure introduced by Ofgem in its DPCR5 price control for the GB DNOs, to provide an indication of the level of primary substation loading risk across all the GB networks. Following discussion with the UR at the start of RP5, NIE Networks has developed load indices for the Northern Ireland network using the same template and algorithms as used by the DNOs. Load indices define the level of network utilisation at individual primary substations and 33kV network within the following general definitions.

Table 12 – load indices definitions

LI Rank	Definition	Demand driver	Duration driver
LI1	Significant spare capacity	0-80%	N/A
LI2	Adequate spare capacity	80-95%	N/A
LI3	Highly utilised	95-99%	N/A
LI4	Fully utilised, mitigation requires consideration	>99%	<9 hours per year
LI5	Fully utilised, mitigation required	>99%	>9 hours per year

7.28 The assessment of spare capacity is defined in relation to the level of load on a substation relative to its firm capacity rating (capacity that is immediately available without manual intervention following a fault on the network) and the duration of the over-firm loading, if any. The LI definitions and drivers are aligned with the agreed Ofgem categorisation in GB.

7.29 Using LI thresholds consistent with those used in GB and based on forecast localised rates of growth, the starting LIs and expected movement during the RP6 period can be shown (see Figure 12). The consistent monitoring of LIs over the regulatory period demonstrates efficient targeting of load-related investment at the primary voltage level.

7.30 The result in investing to meet statutory and licence obligations is a reduction in the level of risk associated with managing the network and as a consequence, we see a reduction in the percentage of network operating within the LI5 category. The conclusion of our primary network analysis is that in order for NIE Networks to meet statutory and licence obligations for the maintenance of supply security to the NI customer, a minimum investment of £17.9m is required to reinforce the 33kV network over the RP6 period. This represents a 28% reduction in the planned annual investment in the same category over RP5.

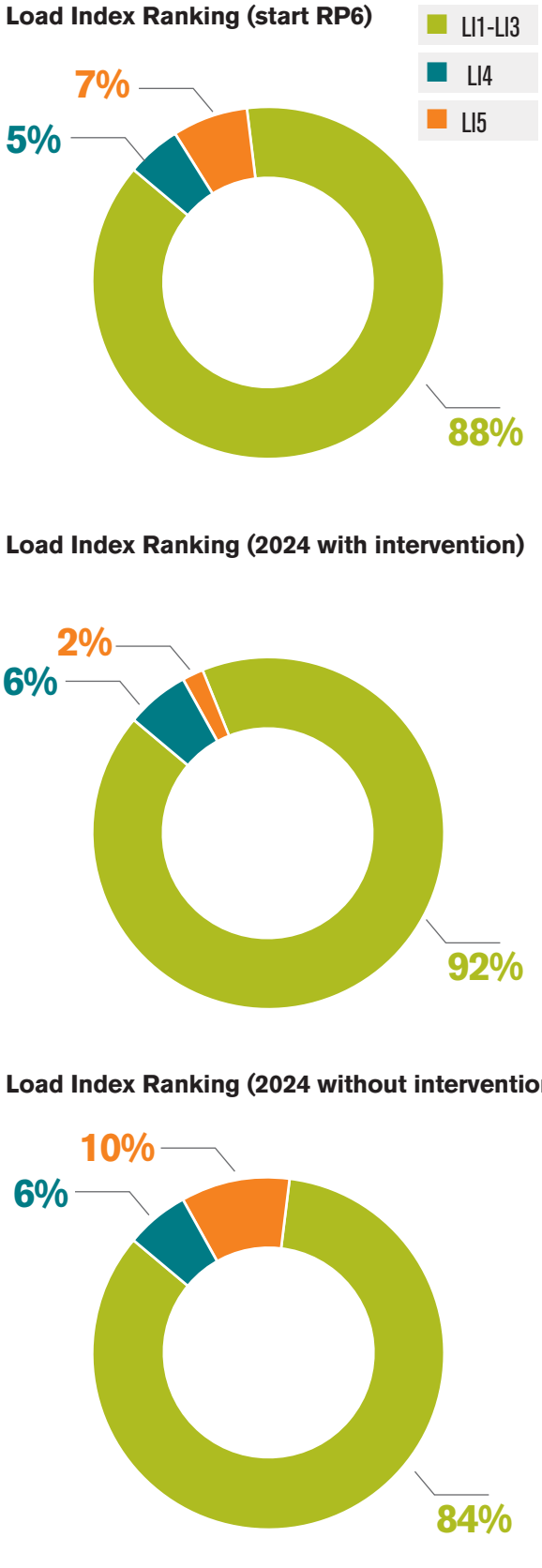
See Figure 12.

Secondary network (11kV, 6.6kV, LV and LCT)

7.31 The term 'secondary' refers to the 11kV HV distribution network (including the 6.6kV network in Belfast) and the 0.4kV low voltage network supplying local properties and comprises equipment, overhead lines and cables.

7.32 The 11kV network has been developed over many years in response to customer connections. During the electrification period in Northern Ireland (mainly during the 1950s, '60s and '70s), the cost of extending the network was partly borne by customers who required the lowest cost connection. Consequently, the rural network in particular is

Figure 12 – possible changes in load indices during RP6



characterised by long meandering low-capacity circuits with a large number of isolated single dwelling connections supplied from spur lines with individual pole mounted transformers.

7.33 The majority of Belfast has historically been supplied via a 6.6kV distribution network. This is generally an older network dating from the 1940s which was originally designed to service the lower demand properties typical of this era. The combination of modern city living creating an increase in electrical demand at individual properties and the limited capacity associated with operating at the lower 6.6kV voltage level, has lead to network overloading and limited headroom for further growth in many parts of the city.

7.34 The 11kV and 6.6kV secondary network is subject to ongoing reinforcement needs as new developments, residential and commercial are connected. Growth on existing customers' installations is also predicted to increase as a result of the clustering effect of retro-fitted LCTs.

7.35 Additional demand increases voltage drop on distribution circuits, particularly on rural circuits, and leaves less spare capacity available for resupply purposes. Loading above design limits compromises the quality and reliability of supply delivered to customers and may also give rise to public safety issues. To mitigate against these issues, we propose an investment of £2.6m on 11kV and 6.6kV network reinforcement over the RP6 period. This is similar to our annual investment in the same category over RP5.

7.36 Approximately 7,000 new customers are connected to the LV distribution network annually, with customer numbers increasing from approximately 810,000 in 2009 to 850,000 in 2015.

7.37 Whilst the majority of individual LV connections are facilitated without the requirement for network reinforcement, the cumulative effects can cause voltage problems or overloading of network equipment. Additional demand, which causes overloading of LV circuits and distribution transformers, can lead to equipment failure and multiple supply outages. Voltage fluctuations result in customer complaints and potentially, in failure of customer equipment.

7.38 Consequently, the LV load-related programme targets low-voltage urban network reinforcement, overloaded distribution transformers and voltage complaint mitigation for the benefit of our customers. We plan to investment £5.8m on general reinforcement on the LV network reinforcement over the RP6 period. This represents an 18% reduction in annual investment against the same category over RP5.

7.39 In addition to new connections, a significant driver of reinforcement investment at the lower voltage levels during RP6 and beyond is the expected growth in LCTs being retro-fitted at existing properties. A detailed assessment of the Transform model, as described in Chapter 5, has been used to derive our forecast expenditure levels.

7.40 Predicting the speed and geographic spread of the uptake in low-carbon technologies is inherently challenging; what is certain is that the uptake will not be uniform across the country and these technologies will have different impacts for different network types (such as those in a rural or urban context).

7.41 The rate of growth will be dependent upon many factors such as the development of these technologies by manufacturers, rate of fall of prices, relative cost of different fuels, availability of subsidies, building regulations and consumer attitudes.

7.42 Our expenditure forecasts for lower voltage reinforcement associated with the take-up of LCTs are based upon pragmatic assumptions informed by data provided by Element Energy and EA Technology which are specific to Northern Ireland. EA Technology has produced an independent report

£21.5 million investment over RP6 to meet general and low-carbon technology driven reinforcement

for the NI distribution network which predicts an investment requirement of £13.1m to reinforce the 11kV, 6.6kV and LV networks over the RP6 period. However, we recognise that there are uncertainties over the investment required to accommodate new and changing patterns of energy use and this issue is covered in more detail in Chapter 11.

7.43 To summarise, NIE Networks has identified a total investment requirement of £21.5m over the RP6 period to meet both the general and the LCT driven reinforcement needed to deliver a quality and secure electricity supply to the NI customer.

Fault level

7.44 Certain faults that occur on the network can cause very high currents to flow (fault current) until the fault is isolated automatically by incorporated protection devices. Whilst the network is designed to withstand these fault currents, continual reinforcement of the higher voltage network combined with the increasing number of generators and large motors connected to the distribution network can cause prospective fault currents to exceed the rating of operational equipment. This introduces a safety risk of catastrophic failure when this equipment is exposed to the high current during fault conditions.

7.45 NIE Networks has a duty of care to its employees and members of the public to ensure that they are not at risk of injury due to the failure of the company's assets.

7.46 During RP5, NIE Networks undertook a network modelling exercise to review the increase in the system fault level and identify network components that were at risk. This fault-level modelling was carried out to ensure that all items of switchgear on our distribution network from 33kV down to 6.6kV level are operated within their rating to ensure compliance with ESQCR and other relevant legislation.

7.47 The fault-level study identified substations with switchgear exposed to a fault level higher than 90% of its nameplate rating. The switchgear is normally only taken to 90% of its assigned rating to allow for any inaccuracies with data available for inputting into the model and to allow for incremental growth in the intervening period to replacement.

7.48 Solutions are generated to eliminate the risk to safety and restore optimal running arrangements, with the main approach being the replacement of the switchgear for higher-rated equipment. Where equipment was identified to be in excess of 95% of rating, operational restrictions have been placed on the switchgear until mitigation measures have been put in place. As the majority of the equipment at risk has generally an older age profile, NIE Networks has managed the replacement of vulnerable switchgear over the RP5 period through the condition related asset replacement programme.

7.49 However, this method of managing increasing fault level is not sustainable in the longer term as our modelling has identified equipment at risk which is not scheduled for replacement until RP7 or beyond. Positive action is therefore required to ensure the safety of staff and the general public. Mitigation of the risk has therefore been included in the reinforcement submission and we have identified a total investment of £1.8m over RP6 to achieve this.

33kV network congestion

7.50 Congestion in the electrical sense is a term used to describe when a network quickly

reaches capacity thereby limiting headroom for further connections and potentially limiting the development of the electricity market. This is becoming an increasing problem on the 33kV network, driven by an increasing prevalence of embedded generation occurring in parallel with a reduction in electricity demand in particular areas of the network (which is referred to as 'load erosion').

Load erosion

7.51 By the end of 2015 NIE Networks had connected a total of 659MW of large-scale generation (LSG, generators equal to or greater than 5MW) and 187MW of small-scale generation and micro-generation (SSG and MG, generators less than 5MW) to the distribution network. In addition, NIE Networks had also committed to connecting a further 601MW of large-scale generation and 119MW of small scale generation, all of which is presently at various stages of construction. This brought the total committed generation to 1566MW at the end of 2015.

7.52 Moderate levels of embedded generation, where the aggregated output is below the minimum load at the local primary substation, can be accommodated on the distribution network. However, the risk to continuity of supply and power quality issues increases substantially if the level of connected generation increases above the minimum load. Alternatively, if the level of minimum load reduces below the level of connected generation, the same network risk is created. This load erosion results from the general energy efficiency initiatives undertaken by customers to reduce their electricity demand.

7.53 The risk to network performance is that local load erosion reduces the original minimum demand leading to reverse power flows on the 33kV primary network in excess of the original design parameters.

7.54 Further load erosion is anticipated with the integration of new-market participants such as Demand Side Units (DSUs) and other ancillary services.

7.55 NIE Networks commissioned WSP Parsons Brinckerhoff to conduct a complete assessment of the 33kV electricity network and to identify the investment required to address the congestion problem.

7.56 The results of this independent study identified 36 sections of the 33kV network, including circuits and primary transformers, which are at risk of operating outside both licence and statutory obligations during RP6 unless funding is approved. Sites already covered under other investment drivers, e.g. asset replacement, have been removed from the list of sites identified by WSP Parsons Brinckerhoff. This results in an investment proposal for RP6 of 12 discrete projects, each of which would include a number of sites. The total cost of these projects is £10.4m and is included in our core investment plan.

7.57 This investment will also enable SONI greater access to distribution connected customers for the provision of non export system services in the Single Electricity Market (SEM), such as DSUs. The investment will also remove distribution network constraints which would otherwise stifle the development of zero export generation connections for existing demand customers across NI.

Investment in the 33kV network will facilitate the further development of the DSU market and zero export projects

7.58 The investment will also cater for the impact of load erosion on the distribution network resulting from the ongoing growth of G83 micro-generation. It will also facilitate the development of energy storage opportunities at both the domestic and commercial level. The investment associated with the impact of export energy resulting from additional micro-generation is covered under the growth of LCTs referred to earlier in this section.

7.59 The transmission system operator (SONI) will have to review the longer term impact that continued load erosion occurring at periods of high-generation will have on the transmission network capacity and on overall system stability.

Dealing with the connection of further generation

7.60 The core investment proposed in the plan covers the 1566MW of generation either already connected or with accepted offers at the end of 2015, together with expected load erosion.

7.61 A large volume (900MW) of new connection applications were received in August 2015, and in the period to June 2016 additional applications increased the total capacity of new applications to 1200MW. These applications have become known as "the Batch" due to the nature of having to deal with them as one group to assess the total impact on the grid.

7.62 WSP Parsons Brinckerhoff estimated the cost of investing in the 33kV network to accommodate the level of initial generation applications (i.e. the 900MW) which was in addition to the connected and committed projects totalling 1566MW. The additional cost of this investment would be £8m and relates mainly to the connection of small-scale generation where associated network reinforcement costs are non-chargeable. Given the uncertainty about the number of projects that will proceed, this cost is included as an uncertainty and is covered further in Chapter 11. The final scope and quantum of this investment will be discussed and agreed with the UR after the submission of our business plan and will be linked to an overall strategy for managing further generation in Northern Ireland.
See Table 13.

Investing for the future

7.63 Our plans for innovation in RP6 are primarily focused on integrating suitably advanced smart solutions into business as usual. We plan to do this by undertaking a programme of focused integration projects with the objective of developing cost effective alternatives to conventional network expenditure, minimising the impact on future customers.

7.64 In particular, the five main projects that we have developed and proposed are likely to help facilitate the connection of LCTs, and to release

Table 13 – summary of drivers and costs associated with mitigating against 33kV congestion, £m

Driver	Network risk	Reinforcement option	Investment category	Reinforcement cost £m
Load erosion following connection of committed generation.	A risk to the safe operation of the network if we are not given control to retrospectively limit all load reduction schemes including system services, e.g. DSUs and the continued deployment of G83 micro generation.	Invest in reinforcing critical sections of the distribution network to remove reliance on third party customer load.	Core plan	10.4
Future connection of generation currently in the planning queue as at December 2015.	A risk to the safe operation of the network if we are required to make connection offers without changes to chargeability rules and/or full control of generator connections.	Invest in additional network infrastructure to increase the available headroom for the connection of further generation above the committed level of 1566MW.	Uncertainty	8.0

network headroom at a lower cost than conventional reinforcement.

7.65 In addition, we have also identified some forward investment in our communications network that is required to enable a wider roll-out of smart solutions in RP7 and beyond.

Integration projects

7.66 It is envisaged that each of the solutions under development should be available for deployment towards the end of RP6 and in succeeding regulatory periods. Investing in the integration of smart solutions now could drive down future expenditure requirements associated with traditional distribution reinforcement and LCTs connecting to the network.

7.67 The downside of not proceeding with this integration programme is that the savings achievable from the adoption of smart solutions will not be available in the future and customers will not see the lower costs of network reinforcement.

Programme costs

7.68 The costs associated with these schemes are set out below:

Table 14 – expenditure on innovation trials, £m

Project	£m
Smart Asset Monitoring	1.2
Demand Side Response	1.3
LV Active Network Management	1.6
Voltage Management	2.2
Facilitation of Energy Storage Services	0.3
Total	6.6

Project selection

7.69 We have undertaken an extensive project selection process to shortlist suitable projects. This has included:

- undertaking an analysis of LCT driven investment requirements derived through the development of the NI Transform model;
- reviewing other key investment requirements including that associated with distribution reinforcement and 33kV network congestion; and
- carrying out a comprehensive review of GB innovation projects to understand which solutions are cost effective, will provide benefits and are at a suitably advanced stage of development.

7.70 This process has involved the cooperation of several key stakeholders across our business through regular workshops.

i. Smart asset monitoring (SAM)

7.71 This project will use specialist equipment to monitor the 33kV overhead lines and 33/11kV transformers in congested parts of the network areas and apply new real-time thermal ratings based on the actual weather conditions, the electrical current and the temperature of the conductor. This can significantly reduce the total network expenditure associated with upgrading overhead line circuits to increase thermal headroom.

ii. Demand side response (DSR)

7.72 DSR is the name given to commercial schemes where electricity customers are financially incentivised to lower or shift their electricity use at peak times. This can help to manage load and voltage profiles on the electricity network.

7.73 DSR schemes require contracts with customers who, when called upon to do so, can reduce their demand by an agreed amount at particular times. DSR is already an established way of balancing the transmission network and has been more recently explored as a means of balancing demand on the distribution network.

7.74 In RP6, NIE Networks plans to carry out a DSR pilot to reduce the electricity demand at a primary substation which is currently close to its capacity under certain fault conditions.

iii. LV active network management (ANM)

7.75 Active network management involves the real time management of load and generation on the network. In GB, there have been numerous projects exploring different means of ANM.

7.76 In RP6, we are proposing to carry out an active network management trial on LV networks which have high levels of LCT penetration. This type of network operation has the potential to increase network headroom and accommodate the ongoing connection of LCTs at lower costs than conventional investment.

iv. Voltage management

7.77 It has been found that a significant part of the Northern Ireland distribution network is constrained, not by thermal issues, but by those of voltage. This is especially true for more rural networks.

7.78 Furthermore, increasing amounts of new generation and LCTs being connected to the network will increase the need to be able to actively manage voltage on the distribution network. A number of voltage management solutions have been trialled in GB and are at a stage where they are sufficiently mature for potentially more widespread deployment.

7.79 In RP6, NIE Networks plans to pilot two forms of voltage management with a view to wider deployment:

- using static synchronous compensators (STATCOMs) to control voltage; and
- using conservation voltage reduction.

7.80 One method of controlling voltage on distribution networks is by connecting STATCOMs to improve the control of power factor and network voltage.

7.81 Conservation voltage reduction is a novel approach to energy efficiency and demand-side response, which has been successfully trialled by some GB DNOs.

7.82 The main benefit of this approach is that it can reduce network reinforcement costs by creating additional thermal headroom at times of peak demand. In addition, it can also help to reduce network losses and individual customers would benefit from increased device efficiency due to voltage optimisation.

7.83 NIE Networks believes that there are significant benefits associated with voltage reduction method and in RP6 we plan to carry out a pilot at a primary substation supplying urban customers.

v. Facilitation of energy storage services

7.84 Energy storage has long been seen as a potential solution to help flatten the demand profile on both transmission and distribution networks, and ultimately help to reduce generation costs and the need for traditional network reinforcements.

7.85 During RP6, we will seek both technical and market opportunities to assess traditional network alternatives by inviting energy-storage providers and other interested parties to submit peak reduction proposals designed for specific parts of the distribution network.

7.86 To enable these new arrangements, we will undertake a preliminary project to develop a suitable framework for these new arrangements.

Telecommunications infrastructure

7.87 NIE Networks utilises its own telecommunications network to monitor the state and loading of its assets on the electrical network, carry out remote switching operations and operate protection schemes that maintain the safety and integrity of the network. This telecommunications network is a critical component of the electricity infrastructure without which it would be impossible to maintain the same level of network performance and availability.

7.88 We have identified investment requirements in our communications network that is required to enable a wider roll out of smart solutions in RP7 and beyond.

7.89 This investment is to replace remote terminal units (RTUs) at main and primary substations during RP6 with new Internet Protocol (IP) compatible RTUs. Approximately 120 of these RTUs are already beyond their designed asset life and are planned for replacement; however effective transition to IP technology can only be achieved once the majority of all RTUs (including pole mounted devices) are migrated to IP. This will require the replacement of the remaining RTUs in RP6 to facilitate the operation of new technology associated with smarter solutions.

7.90 The downside of not proceeding with this strategic investment during RP6 is that we will be unable to fully realise the benefits of the roll out of smarter solutions across the network in RP7.

7.91 The cost associated with this programme is £3.9m.

d. Distribution asset replacement

Expenditure drivers

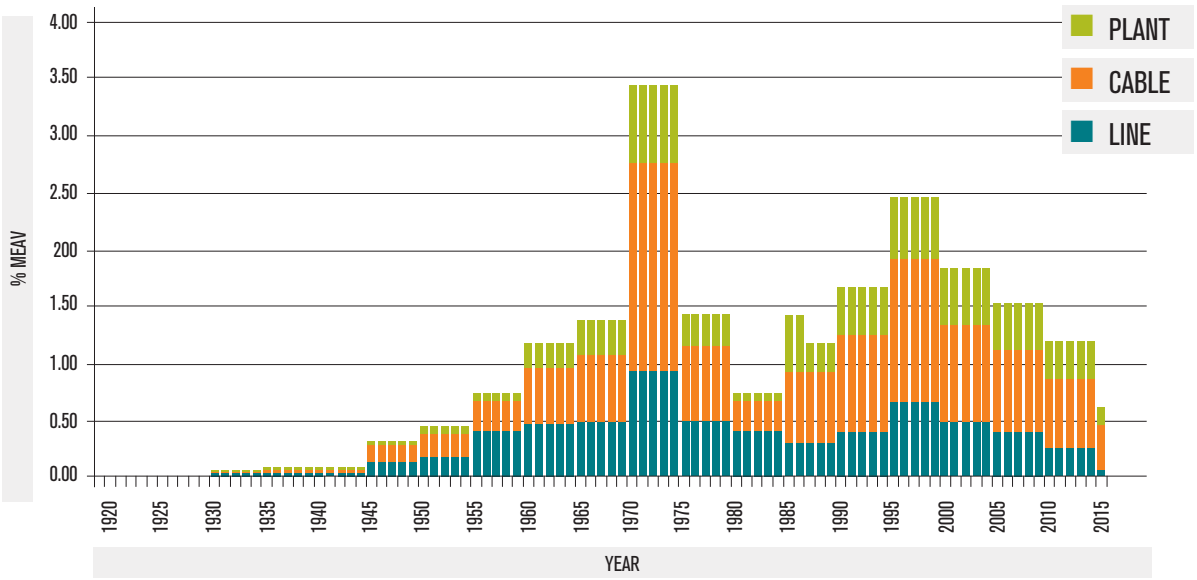
7.92 The drivers for distribution asset replacement expenditure are network safety and reliability and expenditure is considered in the categories of overhead lines, substation plant, cables and protection.

7.93 Due to the rapid manner in which the Northern Ireland rural network developed and new housing developments expanded around towns and villages, many network assets were installed over a relatively short period from the 1950s to the 1970s. As a result, high volumes of plant assets are reaching the end of, or have exceeded, their average asset lives.

7.94 The total value of asset replacement expenditure at £174.6m represents in the order of 0.5% of the total asset base per annum. At this rate of asset replacement, assets would remain on the network until they were around 200 years old. Since asset lives range from 15 to 100 years depending on the type of asset, clearly the rate of asset replacement will have to increase in the future.

7.95 Figure 13 below shows the age profile of the current distribution assets, plant, cables and overhead lines, on the distribution network expressed as a percentage of the total asset valuation (Modern Equivalent Asset Valuation, or MEAV), averaged over a five year period.

Figure 13 – age profile of distribution assets



7.96 The age profile of the distribution assets shows the high growth starting in the mid-1950s with a lull in development in the 1980s and with high rates of cable installation from the late 1980s due to urban expansion. Post 1980, the expenditure would have been a mixture of both new development and asset replacement of plant and overhead line wood poles. Little asset replacement would have taken place prior to 1980.

7.97 The age profile of the overhead lines shown is for the wood pole supports only, as conductor age profiles were not recorded. Since there has been very little overhead line replaced to date, the age profile of conductors would therefore be older than that shown for wood poles.

7.98 Projected expenditure for RP6 is shown in the table below. See Table 15

7.99 The expenditure level in distribution asset replacement is planned therefore to continue at the same level as in RP5.

Plant

7.100 Distribution plant comprises primary and secondary plant.

- 'Primary Plant' refers to plant associated with the primary network including the 33kV network and the interface switchgear with the 11kV network. It covers large transformers, switchgear and associated plant such as batteries and chargers, substation A.C. and D.C. supply systems, capacitor banks, transformer cooling banks and other auxiliaries. Civil infrastructure and structures associated with the plant are also included in this category.
- 'Secondary Plant' covers 11kV/400 Volt substations containing transformers and switchgear and other 11kV and LV plant. In urban areas this plant will be fed by the underground cable distribution network and can be found in substation buildings or kiosks in either private property or public areas, or some plant will be located in cubicles or pillars on roads and streets.

Average asset lives and asset replacement investment decisions

7.101 Both primary and secondary plant may be located in buildings or outdoors depending on the space available to establish a substation and generally outdoor equipment has a shorter asset life than equipment housed indoors.

7.102 Light current equipment such as electronic- or microprocessor-based control and protection equipment and telecommunication equipment has a shorter life of maybe 15 to 25 years and IT software and hardware shorter still at 5 to 8 years.

7.103 While such typical data may be useful in modelling asset replacement expenditure for the medium and longer term, all asset replacement decisions for the incoming period are based on asset condition, obsolescence and the risk associated with failure.

Table 15 – summary of expenditure on distribution asset replacement, £m

	RP5 Average per Year	RP6 Average per Year	RP6							Total
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Distribution Asset Replacement:										
Plant	14.9	12.9	6.5	12.9	12.9	12.9	12.9	12.9	12.9	84.1
Lines	10.6	12.2	6.1	12.2	12.2	12.2	12.2	12.2	12.2	79.0
Cables	1.0	1.2	0.6	1.2	1.2	1.2	1.2	1.2	1.2	7.7
Protection and monitoring	0.0	0.6	0.3	0.6	0.6	0.6	0.6	0.6	0.6	3.9
Total	26.5	26.9	13.4	26.9	26.9	26.9	26.9	26.9	26.9	174.6

7.104 As plant ages, its condition deteriorates and the probability of failure increases. Such failure can cause a loss of supply to customers and, if the plant were to fail catastrophically, a danger to the public and members of staff in the vicinity of the plant. The primary drivers for distribution plant asset replacement are therefore public and operator safety and maintenance of network performance.

7.105 By assessing asset condition and performance, this situation is managed in a manner which controls the level of risk, identifies opportunities for life extension and prioritises replacement.

7.106 The rate of deterioration can vary significantly depending on plant location and other factors such as specification, design, loading and fault history. In Northern Ireland a large percentage of plant is near the coast, and steel cubicles and enclosures corrode severely leading to perforation and oil leakage where the equipment is oil-filled. Large transformers contain very large volumes of oil, but even small distribution transformers and associated switchgear contain oil and the assets must be managed to maintain the integrity of the asset and prevent leaks and contamination of the ground or water courses.

7.107 The deterioration of plant can manifest itself as:

- tank corrosion as discussed above;
- worn operating mechanisms;
- oil contamination showing deterioration of electrical insulation; and
- deterioration of the electrical strength of solid insulation.

7.108 Obsolescence to the extent that parts are not available to maintain equipment or the plant lacks the functionality required of modern networks can also play a part in the investment decision making process.

7.109 In some instances, it is possible to refurbish plant to extend its life. This is particularly so for ancillary primary plant such as transformer coolers, high voltage bushings and some switchgear and transformer tap changer operating mechanisms. This work is essential to allow the main plant to remain in service until it is beyond repair or refurbishment.

7.110 Projected expenditure is shown in the table below.
See Table 16.

7.111 Overall, projected expenditure in respect of distribution plant is expected to be 13% lower in RP6 compared to RP5 as a result of reductions in requirements in some asset categories, primarily primary transformers.

Lines

Background

7.112 The Northern Ireland overhead line network is the second largest in the UK in terms of total length and has 3.5 times the average length of overhead line per connected customer in GB. This is due to the requirement to serve a largely sparse and rural customer base. The network has developed over many years but the largest proportion was installed between the 1950s and 1970s and is largely

Table 16 – expenditure on primary and secondary plant, £m

	RP5 Average per Year	RP6 Average per Year	RP6						Total
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Primary Plant	7.3	5.6	2.8	5.6	5.6	5.6	5.6	5.6	5.6	36.2
Secondary Plant	7.6	7.4	3.7	7.4	7.4	7.4	7.4	7.4	7.4	47.9
Total	14.9	12.9	6.5	12.9	12.9	12.9	12.9	12.9	12.9	84.1

constructed with wood pole supports and a high proportion of single phase spur lines. However there is a small number of steel tower supports on the 33kV and 11kV Networks.

7.113 Generally as assets get older they deteriorate, but the rate of degradation is dependent upon many factors including quality of manufacture and the local environmental conditions, e.g. assets close to the coast suffer from saline corrosion and assets on higher ground also suffer from environmental effects, more so than those on lower ground. Overhead lines can be considered to be a perpetual asset and would not be subjected to a wholesale like-for-like replacement across the network.

7.114 The primary drivers for investment in the distribution overhead line are public and operator safety and maintenance of network performance.

Tower lines

7.115 Some of the oldest lines on the distribution network are constructed on steel towers, which are subject to the effects of the environment and weather. Asset management strategies include refurbishment of the existing tower line or replacement with either wood pole circuits or underground cable. Refurbishment is normally the most economic option.

7.116 Each circuit will have a bespoke refurbishment plan put in place following a detailed condition survey and the work can include replacement of steel members of the tower, protective coatings, insulation and fittings and replacement or repairs to foundations as required. In some instances, conductor replacement will be required. Some of the circuits identified for RP6 will require conductor replacement.

7.117 The tower line refurbishment work is essential otherwise early tower replacement would be required with an exponential rise in costs in future periods.

33kV and 11kV wood pole lines

7.118 High voltage distribution overhead lines

are refurbished by NIE Networks on a 15-year cycle to offset deterioration. The 15-year cycle was determined as the optimum cycle using cost/risk optimisation techniques and is comparable to practice across the UK. In practice, replacement of a component is only carried out if its condition is poor. Some components therefore remain on the system beyond their average asset life and, in particular, there has only been a small percentage of overhead line conductor replaced to date.

7.119 Network re-engineering is required when it is assessed that refurbishment would not deliver either a practical or a cost-effective solution. As a result, a portion of the circuits identified for refurbishment will require re-engineering. Some GB DNOs would refer to re-engineering as heavy refurbishment and includes conductor replacement.

7.120 When an 11kV overhead line is re-engineered, any main line sections containing small cross section 25mm^2 conductors are rebuilt to the current specification with a minimum conductor size of 50mm^2 and intensive refurbishment to the remainder of the main line is carried out. The associated spur lines would also be refurbished but without any conductor replacement. The use of 50mm^2 reduces the number of faults during extreme weather events to between one third and one quarter of the 25mm^2 fault rate and vastly improves customer restoration times following such events.

LV network

7.121 The low voltage overhead lines would be subject to a 15-year cyclic refurbishment programme as for the HV networks. Where LV poles are inaccessible in rear gardens, the overhead line cannot be refurbished and there is little option but to partially underground the circuit.

7.122 Some properties are connected by low voltage undereave conductors where a main line terminates on a wall and insulated conductors are cleated along property walls and under eaves. The insulation on older overhead service cables becomes brittle and cracks over time and must be replaced for safety reasons.

7.123 In order to affect efficiencies, refurbishment of the LV network will be carried out in conjunction with the ESQCR programme of work discussed at paragraph 7.138.

7.124 Projected expenditure is shown in the table below: See Table 17.

7.125 The reasons for the increased overhead line expenditure in RP6 are:

- Recent work on distribution tower lines has been focused on critical items only. A review of the asset condition has confirmed that investment is overdue and must be increased to deal with foundation and structure issues in RP6.

Table 17 – expenditure on distribution lines, £m

	RP5 Average per Year	RP6 Average per Year	RP6							Total
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Distribution Towers	0.3	0.6	0.3	0.6	0.6	0.6	0.6	0.6	0.6	3.8
Distribution Woodpoles:										
33kV	1.3	1.5	0.8	1.5	1.5	1.5	1.5	1.5	1.5	9.9
11kV	5.5	6.4	3.2	6.4	6.4	6.4	6.4	6.4	6.4	41.7
LV Network:										
Refurbishment	2.1	2.1	1.0	2.1	2.1	2.1	2.1	2.1	2.1	13.6
Undereaves	1.4	1.5	0.8	1.5	1.5	1.5	1.5	1.5	1.5	10.0
Total	10.6	12.2	6.1	12.2	12.2	12.2	12.2	12.2	12.2	79.0

- The referral of RP5 to the Competition and Markets Authority (CMA) caused a delay and an uncertainty around funding in the first few years of RP5. Therefore, the updated RP5 specification was not implemented until year three of the period. As such, lower unit costs were noted in years one and two. The unit costs used for RP6 costing purposes are more appropriately based on the circuits targeted in the later years of RP5 and are reflective of the work that must be continued in RP6.
- The cost of undereaves refurbishment has increased slightly. The RP5 programme focused on towns and villages whereas the properties to be addressed in RP6 are now more dispersed throughout the country and the work programme will not benefit from the same efficiencies as were possible in previous years.

Cables

7.126 Distribution underground cables are used predominately within urban areas where the construction of overhead lines is generally impractical, particularly so for higher voltage lines, and often considered less acceptable from a visual amenity perspective.

7.127 The older cables on the network are paper insulated and can be either fluid-filled or mass impregnated with oil. From the 1980s, PVC insulated cables have been used at low voltage and in the1990s, higher voltage cables insulated with polymers or polyethylene, were adopted universally.

7.128 Cables can have very long lives, over 100 years, although some specific cable types introduced in the 1970s are displaying higher failure rates. The main drivers for asset replacement of cables are reliability and reduction of oil leakage with its consequential environmental impact.

7.129 The number and volume of oil leaks from fluid-filled cables can give an indication of the overall condition of the cables and cable accessories and when cables start to develop multiple faults, it is evidence that all or part of the cable is at end of life and must be replaced.

7.130 Asset replacement on cables therefore comprises full or partial replacement of cable sections and replacement or refurbishment of hydraulic oil systems. The RP6 programme for fluid filled cables will provide asset life extension by focusing on the hydraulic oil systems such as oil tanks, oil lines, gauges and valves.

7.131 Projected expenditure is shown in the table below. See Table 18.

7.132 The RP6 investment for distribution cables is driven by condition based assessment and fault history. The RP6 annual expenditure is projected to remain consistent with RP5 investment levels.

Protection and monitoring

7.133 Electrical protection systems are required to detect network faults and initiate signals to isolate faulty sections of the network only to leave healthy

Table 18 – expenditure on distribution cables, £m

	RP5 Average per Year	RP6 Average per Year	RP6							Total
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
33kV Cables	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	2.1
11/6.6kV Cables	0.3	0.3	0.1	0.3	0.3	0.3	0.3	0.3	0.3	1.7
LV Cables	0.5	0.6	0.3	0.6	0.6	0.6	0.6	0.6	0.6	3.8
Total	1.0	1.2	0.6	1.2	1.2	1.2	1.2	1.2	1.2	7.7

parts of the network in service. They are designed to be:

- stable so that it does not interrupt parts of the network that do not need to be interrupted;
- reliable such that it is normally dormant but must react when called upon to do so by the presence of a fault condition;
- fast to ensure the removal of fault current as quickly as possible thereby minimising the impact of the fault on the rest of the system;
- sensitive to detect the fault condition, without being too sensitive and operating for a normal load condition; and
- coordinated to minimise the section isolated to clear the fault.

7.134 Protection expenditure relates to:

- Electrical protection relaying systems for detection and isolation of faults.
- Substation monitors are required for the monitoring and recording of distribution network disturbances, power quality and circuit breaker data. They are particularly useful for post-fault investigations in process industries.
- Reverse power monitoring. Ever increasing embedded generation being connected to the 11kV network can lead to the situation where the complete load of an 11kV feeder can be supplied by embedded generation and at certain times lead to reverse power flow on the 11kV source circuit breaker. A combination of multiple feeders at one primary substation can lead to reverse power flow at the 33/11kV transformers. It is now essential to be able to identify and record where reverse power flows are occurring on the network. This was discussed at paragraph 7.50.

Electrical protection systems are designed to keep the network:

* **stable**
* **reliable**
* **fast-acting**
* **sensitive**
* **coordinated**

7.135 Projected expenditure is shown in Table 19 below.

7.136 Protection expenditure is expected to increase in RP6 reflecting the fact in RP6 a new programme of discrete protection replacement is required on equipment that will be retained in service for the foreseeable future. In addition:

- replacement of poor condition integrated protection systems is now required to ensure continued service of associated switchgear. Only protection equipment associated with plant replacement took place in RP5 and in essence, this is a new programme of work;
- substation monitors are now at end of life due to condition in RP6; and
- a new requirement to monitor the effects of connected generation at primary substations.

Table 19 – expenditure on distribution protection, £m

	RP5 Average per Year	RP6 Average per Year	RP6							Total
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Electrical Protection	0.0	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	1.1
Substation Monitors	0.0	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	1.2
Reverse Power Monitoring	0.0	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	1.5
Total	0.0	0.6	0.3	0.6	0.6	0.6	0.6	0.6	0.6	3.9

Well-defined work such as fitting safety signs, stay insulators and anti-climbing devices must be completed by 2022

e. Electricity Safety, Quality and Continuity Regulations (ESQCR)

Background

7.137 The Electricity Safety, Quality and Continuity Regulations (Northern Ireland) 2012 outline the requirements for an electricity network operator to (i) assess the risk posed by equipment, (ii) rectify specific issues, and (iii) take steps to make the public aware of dangers. Similar legislation was introduced in GB in 2002. DNOs have addressed the legislation requirements during DPCR4 and DPCR5, and they continue to address the legislation requirements in RIIO-ED1.

7.138 The requirements of the regulations are summarised below.

- **Before end 2017.** Line patrols, risk assessments and remedial work on a small section of the network (for trial purposes) will be completed by the end of 2017. The remedial work carried out will inform the nature and extent of remedial work required on the remainder of the network. This work is well under way in RP5.
- **Before end 2022.** Other well-defined work such as fitting safety signs, stay insulators and anti-climbing devices must be completed by 2022 and it will therefore not be possible to carry out all of this work in conjunction with the 15-year cyclic overhead line refurbishment work.
- **Ongoing work.** Ongoing work includes dealing with hazardous sites and achieving compliance with clearance requirements. The risk assessments to be completed before end 2017 will identify hazardous sites and classify them as 'Very High Risk' and will be dealt with during RP6. Where the risk cannot be managed by asset replacement means, it will be managed by the fitting of additional anti-climbing devices and warning signs. Achieving compliance with clearance requirements for high-voltage and bare low-voltage overhead line conductors and equipment to roads, buildings and other structures gives rise to the highest expenditure requirements, particularly but not exclusively on the LV and HV networks. This work is to be addressed by the end of RP8 optimised in conjunction with other overhead line work.

7.139 There is now also a requirement to ensure that trees or other vegetation do not interfere with the network causing interruption of an electricity supply. This requirement is more stringent than NIE Networks' standard tree-cutting policy and incurs additional costs. This 'resilience' tree cutting (as opposed to 'safety' tree cutting) will be required for 33kV and 11kV circuits. The transmission resilience tree cut was carried out in RP5. Resilience tree cutting requirements will be carried out on the 33kV network over a period of 10 years with the 11kV backbone network additionally commencing in RP6.

RP5 programme of work

7.140 During RP5, NIE Networks was granted allowances to commence the programme of ESQCR compliance focusing on the patrolling to identify compliance issues and carrying out trial circuits to inform the cost base for future periods.

7.141 One of the major differences between the ESQCR legislation and the previous Electricity Supply Regulations is the requirement to complete a formal risk assessment within a stipulated timeframe.

7.142 NIE Networks has completed formal risk assessments of all its substations and by December 2017 will have completed the overhead line network. The results of these risk assessments to date have been used to inform the work programme for RP6 and beyond.

7.143 NIE Networks has also completed ESQCR compliance work on a number of trial overhead line circuits, which are representative of the circuits that will be addressed during RP6. The results of these trials have been used to refine the volumes and costs for the RP6 submission.

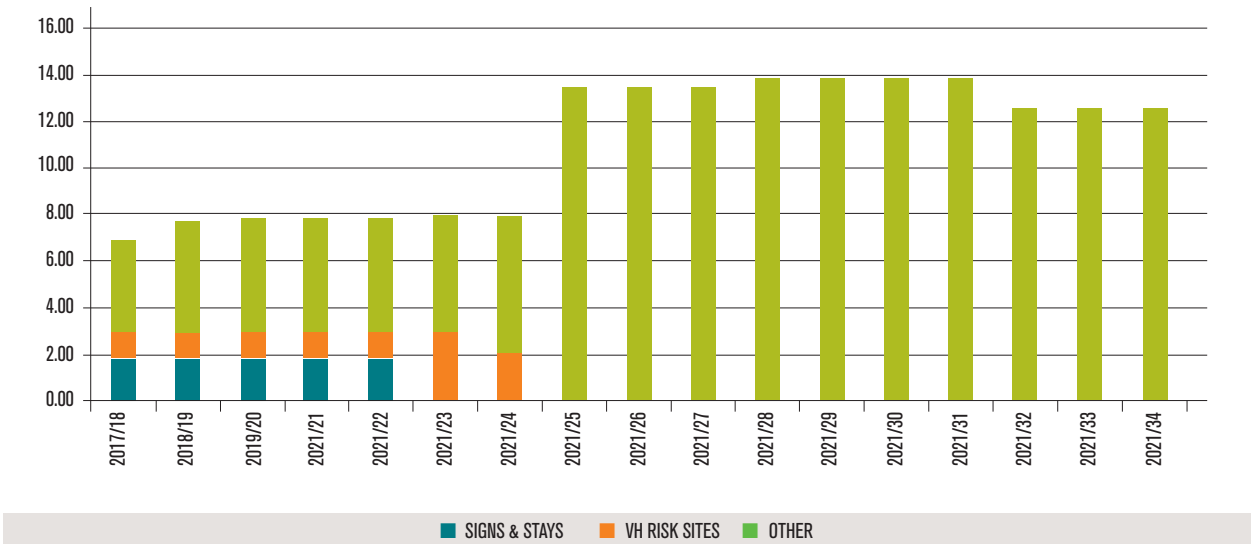
RP6 programme of work

7.144 The activities comprising the necessary programme of work, and the volume of work to be carried out, is shown below:

- addressing the signs, stays and anti-climbing guards as required by 2022;
- completing a programme to address the risks associated with the Very High Risk sites;
- commencing the programme of additional remedial works addressing clearances; and
- continuing with the 25-year programme of resilience tree cutting focusing on the 33kV and 11kV network.

See Figure 14.

Figure 14 – ESQCR work programme



7.145 Projected expenditure is shown in the table below:

Table 20 – expenditure on ESQCR, £m

	RP5 Average per Year	RP6 Average per Year	RP6							Total
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Overhead Lines										
Signs & Stays	0.0	1.5	1.9	1.9	1.9	1.9	1.9	0.0	0.0	9.5
Very High Risk Sites	0.0	1.7	1.1	1.1	1.1	1.1	2.2	2.2	2.2	10.9
Clearances	0.0	5.2	3.9	4.8	4.9	4.9	3.8	5.8	5.8	33.9
Plant	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.5
Cables	0.0	0.4	0.2	0.4	0.4	0.4	0.4	0.4	0.4	2.5
Vegetation Management	0.0	0.4	0.2	0.4	0.4	0.4	0.4	0.4	0.4	2.8
RP5 Trials	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1.9	9.2	7.4	8.7	8.8	8.8	8.8	8.9	8.9	60.0

7.146 In practice the LV ESQCR works will be carried in conjunction with the LV refurbishment programme. The projected expenditure in the table above for LV overhead lines is the incremental cost associated with ESQCR.

f. Other non-load related expenditure

7.147 Other non-load related expenditure relates to:

- network IT and telecommunications;
- network alterations;
- connections driven system work; and
- flood defences.

7.148 Projected expenditure for RP6 is shown in the table below **See Table 21.**

7.149 An increase in expenditure in RP6 is required to replace short life communication equipment, to manage reverse power flow problems caused by embedded generation and to meet substation flooding defence expenditure as a result of updated information from the Northern Ireland Rivers Agency (NIRA).

Network IT and telecommunications

7.150 Network IT and telecommunications consists of three elements:

- Substation RTUs, marshalling kiosks, receivers: These are the devices located at substations or along overhead lines and cables that perform the functions of monitoring and/or remote switching. This is also referred to as distribution Supervisory Control and Data Acquisition (SCADA).

Table 21 – expenditure on other non load distribution capex, £m

	RP5 Average per Year	RP6 Average per Year	RP6							Total
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Network IT and telecommunications	0.7	1.6	0.8	1.6	1.6	1.6	1.6	1.6	1.6	10.1
Network alterations	2.3	2.4	1.2	2.4	2.4	2.4	2.4	2.4	2.4	15.7
Connections driven system work	*0.6	1.1	0.6	1.1	1.1	1.1	1.1	1.1	1.1	7.3
Flood defences	0.1	0.6	0.3	0.6	0.6	0.6	0.6	0.6	0.6	3.7
Total	3.7	5.7	2.8	5.7	5.7	5.7	5.7	5.7	5.7	36.8

**RP5 average is £1.1m per annum on a like-for-like basis with RP6 forecast.*

- Control centre hardware and software: These are IT systems required to operate the SCADA system.
- Communications for switching and monitoring: This is the operational telecommunications infrastructure that carries data between substations/field devices and the control centres. An example is to transport telecommunications for distribution SCADA.

7.151 Significant expenditure is required in RP6 to replace half of the network Remote Terminal Units (RTUs). The IT systems required for SCADA operation will be 10 years old in RP6 and both software and hardware will require replacement during the period. The operational telecommunications network consists mainly of private microwave radio and optical fibre circuits between substations, hilltop sites, area offices and control centres. Investment is required in RP6 to replace aging obsolete network multiplexing equipment and increase capacity of loaded microwave radio circuits.

Network alterations

7.152 NIE Networks is obliged to perform alterations to its network under specific situations. These fall into three categories:

- 'Part Recoverable' where the customer agrees to pay the difference between the 'least cost technical acceptable' (LCTA), i.e. free of charge, and the agreed work to be completed. For example, a customer does not want the overhead line raised and agrees to pay the difference to have an underground cable installed instead.
- 'Non Recoverable' where a specific customer cannot be charged for an alteration. Alterations are non recoverable where we are obliged to carry out the LCTA alteration free of charge to customers because the alteration complies with conditions 12 and 13 of an established Wayleave Agreement or where a notice to remove equipment is enforced. For example: electricity infrastructure is impeding a bona fide development or to provide statutory overhead line clearances to remove unsafe or dangerous situations.
- The Northern Ireland Roads Authority and Utilities Committee (NIRAUC) has developed a Code of Practice for 'Measures Necessary Whereby Apparatus is Affected by Major Works (Diversionary Works)'. This code outlines the process where utility assets may be affected by major roads, bridge or transport works. NIE Networks is required to pay a contribution as defined under the Code towards the costs of such schemes where its assets are affected. Routine small-scale schemes are covered in this network alterations section. Major schemes are discussed further in Chapter 11.

7.153 Alteration expenditure in RP6 is projected to be similar levels to RP5 run rate.

Connections-driven system work

7.154 When a customer requests a connection to the network, we assess the condition of the assets to which any new service will connect. In some cases, an overhead pole or other asset may be in a condition where replacement is required to ensure the longevity of that connection and indeed the safety of our staff who must climb the pole to make the connection. The existing conductor is also assessed to ensure the overall integrity of the new connection.

7.155 This lower level asset replacement achieved alongside the connection job itself is not chargeable to the customer but compliments the planned asset replacement programmes carried out through condition and risk-assessed methods.

Flood defences

7.156 Flood defences have been identified as a high priority issue during the stakeholder engagement exercise.

7.157 NIE Networks has worked with NIRA to assess the risks of its ground-mounted assets from pluvial, fluvial or coastal flooding events. An increase in the accuracy of the NIRA flood maps has led to a revision of the previous risk ranking tables.

7.158 Flood events have the potential to cause damage to substations that would lead to prolonged loss of supply which can be aggravated by minimal spares availability for some older types of switchboards.

Primary sites

7.159 Based on the guidance provided by the Energy Networks Association (ENA) in Engineering Technical Report (ETR) 138, a risk rating has been assigned to each substation site based on factors including historic knowledge of floods, the number of customers supplied by the substation, including critical customers, and the potential for damage to equipment.

7.160 All primary substations that have been highlighted as being at risk have had detailed onsite assessment and flood reinforcement designs have been prepared. These include protection of the main substation building(s), transformer bund(s) and external marshalling and control cubicles. Nine primary sites are to be addressed during RP6.

Secondary sites

7.161 NIE Networks' most recent work with the NIRA has highlighted around 600 secondary substation sites as being at risk. New raised kiosks which would negate the flood risk at most sites have been designed. However, due to the location of most of the substations and the age of the associated assets it is not cost effective to replace them immediately.

7.162 Flood reinforcements are to be prioritised at sites of critical importance, e.g. pumping stations, at all new sites or those ones being replaced under the asset replacement programme. By applying these criteria, approximately one third of the secondary sites that are at risk will be addressed during RP6.

7.163 There are 200 secondary ground mounted distribution substations to be protected during RP6.

g. Network access and commissioning

7.164 This expenditure relates to two direct distribution network activities which are not incorporated into specific projects or projects outlined in previous sections: (1) commissioning, testing and fault location; and (2) network access.

7.165 Commissioning activities are required each time a new network asset is connected to the network to ensure safe and proper operation. Testing activities are carried out on a routine basis on equipment and protective devices. Fault location is a reactive activity post failure of a network asset or on operation of a protective device.

7.166 Network access activities relate to switching duties on the distribution network. These are necessary to isolate network assets to enable work on the assets or connection of new assets to the network and then subsequently to restore supplies and carry out voltage checks.

7.167 Expenditure during RP6 required to support the network investment plan is £8.7m and is consistent with RP5 levels of expenditure.

h. Inspections, maintenance, faults and tree cutting

Overview

7.168 Investment made in the normal day to day operation of the network is classified as Inspection, Maintenance, Fault & Trees (IMF&T) expenditure.

7.169 Some of the work such as reaction to faults is naturally unplanned. In setting the programmes for this work, a view is taken of historic costs and trends. However the other three categories (Inspection, Maintenance & Trees) all consist of planned expenditure. These programmes are determined based on meeting legislative requirements, cost/risk optimisation and industry best-practice.

7.170 The principles of Reliability Centred Maintenance (RCM) combined with Cost/Risk Optimisation (CRO) are applied throughout, with the aim of carrying out the correct work at the optimum time.

7.171 Expenditure across IMF&T is shown in the table below. See Table 22.

Inspections

Inspection policy

7.172 Inspections are carried out for a number of reasons:

- firstly, we have a legislative obligation to inspect our assets to ensure that they do not present any safety hazards to the public, our employees or contractors;
- secondly, inspections allow us to gather information on existing or potential defects. If left untreated, these defects could lead to failure (potentially catastrophic), and interruption of supply to customers; and
- finally, we also gather condition information, which informs us about the remaining life of the asset. This helps inform our investment decisions, and ensures that the correct assets are replaced or refurbished at the correct time.

7.173 For distribution overhead line inspections, a 'Risk-Based Inspection' approach was developed in the late 1990s, as part of a project involving all of the UK electricity companies. This included the development of software tools, which help to balance the cost of inspections against the risk of not carrying out the inspection. We used this tool to develop the existing inspection cycles for our overhead line network.

7.174 Substation assets are also the subject of rigorous inspection routines. The cycles for substation inspections were traditionally developed based on legislative requirements. Under current legislation (the Electricity Safety, Quality and Continuity Regulations), we assess location and asset risk, and this in turn informs future inspection cycles for that site.

Inspection outputs

7.175 In the next regulatory period, we will carry out over 63,000 inspections on distribution sites. In nearly all cases, individual inspections will consider multiple assets within a given site. Inspection frequencies will largely continue in line with the frequencies from RP5. However we have introduced some modifications to secondary substation inspection, on a risk basis; higher risk locations (for example, those with a history of vandalism) will be inspected more frequently, while low risk sites will be inspected less frequently. In addition, RP6 will be the first period where all street furniture will be inspected on the more frequent four-year inspection. Overall inspection numbers will also increase given

Table 22 – expenditure on distribution IMF&T, £m

	RP5 Average per Year	RP6 Average per Year	RP6							Total
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Inspections	1.0	0.9	0.4	0.9	0.9	0.9	0.9	0.9	0.9	5.7
Maintenance	3.5	3.2	1.6	3.2	3.2	3.2	3.2	3.2	3.2	20.9
Fault and Emergency	6.5	6.4	3.2	6.4	6.4	6.4	6.4	6.4	6.4	41.5
Tree Cutting	4.9	5.1	2.5	5.1	5.1	5.1	5.1	5.1	5.1	32.8
Severe Weather	0.5	0.7	0.4	0.7	0.7	0.7	0.7	0.7	0.7	4.6
Network Access & Commissioning	2.5	2.6	1.3	2.6	2.6	2.6	2.6	2.6	2.6	17.2
Income	-0.9	-0.7	-0.3	-0.7	-0.7	-0.7	-0.7	-0.7	-0.6	-4.3
Total	18.0	18.2	9.1	18.2	18.2	18.2	18.2	18.2	18.2	118.4

network growth due in part to the number of new substations installed as a result of small-scale renewable generation connections.

7.176 Around 42,000km of distribution overhead line will also be inspected. The inspection frequencies for overhead lines are consistent with RP5.

Maintenance

Maintenance policy

7.177 Preventative maintenance addresses routine wear and tear and also helps to identify any arising defects that may have to be addressed. Preventative maintenance is generally carried out for one of two reasons:

- the asset is due a routine planned maintenance; or
- the asset requires maintenance after a specified number of operations.

7.178 Where assets are routinely maintained, we use a Cost/Risk Optimisation technique, to determine the correct maintenance cycles. This tool assesses the risk of failure if we do not carry out maintenance, against the cost of actually doing the maintenance. The optimum maintenance cycle is where the sum of the maintenance costs and the value of the mitigated risk is lowest. This approach was developed as part of a UK electricity industry exercise in the late 1990s, based on Reliability Centred Maintenance. We have continued to use this model and recently revised all our maintenance cycles accordingly.

7.179 Maintenance cycles are managed through the asset management system which tracks all assets, their maintenance history, and the relevant maintenance cycles. This allows maintenance programmes to be projected into the future.

7.180 All our distribution maintenance tasks are carried out by trained operatives. They can only work on specific asset types after they have completed the relevant training. Maintenance processes are controlled through our ISO 9001 Quality Management processes.

Maintenance outputs

7.181 During RP6 we plan to spend approximately £3.2m per annum on the key distribution maintenance categories delivering over 11,000 units of maintenance during the period. This work will be carried out on a wide range of equipment, from street furniture through to high-voltage circuit breakers and cables. Maintenance will involve testing equipment, replacing consumable components and materials, and performing condition assessment work. All of this work will in turn provide valuable data on condition that will help to determine future replacement needs.

7.182 During RP6, we will carry out more maintenance than in RP5. This is largely due to the increasing number of assets on the distribution network, through normal network growth, and the increase in small scale generation. However, we will also see reductions in some areas of maintenance, as new technology with lower maintenance requirements is introduced.

Fault and emergency

7.183 Fault and emergency (F&E) activities are regarded as works that are required immediately after a fault has occurred on the system including the initial on site response. These faults can be due to deteriorating and ageing assets, as a result of third party damage or interference or as a result of bad weather. A F&E event is initiated by:

- a fault on the system affecting customers' supplies;
- an incident or fault having the potential to compromise public safety or system security, e.g. overhead or underground repairs to allow customers' supplies to be restored; or
- network equipment repairs to prevent imminent failure (completed within 24 hours of initial fault).

7.184 During the first three years of RP5 (i.e. 2012/13, 2013/14 and 2014/15), average costs associated with faults were £6.5m per annum. Given that NIE Networks' investment proposals for RP6 only address approximately 0.5% of the network per annum, and the ageing asset base, we aim to

We need to cut trees to maintain safety clearance distances and protect the network from damage

manage the level of fault expenditure to the average RP5 run rate. This would project expenditure at £41.5m for the RP6 period.

Tree cutting

7.185 Overhead lines are susceptible to damage from growing trees, falling trees and windborne vegetation. Climbable trees near overhead lines also pose a danger where physical contact with conductors is possible.

7.186 Safety clearance distances are specified within industry standard ENA TS 43-8 at a minimum of 3m clearance for climbable trees and 0.8m for all others.

7.187 In addition to safety clearance requirements, Regulation 21 of ESQCR outlines the requirement to ensure that trees or other vegetation do not interfere with or cause interruption of an electricity supply.

7.188 Our policy is to cut trees on a cyclic basis for safety clearances on a three-year cycle. This is deemed to be the optimum cutting-cycle to minimise costs and manage risks associated with trees near overhead lines.

7.189 The average cost of tree cutting during RP5 is £4.9m per annum. The cost in RP6 is predicted at £5.1m per annum due to an increase in requirements to address tree cutting on the low-voltage network.

Severe weather

7.190 The Fault and Emergency category of expenditure covers normal day to day faults and those faults that result from bad weather. However, extreme weather circumstances place the predominantly overhead network under exceptional strain and can result in widespread damage affecting more than 75,000 customers.

7.191 In the first three years of RP5, NIE Networks has experienced three such '1 in 20 year' events costing £2.6m to repair. In RP5, we were given an allowance to cover extreme weather events and this approach is consistent with GB. We are seeking an allowance for RP6 of £4.6m.

Network access and commissioning

7.192 In a similar manner to the requirements for the network investments outlined above, the IMF&T plan also requires expenditure for (1) network access and (2) testing and fault finding.

7.193 Network access activities relate to switching duties on the distribution network. These are necessary to isolate network assets to enable inspection, maintenance and fault repair work on the assets. It also covers for the activities of commissioning and testing post repair to enable safe return to service.

7.194 The investment during RP6 required to support these activities is £17.2m and is consistent with RP5 levels of expenditure.

Income

7.195 Income relates to monies received for third party damage to the network and is forecast at £4.3m for RP6.

i. Indirects

7.196 Further to the direct expenditure incurred in physically constructing and maintaining the network, NIE Networks also incurs costs related to 'indirect' functions that serve to support these direct activities. These include functions such as planning, project management, and business support.

7.197 We categorise indirect costs into the following main areas:

- engineering management;
- vehicles, IT, property and engineering equipment;
- corporate and business support;
- wayleaves;
- operational training; and
- non operational premises.

7.198 Expenditure incurred under the above listed categories is required to support the core distribution capex plan set out earlier in this chapter. Should we be required to undertake any additional works if any of the projects set out in Chapter 10 are approved and proceed, we will seek additional indirect allowances to support the additional capital works.

7.199 Indirects expenditure during RP6 is set out in the table below.

See Table 23

7.200 The increase in indirect costs is broadly attributable to (1) additional resources required to deliver the new ESQCR workstream, (2) increases in IT costs and (3) higher wayleave costs.

7.201 In the sections below we set out some further details on each of the above areas of expenditure.

Table 23 – summary of expenditure on distribution indirects, £m

Costs excluding RPEs (£m at 2015/16 prices)	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Engineering management	17.9	19.9	10.0	19.9	19.9	19.9	19.8	19.8	19.8	129.1
Vehicles, IT, property & engineering equipment	8.7	9.6	4.7	9.3	9.4	9.6	9.7	9.7	9.7	62.1
Business Support	7.2	6.8	3.3	6.6	6.6	6.6	6.6	7.5	6.6	44.1
Wayleaves	4.8	5.1	2.5	5.1	5.1	5.1	5.1	5.1	5.1	32.9
Operational training	0.6	0.7	0.4	0.7	0.7	0.7	0.7	0.7	0.7	4.6
Non Operational Premises	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	2.2
Less Income relating to Indirect activities	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.3
Indirects	39.3	42.3	21.1	42.0	42.0	42.2	42.2	43.1	42.2	274.8

Engineering management

7.202 Engineering management costs are primarily staff costs. Network design and engineering, project management, and engineering management and clerical support in particular are closely linked to the capital investment programme.

See Table 24

Engineering management and clerical support

7.203 This category includes the office-based activities of engineering and clerical support staff engaged in managing or assisting employees undertaking direct activities.

7.204 Key tasks undertaken in this area include:

- line management of staff undertaking direct activities;
- work planning, budgeting, allocation and control;
- identifying inspections and maintenance work requirements for the year;
- forecasting capital activity and identifying resource requirements;
- developing annual budgets and reporting and analysis of Key Performance Indicators ("KPIs");
- operational performance management;
- clerical support including liaising with contractors;
- ensuring proper health and safety procedures are in place and followed; and
- environmental management.

7.205 Engineering management and clerical costs are forecast to increase in RP6 compared to RP5, as a result of increases in the scale and scope of specific aspects of the overall capex plan, particularly in respect of the ESQCR programme and innovation work. As a large element of the ESQCR programme will be delivered through third party providers, NIE Networks will require additional internal project and contract management resources. The successful delivery of these additional programmes requires additional engineers, team managers and support staff.

7.206 The total cost of the additional resources needed to meet the requirements of the ESQCR programme and innovation schemes is £7.9m.

Control centre

7.207 NIE Networks has a dedicated control centre that is responsible for the operational management and control of the network. The control centre will coordinate both planned activities as well as fault and emergency response incidents.

7.208 Tasks undertaken include:

- approval of planned incident proposals and switching schedules;
- instructing and controlling the execution of network switching and issuing of safety documentation associated with both planned and unplanned incidents;

Table 24 – expenditure on distribution engineering management, £m

Engineering Management	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Engineering Management & Clerical Support	10.0	11.1	5.5	11.1	11.1	11.1	11.1	11.1	11.1	72.0
Control Centre	2.6	2.6	1.3	2.6	2.6	2.6	2.6	2.6	2.6	16.8
Project Management	1.6	2.1	1.1	2.1	2.1	2.1	2.0	2.0	2.0	13.4
Network Design & Engineering	1.4	1.9	1.0	1.9	1.9	1.9	1.9	1.9	1.9	12.4
Call Centre	0.9	0.9	0.4	0.9	0.9	0.9	0.9	0.9	0.9	5.7
System Mapping - Cartographical	0.6	0.6	0.3	0.6	0.6	0.6	0.6	0.6	0.6	4.2
Stores	0.5	0.4	0.2	0.4	0.4	0.4	0.4	0.4	0.4	2.4
Network Policy	0.4	0.4	0.2	0.4	0.4	0.4	0.4	0.4	0.4	2.3
Total	17.9	19.9	10.0	19.9	19.9	19.9	19.8	19.8	19.8	129.1

- interacting with the SONI control centre to manage the network interface between the transmission and distribution networks;
- instructing and undertaking the remote control operation of switchgear during both planned and unplanned incidents;
- updating the network control diagram in respect of sustained changes to the network;
- prioritising incidents by interrogation of information systems to determine most appropriate resource to dispatch, and then despatching this resource;
- updating IT systems with information from site;
- advising customers of appropriate information regarding unplanned incidents;
- updating messaging systems; and
- completion of fault reports and entry into fault recording systems.

7.209 Control centre costs are forecast to remain flat in RP6 as a result of efficiency initiatives and enhanced IT systems and processes.

Project management

7.210 Project managers assume overall responsibility for major project delivery including risk assessments of the overall project and issue of work instructions to own staff and contractors with follow up quality checks on work undertaken.

7.211 Costs are forecast to increase in RP6 as a result of increases in the overall capex programme, particularly the ESQCR programme and innovation schemes. We have also proposed a number of additional innovation projects including smart asset monitoring, demand side response and voltage management which will require additional project managers for the first three and a half years of RP6.

Network design and engineering

7.212 Network design and engineering involves all processes and tasks involved in the strategic planning of the distribution network at all voltages and the detailed engineering design of any changes to the network. Key activities undertaken include: load forecasting; maintenance of network design data models; capital planning; and network modelling.

7.213 There will be additional resource requirements in this area in RP6 to deliver the increased capex plan and the ESQCR programme.

Customer call centre

7.214 The customer call centre department is responsible for answering and responding to queries received from the general public, usually through calls received at our dedicated call centre.

7.215 Call centre staff also handle customer complaints and the calculation of customer compensation claims.

7.216 Costs in this area are forecast to remain flat in RP6 compared to RP5, as a result of efficiency initiatives and business process improvements.

System mapping

7.217 System mapping is responsible for updating the geographical system maps with asset and locational information following the installation, removal or repositioning of system assets, and updating of GIS records following Ordnance Survey mapping rebasing upgrades.

Stores

7.218 The stores function is responsible for the storage and management of all materials and stock items. This includes any labour and transport costs associated with the delivery of materials or stock.

7.219 Following a review in RP5 we have reduced the number of store locations. We now maintain two main store depots and these are supplemented by satellite depots at strategic locations across the province.

7.220 RP6 costs will be 24% lower compared to RP5 primarily as a result of these efficiency initiatives and improved business processes.

Network policy

7.221 The network policy team is responsible for all processes and tasks involved in the development and review of environmental, technical and

engineering policies including research and development. This involves evaluating the impact of changes in relevant legislation and developing and updating policies as appropriate.

7.222 Such policies typically cover areas such as asset replacement, maintenance and inspection; technical standards and specifications; vegetation management; and asset and network design and protection policy.

Vehicles, IT, property and engineering equipment

7.223 Costs in the vehicles, IT, property and engineering equipment category include those costs associated with providing the necessary infrastructure to manage the network business.
See Table 25.

IT and telecoms operational costs

7.224 We are forecasting an increase in IT and telecoms operating costs of approximately 23% over the RP6 period, compared to RP5.

7.225 Infrastructure-related operating costs are forecast to increase due to additional hardware support and associated operating system licence costs. This is a result of an enhanced Network Management System infrastructure; the introduction of additional IT security devices to protect the network; and an increase in the population of mobile devices.

7.226 Telecoms related operating costs are forecast to increase over the RP6 period. Our operational telecoms network will expand significantly to introduce new devices and circuits to the network which will require hardware support, software support and maintenance services charges.

7.227 In addition to the network expansion, there will be increases in BT circuit rental charges as a result of the BT 21st Century project to replace obsolete analogue circuits with high-capacity Megastream circuits. These new, higher cost circuits are required to ensure critical protection schemes continue to operate properly.

7.228 Operating costs for our business voice and data network will also increase during RP6 following the introduction of gigabit links to office locations. This will support the growth of data due to increasing use of video, social media and other digital facilities expected by customers and the general public. There will also be increases in third party data charges to support a more mobile workforce.

7.229 We plan to implement a range of transformation projects during RP6 to consolidate and maximise the enterprise IT assets within the company, and to drive efficiencies across assets, information and customer service.

Vehicles, transport and equipment

7.230 This category covers the management, operation and maintenance of the commercial vehicle fleet and mobile plant used by the company or any other related party for the purposes of providing services to the company.

Table 25 – expenditure on vehicles, IT, property and engineering equipment, £m

Vehicles, IT, Property & Engineering Equipment	RP5 average per year	RP6 average per year	Spend profile in RP6							
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	Total RP6
IT & Telecoms	3.8	4.6	2.3	4.4	4.4	4.6	4.7	4.7	4.7	29.8
Vehicles, transport & equipment	3.6	3.5	1.8	3.5	3.5	3.5	3.5	3.5	3.5	22.8
Property Management	1.3	1.5	0.7	1.5	1.5	1.5	1.5	1.5	1.5	9.5
Total	8.7	9.6	4.7	9.3	9.4	9.6	9.7	9.7	9.7	62.1

7.231 NIE Networks' fleet comprises approximately 400 vehicles ranging from small vans to large lorries. Our policy is to lease all vehicles on a contract hire basis, typically for periods of three to seven years depending on the vehicle type.

7.232 We outsource all repairs and maintenance works to a third party provider. This eliminates the need to maintain an extensive garage network and team of maintenance staff. Due to the dispersed nature of the distribution network in Northern Ireland, we require access to multiple repair locations. As such, utilising an existing provider's infrastructure is deemed the most efficient operating model.

7.233 We review this operating model regularly to ensure it remains the most efficient delivery option for the business.

7.234 Also included in this category is capital expenditure on tooling and small plant and machinery that does not fall under fleet vehicles. This will include items such as wood chippers, mobile elevated work platforms, and specialist saws. Equipment costs are forecast to increase in RP6 to deliver the larger capex programme and due to several of the larger, specialist vehicles being due for refresh during the period.

7.235 Average annual fleet expenditure in RP6 is expected to be lower compared to RP5 levels. This is due to reduced financing costs and a vehicle rationalisation programme undertaken in RP5.

7.236 Overall expenditure on vehicles, transport and equipment is expected to remain relatively flat in RP6.

Property management

7.237 We have a dedicated facilities management department which is responsible for the activity of managing, providing and maintaining non-operational premises.

7.238 Typically, we lease our properties on both long-term and short-term leases. Operational properties are typically held on longer term leases while non specialised premises such as office premises are held on shorter term leases.

7.239 Included within these costs are: rent and rates paid on non-operational premises; postage, print and stationery costs; utilities including electricity, gas and water (supply and sewerage); and inspection, maintenance and facilities management costs of non-operational premises.

Business support

7.240 Business support costs relate to HR, finance and regulation and other corporate activities.
See Table 26.

Finance and regulation

7.241 Expenditure in finance and regulation covers a wide range of activities including the statutory, regulatory and internal management of cost, procurement, insurance, taxation and auditing activities.

7.242 Annual costs in this area are forecast to be around 6% below the RP5 average, due to lower staff costs and lower company overheads following

Table 26 – expenditure on business support costs, £m

Business support	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Finance & Regulation	4.5	4.2	2.0	4.0	4.0	4.0	4.0	4.9	4.0	27.1
HR & Non-operational Training	1.5	1.4	0.7	1.4	1.4	1.4	1.4	1.4	1.4	9.2
CEO	1.2	1.2	0.6	1.2	1.2	1.2	1.2	1.2	1.2	7.7
Total	7.2	6.8	3.3	6.6	6.6	6.6	6.6	7.5	6.6	44.1

We plan to recruit and train up to 100 apprentices during RP6

efficiency initiatives implemented during RP5. However costs in 2022/23 are forecast to increase for that year only, owing to the additional resource needed in our regulation and finance functions for the development of RP7.

HR and non-operational training

7.243 NIE Networks employees around 1,250 staff across multiple locations in Northern Ireland and employs a business-linked HR strategy.

7.244 The HR function is responsible for developing and implementing this strategy and ensures that objectives that are aligned to business needs and that NIE Networks maximises the potential of all employees.

7.245 The HR function is continually focused on ensuring that all employees' terms and conditions are benchmarked externally against market rates ensuring that working hours, shift patterns and flexible working are leading edge, maximising productivity and efficiency.

Wayleaves

7.246 A wayleave permits NIE Networks to install electricity lines and associated equipment on, over or under private land and to have access to that land. The landowner is then compensated in the form of wayleave payments.

7.247 We do not negotiate wayleave payments on a case by case basis with individual landowners, rather our rates are based on rates paid by Scottish Power which are in line with rates recommended by the Electricity Networks Association (ENA).

7.248 The ENA uses rates reviewed in accordance with detailed studied carried out by the Agricultural Development Advisory Service to calculate, revise and recommend wayleave payments. We update the farmers' unions annually with the recommended payment rates.

7.249 We do not believe it is in customers' interests to depart from this policy which mitigates against potentially lengthy and expensive negotiations each year. The current annual cost of distribution wayleaves is around £5.1m per annum. However, depending on what happens in the UK, there is a risk that this cost could change during RP6 for reasons outside our control. We propose therefore that the RP6 allowance for wayleaves should be reviewed if the cost increases or decreases by more than 10% compared to the current level.

Operational training

7.250 Operational training of direct staff will involve coordinating and leading training courses, and training centre costs for staff working on system assets.

7.251 We anticipate a continuing requirement to recruit and train 10-15 apprentices every year to facilitate succession planning.

Non operational premises

7.252 These costs are typically capital spend on minor building enhancements or refurbishment and are forecast to remain at RP5 levels.

Income

7.253 Income relates to rental income and fees for management of the bank of land NIE Networks manages and maintains for future generation purposes (the "land bank").

j. Non network IT

7.254 As a key objective during RP6, NIE Networks will focus on becoming an increasingly information-driven organisation. This will facilitate regulatory and statutory reporting requirements and enable the company to operate more efficiently and commercially, using data and information to drive decisions.

7.255 To support achievement of this objective, PA Consulting was engaged to assist in the development of an IT Strategy and implementation plan for the period. This strategy informs the NIE Networks' RP6 Non-Network IT capex investment plan.

7.256 The NIE Networks IT Strategy and associated investment plan describes in detail how the company's information assets will be developed during RP6 to improve business operations and customer service.

7.257 Our IT investment is considered under three areas:

- IT infrastructure: investment in computer hardware (including servers, desktop and mobile equipment) and associated operating systems which are used to deliver business functionality to end users.
- Telecommunications: investment in the infrastructure required to deliver business voice and data services to the desktop (including customer contact centre) and the field.
- Business IT applications: investment in the in-house and third party IT applications used by NIE Networks users to operate the business.

Infrastructure

7.258 An effective and reliable IT Infrastructure

is essential if we are to continue to meet our customer, regulatory and statutory obligations. IT infrastructure investment includes spend on hardware and associated software for servers, storage devices, desktops, printers and mobile devices used to support the business.

7.259 During RP5, we have continued to improve service levels through investment in modern technologies and ongoing refresh of hardware based on manufacturer's support life cycles and industry best practice. The company has continued the process of server rationalisation and the increasing use of central Enterprise architecture, with virtualised environments and SAN technology.

7.260 Two of the main enterprise architecture platforms will be refreshed during RP6, to maintain vendor support. An HP infrastructure hosts the majority of the distribution business applications and an IBM platform is used to host the distribution control centre Network Management System. Both are critical to the operation of our customer service activities and high levels of availability and performance must be maintained. Due to the manufacturer's support cycle and the longer RP6 period, the IBM platform will have to be replaced in year one of RP6 with a second refresh cycle beginning in 2023/24. This contributes to higher average spend during RP6 when compared to RP5.

7.261 The end user estate (PCs and laptops) will be refreshed during RP6, moving to thin client devices where possible to reduce investment costs. There was limited end user refresh undertaken during RP5 so the entire estate will need to be replaced during RP6. We have recently introduced a Mobile Device Management platform to provide business information to the field in a secure manner. Further investment is planned during RP6 to extend mobile facilities, enabling streamlined business processes and improved information for customers.

7.262 Cyber security threats continue to be an area of focus for all network operators and significant investment is planned for RP6 to ensure that we can effectively combat the increasing levels of risk.

Telecoms

7.263 An effective and reliable telecoms infrastructure is also essential if we are to continue to meet our business objectives. The business telecoms infrastructure includes hardware and associated software for routers, switches, voice gateways and the desktop phones used to provide voice and data services to end users and customers.

7.264 During RP4, we invested in a new corporate MPLS (Multi-Protocol Label Switching) network to address increasing data bandwidth and application performance demands.

7.265 To maintain current high levels of telecom performance and availability and avail of enhanced functionality, the business voice and data infrastructure assets will be refreshed during RP6 in line with manufacturer's support cycles. This investment is required to ensure that, for example, call centre services to customers will continue to be delivered in a reliable and cost effective way.

7.266 Communications links to office locations will be enhanced to support the exponential growth of data via the increasing use of video, social media and other digital facilities. Maintaining sufficient communication links is critical to operate successfully in the modern business environment.

Business applications

7.267 Our IT business applications consist of a number of systems covering the main business functions including work management, network planning, customer operations, asset management and finance. A number of these applications are used to support critical business and customer processes and the availability and performance of these applications must therefore be maintained. This creates a need for ongoing investment to maintain supportability and to deliver the enhanced functionality needed to meet evolving customer, business and regulatory requirements.

7.268 Our IT strategy has identified the need for an increased level of applications investment during RP6. The key driver for this increased spend relates to a move away from expenditure mainly focused on maintenance and obsolescence, as was the case in RP5. The majority of the increase is driven by transformation projects, designed to consolidate and maximise the enterprise IT assets within the company, primarily in order to deliver improvements across assets, data quality and customer service.

7.269 The planned investment in IT transformation projects will be central to delivering the forecast operating efficiencies in our RP6 business plan.

7.270 A key principle of the application strategy moving forward is application consolidation. The company will continue to seek to consolidate applications, maximising the use of enterprise solutions and minimising the reliance on bespoke solutions.

7.271 During RP6, significant changes will be made to our IT business applications used to support work and asset management (SAP and Maximo). Asset data, for example, will be consolidated into a single central work management system, with multiple separate systems merged into one instance. This investment will enable the company to more effectively manage work (including capital asset delivery), monitor costs and volumes of work undertaken, improve cost collection processes, improve data quality and transparency and improve process performance.

7.272 This investment will also enable NIE Networks to accurately and efficiently report on performance against allowances, by automating the regulatory data reporting process. Accuracy and efficiency will be improved primarily via a reduction in manual processing and interventions, alongside better visibility (including timeliness) of operational and unit costs. Automating the process will also enable us to adapt and incorporate any new, modified or expanded regulatory requirements in a timelier manner.

7.273 Major investment is also planned for the distribution Network Management System (NMS), including introduction of customer self service facilities and LV modelling of the network. This will enable improvements in fault and emergency processes.

7.274 A further area of focus for RP6 will be the applications used to support effective asset management processes. A condition based risk management system will be introduced to support effective asset investment decisions and a number of asset record systems will be enhanced. This will include the consolidation of separate geographic mapping systems into one instance, with all maps and asset data standardised in this single application. There will be a particular focus on improving the quality of records held.

7.275 Significant investment is planned to enhance and expand mobile working capability. Field work processes will be migrated to, and supported by, mobile work management devices using wireless data transfers. Wider use of mobile for the management of field work will result in improved customer service (via, for example, higher productivity per field worker reducing repair times), better data quality and real time data access across the business.

Planned investment

7.276 As in previous price control periods, we will focus on delivering a value for money IT programme during RP6. The IT Strategy and associated investment plan has been developed to ensure that all investment is closely aligned to business objectives and that projects are prioritised and scheduled in the most efficient manner.

7.277 A Project Management Office will oversee the programme, ensuring that projects are scoped, planned and delivered on time, to budget and that expected business benefits are realised. RP6 forecast expenditure has been developed based upon external best practice information acquired through the PA Consulting engagement, historical

information from previous projects and assumes that significant savings in third party costs will be achieved through robust tendering processes.

7.278 The forecast expenditure for distribution non-network IT in RP6 is shown in the table below. See Table 27.

7.279 Non-network IT investment costs have been apportioned between transmission and distribution based on RIGs apportionments. Details of the transmission spend are provided Chapter 9 where we set out expenditure on the transmission network.

k. Market operations

7.280 Our market operations activities relate to meter installation and certification services, meter reading and the provision of metering data and registration services to support operation of the retail and wholesale electricity markets. This includes operation and management of major IT systems that are central to the operation of these markets.

Operational effectiveness

7.281 We deliver our market operations activities to a consistently high standard in compliance with a range of service standards and market rules. Performance had been maintained at a time of major business transformation reflecting a significant increase during RP5 in the level of market operations activity primarily as a result of the introduction of the Enduring Solution market arrangements and also the commencement of a major meter replacement programme. For example, the Enduring Solution arrangements now requires us to obtain reads from our prepayment keypad meters which has increased by more than 50% the volume of meters needing read annually. In addition, annual metering work volumes have more than doubled as a result of the meter replacement programme. These outcomes have both been achieved while maintaining overall customer service standards.

7.282 We continue to focus on delivering our market operations activities effectively and efficiently. Our major contracts with services and material providers make up some 50% of our costs and are market-tested through application of rigorous procurement procedures. Our internal costs are mainly salary-based and are managed tightly taking account of relevant salary benchmarks and productivity targets. For example, we have significantly reduced the administrative cost of meeting our market services obligations through process simplification and up-skilling of staff. We also continue to focus on maximising the productivity of our field staff through optimising the scheduling of work and strong performance management to ensure the working week is fully maximised.

7.283 Looking forward to RP6, the challenge to maintain performance remains strong. Our customer base continues to grow incrementally, increasing

Table 27 – expenditure on distribution non-network IT, £m

	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Infrastructure	0.7	0.9	1.0	1.2	1.0	0.9	0.4	0.2	1.0	5.8
Telecoms	0.2	0.2	0.1	0.1	0.1	0.1	0.3	0.2	0.1	1.0
Applications	1.2	1.4	1.2	1.0	3.2	1.6	0.5	0.8	0.5	9.0
NMS	0.7	0.9	1.3	1.7	0.3	0.1	1.0	0.1	1.3	5.9
Total	2.7	3.3	3.7	4.1	4.6	2.8	2.3	1.4	2.9	21.7

the volumes of meters to be maintained and read. Similarly, the number of electricity suppliers operating in the Northern Ireland market continues to grow which is likely to increase the volume of our market operations activities as a function of an increasingly competitive and mature retail market.

7.284 Our forecast expenditure for Market Operations costs is shown in the table below. See Table 28.

Installs, recertification and non-network IT

Meter installs / changes

7.285 We provide a range of metering services including the installation, exchange and alteration of electricity meters at the request of electricity suppliers for example, to provide metering at newly connected properties or to facilitate change of tariffs for their retail customers. This includes metering in domestic, commercial and industrial properties including generators.

7.286 Metering services fall under the Guaranteed Customer Standards and we are obliged to fulfil appointments with our customers on a morning or afternoon basis. During RP5 we have delivered on average 62,000 metering visits per annum and our forecast of costs assumes that this volume of activity will fall to 58,000 visits per annum during RP6.

Meter recertification

7.287 Statutory obligations require that when a meter reaches the end of its prescribed certification life it must be replaced. During RP5 we expect to replace on average 36,000 meters per annum and on the basis of the age profile of our meter population, we plan to increase this to replace 39,000 meters per annum during RP6. The higher cost per annum forecast for RP6 also reflects changes in the mix of meter types being replaced; for example, the RP6 programme will focus on replacement of a greater number of commercial meters than is the case for RP5. These replacements have a higher unit cost compared with standard domestic meter replacements. We have also made provision for the continued replacement of meters in cases of suspected meter tampering by customers.

7.288 Meter recertification activities are largely delivered by third-party contractors and delivery costs have recently been market tested through competitive tendering.

Non-network IT (market systems)

7.289 In May 2012, we successfully implemented the Enduring Solution project at a cost of £40 million. This was a complex IT project to facilitate full competition within the electricity market. It has delivered unconstrained switching whereby 860,000 customers can freely move between electricity

Table 28 – summary of market operations expenditure, £m

	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Installs, recertification, non network IT										
Meter Installs/Changes	4.0	3.9	2.0	3.9	3.9	3.9	3.9	3.9	3.9	25.5
Meter Recertification	2.4	3.7	3.3	4.8	3.6	3.5	3.0	2.9	2.8	23.9
Non network IT	1.9	1.8	2.5	3.6	1.4	0.7	0.5	0.8	2.2	11.7
Subtotal	8.3	9.4	7.7	12.3	8.9	8.1	7.4	7.6	9.0	61.1
Meter Reading	3.6	3.8	1.8	3.7	3.8	3.8	3.8	3.8	3.9	24.6
Enduring Solution Opex	6.2	5.3	2.7	5.4	5.3	5.2	5.2	5.2	5.1	34.1
Other operating costs	3.6	3.6	1.7	3.5	3.6	3.6	3.6	3.8	3.6	23.4
Subtotal	13.4	12.6	6.3	12.6	12.6	12.6	12.6	12.8	12.6	82.2
Total	21.8	22.0	14.1	24.9	21.6	20.7	20.0	20.4	21.6	143.3

suppliers, introduced improved functionality for customers, ensured data integrity for the wholesale and retail markets and enabled harmonisation of processes between markets in Northern Ireland and the Republic of Ireland.

7.290 SAP-ISU is our central market IT system, and it has been developed to support 50,000 transactions per day including meter readings and other 'market messages' necessary to support operation of the electricity market. NIE Networks is also responsible for operation of the TIBCO market messaging application for the all-island electricity market which supports, on average, 110,000 messages daily across the Northern Ireland and Republic of Ireland markets.

7.291 The IT market systems underpinning these critical market processes require on-going investment to maintain supportability and mitigate the risk of service failure. This includes upgrades to SAP-ISU and TIBCO systems, as well as to our Routestar system which is used to manage our meter reading process.

7.292 Other investments are required to deliver developments to continue to meet the evolving requirements of the electricity market and our business processes.

Meter reading

7.293 We collect and process meter reading data for all 860,000 customer premises throughout Northern Ireland. While data can be obtained remotely via telecommunication links from meters at 10,000 commercial and industrial premises, the vast proportion of meters are read manually by our meter reading staff. Under our Overall Standards, we are required to obtain a meter reading from 99.5% of customers once per year. To achieve this, we aim to read each meter on a quarterly basis which involves over 3 million visits to customer premises per annum.

7.294 Rates of access to our meters are important as obtaining an actual reading improves the accuracy of customer bills issued by electricity suppliers, which would otherwise be based on estimates of electricity consumption.

7.295 The annual volume of scheduled meter readings increased significantly in 2012 as a result of a new regulatory requirement to read keypad meters brought about by the introduction of the Enduring Solution retail market arrangements.

7.296 No change in meter reading strategy is expected in RP6. Our customer base continues to grow incrementally, increasing the volume of meters to be read. Accordingly, expenditure in RP6 is forecast to increase incrementally by 0.8% per annum from the current RP5 run-rate.

Enduring Solution opex

7.297 Enduring Solution opex costs relate to IT support and market services.

7.298 As noted above, we operate major IT systems that are critical to the operation of the retail and wholesale electricity markets. These IT systems require on-going support which presents operating costs associated with the hosting of IT infrastructure (servers and other hardware), software licence and other third party costs as well as the provision under contract of technical managed services necessary for incident resolution and other technical support.

7.299 Market services costs include a range of administrative processes necessary to ensure that we comply fully with our obligations to provide registration and data services to the electricity market in accordance with agreed market rules.

- This includes the management of data exceptions and supporting retail market activities (for example, the process by which customers can change their supplier) ensuring that they are completed correctly.
- We also collate electricity consumption and generation data on a daily basis in order to submit settlement data to the wholesale market and ensure that appropriate market messages are transmitted to suppliers to facilitate their billing of retail customers.

We collect and process meter-reading data for all 860,000 customer premises throughout Northern Ireland

- We also have a governance role in respect of the Northern Ireland retail market procedures. We manage the Central Design Authority, a forum which enables electricity suppliers to raise current procedural issues and discuss possible changes; and we also ensure continual alignment between retail and wholesale market processes through active participation on the Trading and Settlement Code Modifications SEM Committee.

7.300 Costs have reduced significantly in the course of RP5 as the Enduring Solution IT systems and processes have become fully established allowing manpower resource to be reduced to the optimum long-run level. Current service requirements are not expected to change in RP6.

Market operations – other operating costs

7.301 Other operating costs incurred by Market Operations comprise the following:

- fault and emergency;
- IT, stores and safety;
- finance and HR costs; and
- other costs.

7.302 We are required to respond to reports of meter faults. In particular, our electricians are available 24/7 to respond to metering faults that have resulted in an interruption of supply, present safety risks or which are critical to operation of wholesale market settlement.

7.303 IT, stores and safety costs include:

- IT – including costs associated with the provision and support of computer and telecoms for our office-based staff and hand-held communication devices used by our field staff for work management and to capture meter readings.
- Stores – the costs of procuring, storing and issuing metering equipment.
- Safety – the costs of managing the health and safety of our metering electricians, meter readers and office-based staff. In particular, because of the inherent risks of working in close proximity to live electricity, our metering electricians are only permitted to work following rigorous training and regular assessment of their understanding of our safety rules and procedures.

7.304 Finance and HR costs include:

- Finance costs include the costs of financial reporting and analysis necessary for accounting reasons and to ensure the ready availability of performance information to manage operations efficiently and effectively.
- HR costs include the costs of managing payroll, recruitment and other staff support requirements.

7.305 Other operating costs relate to revenue protection activities to counter meter tampering, transactional services to suppliers, keypad meter operating costs and other business support costs.

7.306 Expenditure across these four categories is shown in the table below.

See Table 29.

Table 29 – expenditure on other market operations costs, £m

	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Fault & Emergency	0.8	0.9	0.4	0.9	0.9	0.9	0.9	0.9	0.9	5.7
IT, Stores & Safety	1.0	1.2	0.5	1.1	1.2	1.2	1.2	1.2	1.2	7.6
Finance & HR	0.8	0.8	0.4	0.8	0.8	0.8	0.8	0.8	0.8	5.4
Other	1.0	0.7	0.3	0.7	0.7	0.7	0.7	0.9	0.7	4.7
Total	3.6	3.6	1.7	3.5	3.6	3.6	3.6	3.8	3.6	23.4

I. Other expenditure within the price control funded through DUoS

Real price effects (RPEs)

7.307 NIE Networks' price control is set by the UR in constant prices (i.e. in "real terms") and then indexed to changes in the Retail Price Index (RPI) that occur over the period. In reality however the company will be subject to RPEs which is the standard regulatory term used to describe how a firm's costs will differ from RPI over a period.

We commissioned NERA Economic Consulting (NERA) to forecast RPEs for labour, materials, plant and equipment over the RP6 period.

Based on NERA's analysis, the forecast level of RPEs during RP6 is estimated to be £53.2m. NERA's approach draws on similar methods to those used by other regulators at previous reviews:

- NERA conducted research to identify published price and cost indices that track the prices of inputs required by NIE Networks;
- where possible, it used information from reputable third party agencies, most notably recent projections from the Office for Budget Responsibility, to forecast changes in these indices; and
- where reputable third party forecasts were not available, NERA used objective, statistically robust methods to forecast changes in inputs prices.

Business rates

7.308 Rates are a tax on the occupation of property. They are based on the rental value of the property set by Land and Property Services (LPS), a division within the Department of Finance and Personnel (DFP). Rates are calculated by rateable value multiplied by the non-domestic rate poundage which is made up of the regional rate and the district rate. The regional rate is set annually by the Northern Ireland Executive and is applied to each district council area in Northern Ireland. The district rate is set annually by each district council in Northern Ireland.

7.309 The most recent business rates revaluation to set rateable values in Northern Ireland took effect on 1 April 2015. We have assumed that rates charges will remain at the same level throughout RP6 as those incurred in 2015/16. The figures for rates post the 1 April 2015 valuation are allocated between the distribution and transmission businesses based on the size of their respective RABs. The rates figures for the first three years of RP5 are based on the rates formula which applied pre the 1 April 2015 revaluation.

Licence fees

7.310 The UR's licence fees are calculated for each year based on an estimate of UR's net costs. These are allocated across licence holders according to a methodology determined by the UR.

7.311 Fees are assumed to remain at the same level as those incurred in 2015/16. Licence fees have been allocated between distribution and transmission based on headcount. In 2015/16 distribution licence fees were £1.3m.

Pensions

7.312 There are two types of pension scheme:

- final salary schemes that provide a pension to employees based on their salary at the time they retire (or leave employment if that is earlier) and their years of service; and
- defined contribution schemes that provide a pension that depends on how much was paid into the scheme by the employee and employer.

7.313 A final salary scheme (also known as a "defined benefit" or "DB" scheme) is a source of significant risk for the sponsoring employer because the scheme's liabilities are unpredictable and vary with time due to factors beyond the employer's control. The deficit changes with movements in financial markets, the level of contributions, membership changes and other assumptions (e.g. future interest rates) made by the actuaries when they estimate future cost of paying the pensions. As a result, a deficit may arise in relation to a final salary scheme which the employer will be required to address via additional contributions. Conversely,

where the fund is in surplus, an employer may enjoy "contribution holidays". By contrast, in a defined contribution scheme (also known as a "DC" scheme), the employer's future contribution obligations are more predictable, since they are limited to the contributions specified in relevant employment contracts.

7.314 Pension matters are overseen by the Pensions Regulator who ensures that companies meet their obligations to the pensions schemes under both the pension scheme trust deeds and the Pensions Act.

NIE Pension Scheme

7.315 NIE Networks was privatised in 1993 and effectively inherited the sponsorship of the Northern Ireland Electricity Pension Scheme (NIEPS), a final salary pension scheme. A key feature of the scheme is that the existing and future benefits of pre-privatisation employees and former employees of NIE Networks are protected by statute. The benefits enjoyed by such employees, known as "protected persons", cannot be reduced without their consent, and this applies to both past and future service. 92% of the members of the final salary pension scheme are pensioners or deferred pensions.

7.316 In order to manage its pension costs more effectively, NIE Networks closed the final salary section of the NIEPS (known as the "Focus" section) to new entrants in March 1998. NIE Networks was one of the first privatised electricity companies in the UK to do this. New employees are instead offered membership to a defined contribution section of the NIEPS (known as the "Options" section). Currently, 800 of our employees are members of the Options section and 450 employees are members of the Focus section.

Deficit contributions

7.317 Since privatisation, the financial position of the Focus section of NIEPS has shifted from a surplus to a deficit position. The most recent actuarial valuation as at 31 March 2014 showed a deficit of £110.7m, corresponding to a funding ratio of 90% (assets to liabilities). A funding update from the Scheme Actuary estimated that the funding ratio of the Scheme updated to 31 March 2016 was approximately 82%.

7.318 The contributions which NIE Networks is obliged to make to the Scheme are set out in the Schedule of Contributions. The deficit repair contributions payable under the Schedule of Contributions were £16.5m for the year ended 31 March 2016 and are subject to review following the next actuarial valuation due no later than 31 March 2017.

7.319 As part of the RP5 price control determination it was decided that the Focus section historic deficit should be split into historic and incremental deficits using the Ofgem Pension RIGs methodology; the cut-off date for the historic deficit being 31 March 2012. The historic deficit is funded by customers with any incremental deficit being funded by NIE Networks.

7.320 NIE Networks has maintained this principle for the recovery of pension deficit costs in the business plan. We have also included a disallowance in respect of the RP5 determination that NIE Networks' shareholders should be responsible for funding 30% of the cost of granting enhanced early retirements in the late 1990s and early 2000s which were not funded by NIE Networks at the time. Since 2003 all costs associated with enhanced benefits on early retirement have been met by the company immediately at the time of retirement.

DISTRIBUTION EXPENDITURE - POTENTIAL ADDITIONAL INVESTMENT

a. Introduction

8.1 This chapter sets out a number of investment options which would enhance the resilience of the network to severe weather and improve the quality of service for worst served customers. The options include:

- investment to strengthen the 11kV overhead line network, costing £25.6m;
- investment to increase flood defences, costing £2.6m;
- accelerated tree cutting, costing £0.7m; and
- investment to reduce the number of unplanned power cuts, costing £16.5m.

8.2 We have presented these programmes as optional because the investments received mixed levels of support during our customer and stakeholder engagement process. Domestic customers surveyed were generally supportive of the programmes and willing to pay for improvements, whilst business customers supported improvements in principle but the majority were not willing to pay for these improvements.

8.3 Given other competing priorities in our core plan, we have decided to include these projects as optional.

b. Strengthening the 11kV overhead line network

8.4 A large amount of 11kV network was constructed during the 1950s, '60s and '70s when electrification schemes were being developed across the province. The lines were largely constructed using three sizes of Steel-Cored Aluminium conductor (SCA), 25mm^2, 50mm^2 and 75mm^2 although a small amount of Hard Drawn Copper conductor (HDC) was used initially. Many of these schemes were partly financed by customers.

8.5 Some 75% of the network was constructed with the smallest size conductors, which was ample to supply the small rural loads. There were compelling economic arguments at that time in favour of reducing design standards, in order to make progress on the huge programme of rural electrification started in the 1950s and design standards were relaxed across the UK and elsewhere.

8.6 The majority of lines have given good service over the last 30 years but with the hindsight obtained through the experience of several ice accretion storms, it is clear that the relaxation of standards during the electrification period has led to resilience problems on the network.

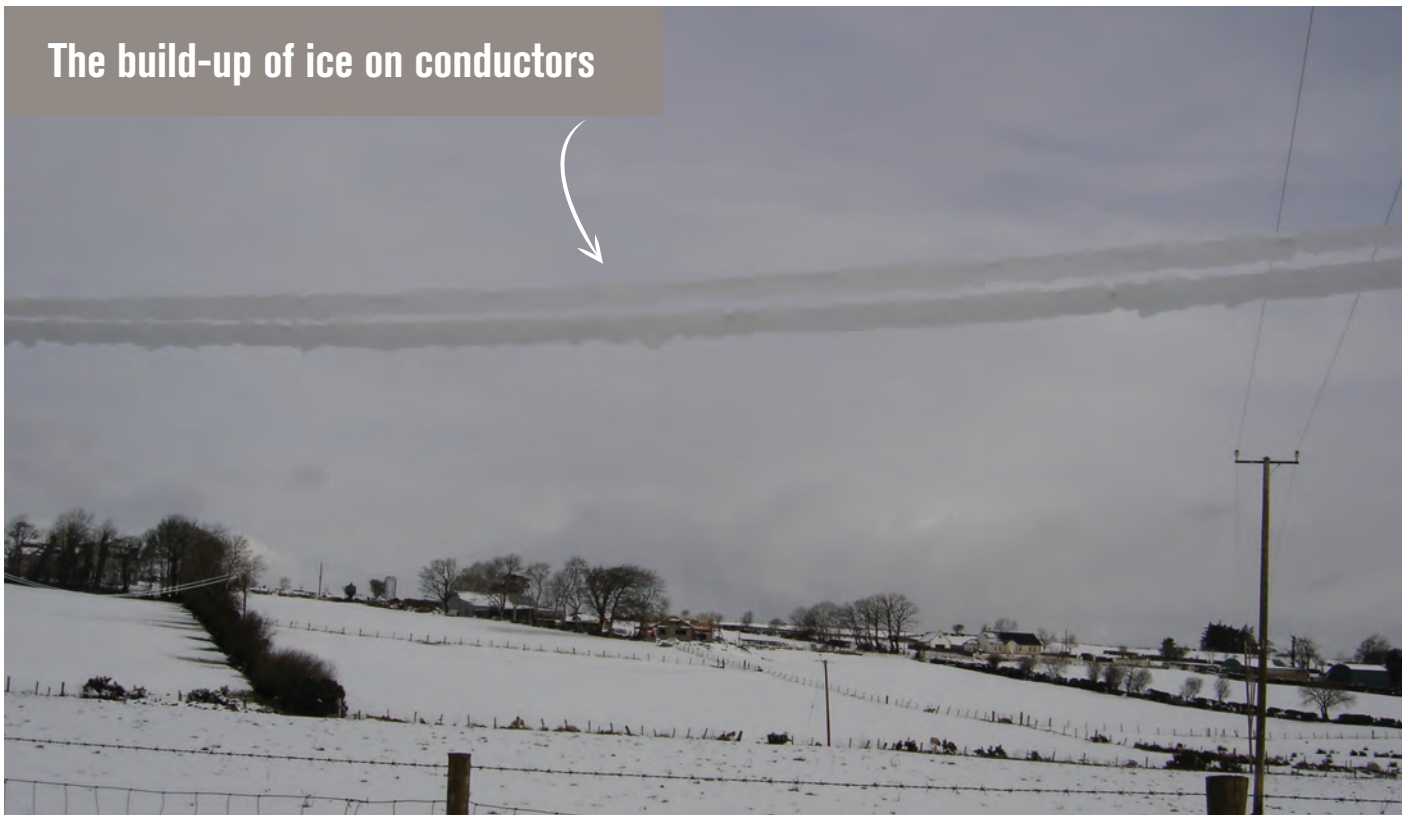
8.7 Current design standards mandate a minimum conductor size of 50mm^2.

8.8 Overhead lines constructed with 25mm^2 conductors are particularly vulnerable to ice accretion when weather conditions are extreme. Such extreme weather events are now occurring more frequently. Ice can form on conductors increasing the weight and stretching the conductor until it either touches the ground or breaks. Conductors with a smaller cross-sectional area (e.g. 25mm^2), are much more prone to this kind of weather damage. Ice accretion can lead to broken poles as well. By contrast, circuits that are built from stronger poles and conductors with a larger cross-sectional area are less likely to be damaged by ice accretion.

8.9 The photograph on page 112 shows the build-up of ice on conductors that lie orthogonally to wind direction (left to right across the photograph) but those that lie in the same direction as the wind are unaffected.

See photograph on page 112.

8.10 Although ice accretion events are relatively rare, the impact on homes and businesses can be significant. For example, the time required to restore supplies to all affected customers after such an event may be of the order of one week or longer depending on the area affected. The impact of widespread power cuts like these is often felt not



just by domestic customers but also by businesses in the worst affected areas. This can have a knock-on effect on the local economy.

8.11 The most vulnerable parts of the network are the high-ground areas in South Down, on the Antrim Plateau and in the Sperrin Mountains. Recent ice accretion events have been in these areas, the most recent being in the Cloghmills area. There are approximately 3,600km of 11kV overhead line, one sixth of the total length, in these vulnerable areas and the majority of the lines were constructed with small cross section (25mm^2) conductor. Therefore should this option proceed to strengthen the network in these upland rural areas by increasing the conductor size on the circuits and by putting in stronger poles, we believe we can reduce the network's susceptibility to damage from ice or snow.

8.12 The project would involve strengthening the network in these vulnerable areas over a 15-year period. Experience shows that 50mm^2 conductor has approximately one third of the number of faults during ice accretion events and that each fault location has significantly less damage. The net additional expenditure incurred during RP6, over and above the core refurbishment and re-engineering work programmes, would be £25.6m.

8.13 An economic appraisal may conclude that this investment is not justified at present however the network will need investment in subsequent price control periods.

8.14 There are also other factors which could be taken into account when considering whether to proceed with this project in RP6. The risk for the rural communities involved is that during severe weather events they could suffer prolonged power outages at a time that they need the electricity network most. This would affect both homes and businesses. The benefit of reducing this risk is difficult to quantify in a standard cost-benefit analysis. The investment would also improve network safety and improve the network for future embedded generation.

c. Increased flood defences

8.15 Recent work with the Northern Ireland Rivers Agency (NIRA) has highlighted around 600 secondary sites as being at risk of flooding.

8.16 Our core investment plan includes protection against flooding events at nine primary 33/11kV substations and 200 secondary ground mounted 11/0.4kV distribution substations. These are sites covering:

- sites of critical importance e.g. pumping stations;
- all new sites; and
- those being replaced under the investment asset replacement programme.

8.17 Our customer and stakeholder engagement exercise identified that, there was significant customer support to provide enhanced flood protection at an additional 200 locations at a cost of £2.6m.

8.18 Should this work not proceed, then these 200 locations with approximately 4,000 connected customers would remain at risk from pluvial, fluvial or coastal flooding events.

d. Accelerated tree cutting

8.19 The Electricity Safety, Quality and Continuity Regulations (ESQCR) require tree cutting to increase the clearance distance for resilience purposes. In addition to safety clearance requirements, Regulation 21 of ESQCR outlines the need to ensure that trees or other vegetation do not interfere with or cause interruption of an electricity supply.

8.20 This requirement is more stringent than our standard 'safety' tree cutting policy and is referred to as 'resilience' tree cutting. For example, at 33kV a 'safety' cut will address all trees within 3m of the conductors. However, when applying a 'resilience' cut, a tree which is outside the 3m distance may need to be topped to ensure that during severe weather, it could not affect the overhead line network.

See Figure 15.

8.21 Our core investment plan includes tree-cutting on a 25-year cycle. If this was shortened to a 20 year cycle, this would reduce the likelihood of trees damaging the network and thus increase the resilience of the network. The additional cost of this accelerated programme in RP6 would be £0.7m.

e. Worst-served customers

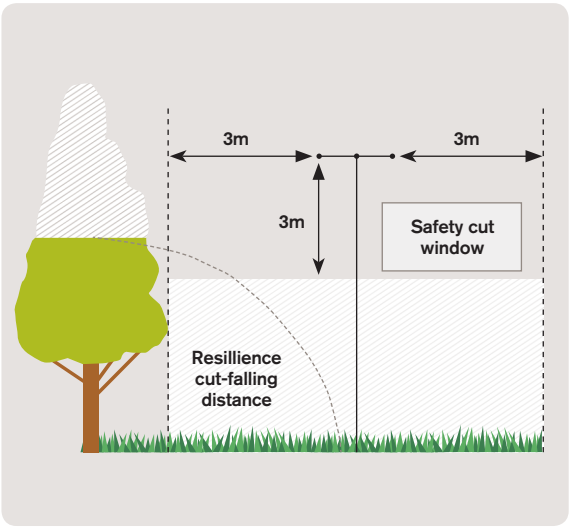
8.22 To deliver an improvement in performance for worst-served customers we have focused on two areas:

- long duration power cuts – reducing the number of customers per year who are experiencing power cuts lasting over ten hours in duration by 25%; and
- frequent power cuts – reducing the number of customers per year who experience six or more power cuts in an 18 month period by 20%.

Long duration power cuts

8.23 In nine out of ten cases, NIE Networks restores power within three hours. However around 5,000 homes and businesses every year experience unplanned power cuts which last over ten hours. If there are major storms or extreme weather events this number may rise significantly.

Figure 15 – safety and resilience tree cutting



8.24 Customer feedback suggests that more than half of domestic customers would give their full support to limiting the number of households who are affected by power cuts over 10 hours in duration (54%). Likewise, almost half of non-domestic customers would give their full support to limiting the number of households who are affected by power cuts over 10 hours in duration (48%).

8.25 The costs associated with reducing the number of customers per year who are experiencing power cuts lasting over 10 hours in duration by 25% are set out below.

Table 30 – proposed expenditure to improve long duration power cuts, £m

Item	£m
Investment in LV generation and associated technology to re-supply customers whilst the fault is located.	1.0
Increasing the number of dedicated resources available for fault and emergency response.	10.5
Total	11.5

Frequent power cuts

8.26 Some customers who live in rural areas are supplied by long and poorer-performing overhead lines, some of which do not have re-supply connections available when a fault occurs. These customers experience considerably more faults per-annum than the average customer.

8.27 Customer feedback suggests that more than half of domestic customers would give their full support to limiting the number of households who are repeatedly affected by power cuts (55%). Likewise more than half of non-domestic customers would give their full support to limiting the number of households who are repeatedly affected by power cuts (55%).

8.28 Against other improvements considered, both domestic and non-domestic customers ranked this area as their second-highest priority.

8.29 Should this optional investment go ahead during RP6, we would reduce the number of customers who experience six or more power cuts in an 18-month period by 20% by investing in the 25 worst-performing rural circuits through a mix of:

- circuit reconfiguration;
- targeted network reinforcement; and
- application of distributed automation to automatically locate and isolate faulty sections of the network (self-healing network).

8.30 The costs associated with this programme are set out below:

Table 31 – proposed expenditure to improve worst performing circuits, £m

Worst performing circuits to target	Cost per circuit, £m	Total scheme cost, £m
25	0.2	5.0

8.31 The downside of not proceeding with this investment is that the worst-served customers will continue to receive a level of service which is considerably poorer than that enjoyed by the majority of customers.

55% of customers would give their full support to limiting the number of households that are repeatedly affected by power cuts

TRANSMISSION EXPENDITURE

a. Background

9.1 This section describes the forecast expenditure that is funded through our transmission service charges (TSCs). It includes:

- the cost of maintaining and replacing transmission assets;
- project costs associated with the reinforcement of the transmission network; and
- other business costs such as business rates and licence fees.

9.2 The forecast excludes costs associated with potential load-related projects which are uncertain and have not yet been approved by the Utility Regulator (UR). SONI is responsible for the planning and design of these projects which can take many years to proceed through a number of key stages, including an initial identification of the need; a detailed process of evaluating technical design options; extensive consultation with stakeholders and the public; and a rigorous assessment of environmental impacts. Potential projects which may commence during RP6 are summarised in Chapter 10. The UR will assess the relative merits of these projects on a case-by-case basis having regard to the project costs and benefits. No expenditure will be incurred without the UR's approval.

9.3 Planning and developing the electricity transmission network is needed for the bulk transfer of electricity and for creating high-capacity connections between the sources of power generation and major locations of electricity demand.

9.4 This involves developing large transmission projects, such as the building of new high-voltage circuits or grid substations that form part of Northern Ireland's long-term strategic assets.

9.5 Government targets for more of our energy to come from renewable sources, such as wind or wave, have significant implications for the future shape of our electricity network, because the power has to be transported safely and efficiently from where it is produced to where it is used in homes and businesses. This means that the transmission network needs to be further developed in areas where wind farms or other energy generators are being built.

9.6 The allocation of responsibilities between NIE Networks and SONI in respect of the transmission network is defined in the respective licences. In summary:

- SONI's transmission licences authorise SONI to plan the transmission network and projects that increase capacity on the transmission network up to the point where all statutory consents have been maintained.
- NIE Networks retains ownership of the transmission network, and is responsible for transmission construction and maintenance.
- SONI has the right to request amendments to NIE Networks' plan in respect of the replacement of transmission assets; including the option of referring a dispute to the UR for determination if NIE Networks does not agree to any request.
- SONI is required to have Transmission System Security and Planning Standards in place. These underpin the case of need for investment in the transmission network.
- SONI and NIE Networks are required to comply with the Transmission Interface Arrangements (TIA), whereby the transmission system is to be developed and maintained by NIE Networks and planned and operated by SONI.

b. Expenditure summary

9.7 NIE Networks derives its revenues in respect of the transmission network through charges levied on SONI (the TSCs). In total £207m will be required. 1m will be required to be funded through the TSCs in RP6: £154.6m for core expenditure and £52.3m on other costs. These forecasts exclude the cost of potential additional load-related projects, the timing and cost of which are uncertain (see Chapter 10).

9.8 Core investment costs are shown excluding real-price effects (RPEs). The elements of the core expenditure are shown in the table below:

Table 32 – summary of core transmission expenditure, £m

	RP5	RP6	RP6							Total
	average per year	average per year	6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Transmission capex	23.2	16.1	10.2	17.5	17.2	19.2	16.0	16.0	8.5	104.4
Inspections, Maintenance, Faults & Tree cutting (IMF&T)	1.3	1.6	0.8	1.6	1.6	1.6	1.6	1.6	1.6	10.2
Indirects	6.9	6.3	3.1	6.3	6.3	6.3	6.3	6.5	6.3	41.3
Non Network IT	0.2	0.4	0.4	0.4	0.7	0.5	0.2	0.2	0.3	2.7
RP6 Productivity savings*	-	-0.6	-0.1	-0.3	-0.5	-0.6	-0.7	-0.8	-0.9	-3.9
Total	31.6	23.8	14.4	25.3	25.3	26.9	23.4	23.5	15.7	154.6

*As noted in Chapter 5 our business plan assumes we will achieve annual efficiency savings of 0.7% per annum during RP6. Efficiency savings achieved during RP5 are reflected within the RP5 actual costs.

9.9 Other expenditures, including the cost of pensions and RPEs, is shown in the following table:

Table 33 – summary of other transmission expenditure, £m

	RP5	RP6	RP6							Total
	average per year	average per year	6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
RP6 Real price effects*	-	0.6	0.1	0.3	0.4	0.5	0.7	1.0	1.2	4.1
Rates	3.6	4.2	2.1	4.2	4.2	4.2	4.3	4.2	4.2	27.5
Licence fees	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	1.2
Pension deficit contributions	3.6	4.1	2.1	4.1	4.1	4.1	4.1	4.1	4.0	26.6
Pension ERDC disallowance	-1.0	-1.1	-0.5	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-7.1
Other	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	6.5	8.0	3.8	7.7	7.8	7.9	8.2	8.4	8.5	52.3

** NIE Networks' price control is set by the UR in constant prices (i.e. in "real terms") and then indexed to changes in the Retail Price Index (RPI) that occur over the period. In reality however, the company will be subject to RPEs which is the standard regulatory term used to describe how a firm's costs will differ from RPI over a period. The RPEs for RP5 are reflected within the RP5 actual costs.*

9.10 The following pages provide a more detailed breakdown of the core transmission expenditure for NIE Networks.

Table 34 – transmission core expenditure, £m

Costs excluding RPEs (£m at 2015/16 prices)	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Transmission Reinforcement	9.2	0.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Transmission Asset Replacement	13.7	15.7	9.1	17.3	17.0	19.0	15.8	15.8	8.3	102.1
Network Access & Commissioning	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	1.3
Total transmission capex	23.2	16.1	10.2	17.5	17.2	19.2	16.0	16.0	8.5	104.4
Inspections	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.6
Maintenance	0.9	0.8	0.4	0.8	0.8	0.8	0.8	0.8	0.8	5.5
Fault and Emergency	0.5	0.5	0.3	0.5	0.5	0.5	0.5	0.5	0.5	3.5
Tree Cutting	0.0	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	2.2
Network Access & Commissioning	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Income	-0.2	-0.3	-0.1	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-1.9
IMF&T	1.3	1.6	0.8	1.6	1.6	1.6	1.6	1.6	1.6	10.2
Engineering management	3.7	3.1	1.6	3.1	3.1	3.1	3.1	3.1	3.1	20.3
Vehicles, IT, property & engineering equipment	1.4	1.4	0.7	1.3	1.4	1.4	1.4	1.4	1.4	9.0
Corporate and business support	1.2	1.2	0.6	1.1	1.1	1.1	1.1	1.3	1.1	7.6
Wayleaves	0.4	0.4	0.2	0.4	0.4	0.4	0.4	0.4	0.4	2.8
Operational training	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	1.3
Non Operational Premises	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Indirects	6.9	6.3	3.1	6.3	6.3	6.3	6.3	6.5	6.3	41.3
Non Network IT	0.2	0.4	0.4	0.4	0.7	0.5	0.2	0.2	0.3	2.7
RP6 Productivity savings	-	-0.6	-0.1	-0.3	-0.5	-0.6	-0.7	-0.8	-0.9	-3.9
Total core costs	31.6	23.8	14.4	25.3	25.3	26.9	23.4	23.5	15.7	154.6

c. Transmission reinforcement

9.11 The RP6 expenditure forecasts exclude costs associated with potential transmission reinforcement projects which are uncertain and have not yet been approved by the UR. Potential projects which may commence during RP6 are summarised in Chapter 10.

9.12 During RP5 transmission reinforcement expenditure was incurred in relation to reinforcement for Renewables, Omagh to Tamnamore third circuit, and Belfast North Main substation.

9.13 Reinforcement for renewables expenditure focused on the strengthening of the transmission network which involved the completion of six individual projects located in the north and west of the province. This investment has allowed in excess of 800MW of renewable generation to connect to the grid. The combined value of this investment was approximately £30m in RP5.

9.14 The Omagh to Tamnamore overhead line project, which is currently underway in RP5, involves the construction of 50km of 110kV overhead line between Tamnamore and Omagh substations and will include the connection of the new Gort Cluster

substation located near the town of Ballygawley. The project is required to create additional capacity in the network to permit the connection of larger scale renewable generation in this area. The value of this investment is £21m with £1m anticipated expenditure falling into RP6.

9.15 Due to general load growth in the greater Belfast area, Belfast North Main substation has been developed into a 110/33kV supply point. The project commenced in RP4 and will be completed in RP5. Expenditure on this project in RP5 is £1.6m.

d. Transmission asset replacement

9.16 Figure 16 below shows the age profile of the current transmission assets, plant, cables and overhead lines, on the network expressed as a percentage of Modern Equivalent Asset Valuation (MEAV), averaged over a five year period.

9.17 The development of the 275kV network in the 1960s explains the very high expenditure at that time. The most significant expenditure is in the transmission overhead circuits which comprise both 110kV wood pole lines and 110kV and 275kV tower lines.

9.18 Expenditure from 1990 relates to both network development and plant replacement.

9.19 The drivers for transmission asset replacement expenditure of network safety and reliability are the same as for the distribution assets, however the consequences of failure can be very high.

9.20 The specific requirements in each asset category are assessed for condition, obsolescence, fault history and network risk; the projected expenditure is shown in Table 35. A number of major projects have been identified separately as they can span a number of periods and have specific deliverables. General asset replacement is identified separately for a more appropriate comparison between RP5 and RP6 expenditure levels. RP6 expenditure on general asset replacement is 43% lower than in RP5.

See Table 35

Figure 16 – age profile of transmission assets

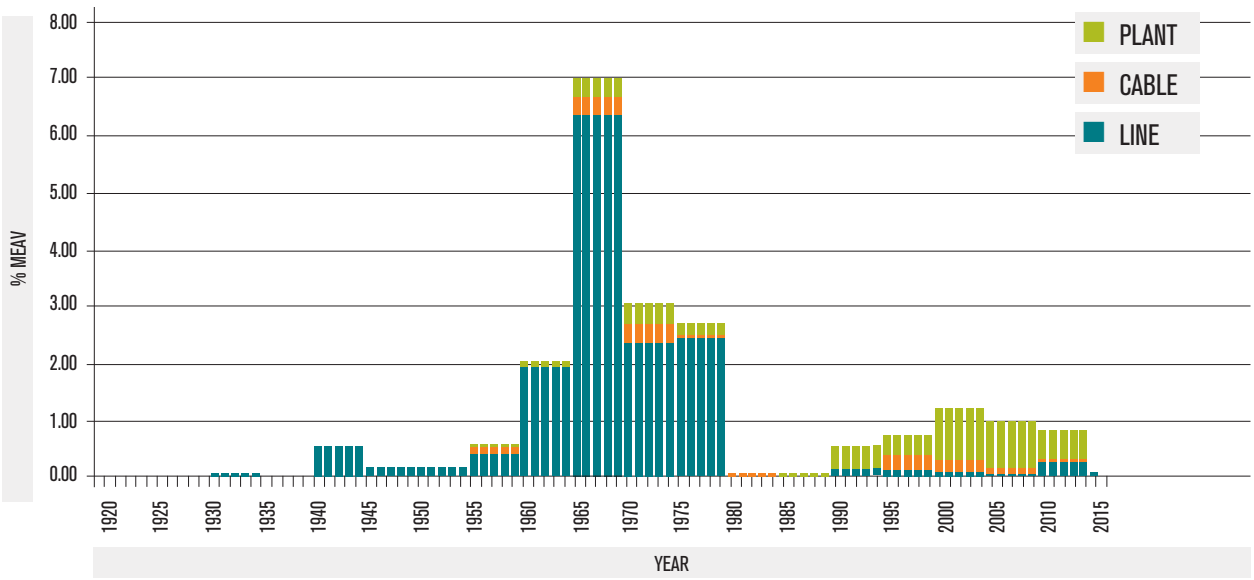


Table 35 – expenditure on transmission asset replacement, £m

	RP5 Average per Year	RP6 Average per Year	RP6							Total
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Major Projects:										
Ballylumford switchboard	0.4	2.5	4.5	7.5	4.0	0.0	0.0	0.0	0.0	16.0
Coolkeeragh - Magaherafelt OHL	0.2	4.0	0.3	1.0	2.0	7.5	7.5	7.5	0.0	25.8
Ballylumford - Eden - Carnmoney - Castlereagh OHL	0.1	1.0	0.3	0.5	2.8	3.2	0.0	0.0	0.0	6.7
General Transmission Asset Replacement										
Plant	8.6	4.4	2.2	4.4	4.4	4.4	4.4	4.4	4.4	28.5
Lines	2.7	3.0	1.5	3.0	3.0	3.0	3.0	3.0	3.0	19.2
Cables	0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.9
Protection and monitoring	0.7	0.8	0.4	0.8	0.8	0.8	0.8	0.8	0.8	4.9
ESQCR	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Total	13.7	15.7	9.1	17.3	17.0	19.0	15.8	15.8	8.3	102.1

Major projects

9.21 There are three major asset replacement projects planned during RP6:

- Ballylumford switchboard;
- Coolkeeragh – Magherafelt overhead line re-conductoring; and
- Ballylumford – Eden – Carnmoney – Castlereagh overhead line re-conductoring.

9.22 These projects are described further below.

Ballylumford switchboard

9.23 The 110kV substation at Ballylumford was installed in 1966 and is an important node on the network, providing a connection from the 275kV busbar and the large combined cycle gas turbine generators to the four outgoing 110kV circuits that are important to the export capacity and supply to Eden and Carnmoney 110/33kV bulk supply points.

9.24 The switchgear is now obsolete with limited spares availability and there have been reliability issues. The building is also in poor condition and contains asbestos. During high levels of generation, the fault rating of the 110kV double busbar arrangement at Ballylumford can be exceeded. The system is operated with an abnormal configuration, usually with a 275/110kV interbus transformer out of service, to manage the fault level to a safe level.

9.25 The drivers for this work are poor condition, lack of spares and technical support and inadequate fault level rating.

9.26 It has been recommended that due to health and safety concerns associated with in situ replacement, a new off-site switchboard and house is the only feasible option.

9.27 The project will establish a new switch house with gas insulated switchgear of a suitable rating and the existing switchgear will be decommissioned and removed together with the existing switch house.

Coolkeeragh – Magherafelt overhead line re-conductoring

9.28 The 275kV double circuit tower line between Coolkeeragh and Magherafelt exports power from Coolkeeragh power station into the grid substation at Magherafelt from where circuits feed onwards towards Belfast and the south of the province. The circuits also carry power to the north west of the province when there is insufficient generation at Coolkeeragh.

9.29 The line was constructed in 1963 and is the oldest 275kV line on the network. It has the

Sagging lines due to ice accretion on the Coolkeeragh to Magherafelt 275kV line in 2011.

smallest size conductor of all 275kV overhead lines on the network. The line is subjected to very strong winds as it crosses the Sperrin Mountains which cause wear on the insulator strings and other conductor suspension components. Failures have highlighted the onset of age-related wear in some critical components on the line. The most recent failure resulted in the loss of supply to more than 44,000 customers in the North-West area for a period in excess of two hours. An investigation into this failure concluded that the overall remaining life expectancy of the conductor on this line is less than five years.

9.30 Based on the recent failures on the Coolkeeragh–Magherafelt 275kV line, the strategic importance of this line and the conclusive results drawn from the expert opinion sought at the time of the failures, the pre-construction phase of the project for conductor replacement has commenced during RP5 and will continue during RP6.

9.31 Due to the terrain of this circuit route over the Sperrins, exposure to winds, the increased susceptibility to snow and the small conductor size, the impacts can be severe. As a result of the major snow storm in December 2011, there was critical sagging of the conductors which nearly touched the ground.

9.32 The case for conductor replacement was fully justified in the RP5 regulatory submission and it was agreed by the CMA that the project should proceed.

Ballylumford – Eden – Carnmoney – Castlereagh overhead line re-conductoring

9.33 The 110kV double-circuit tower line between Ballylumford and Castlereagh was constructed in 1943 and is one of the oldest 110kV lines on the network. This overhead line is a strategically important corridor of NIE Networks' 110kV transmission network connecting generation at Ballylumford with a load centre on the outskirts of Belfast. During the major snow storm in March 2013 when a significant number of 275kV circuits were out of service, this line was critical to maintaining supplies to the greater Belfast area until the 275kV circuits were returned to service.

9.34 On 26 September 2015, a fault occurred on an insulator string resulting in a conductor falling to a level below statutory clearance. The cause of this failure was significant corrosion of the shank of the insulator leading to a catastrophic failure. Replacement of those insulator strings exhibiting significant corrosion was completed during November 2015. Further condition assessments and selected replacement will be deployed to mitigate the risk of another failure pending a complete refurbishment in RP6.

9.35 A report commissioned to assess the condition of the steel-cored copper conductor concluded that, *"The conductor was found to be at end of life. This was due to the substantial degradation of steel core strands and, as a result, the breaking load of the conductor being significantly below specified nominal breaking load."* The degradation of the steel can be seen in the photograph above.

Corrosion of 110kV line between Ballylumford and Castlereagh.

9.36 Given the recent failure and the conclusion of the conductor report, commencement of the conductor replacement on this line is considered to be urgent.

General asset replacement expenditure

Plant

9.37 Transmission substations contain switchgear that connects and disconnects overhead line and underground cable circuits as required. They may also contain transformers to step the voltage down from 275kV to 110kV or from 110kV to 33kV to supply distribution substations. Ancillary plant associated with switchgear and transformers will include batteries and chargers, telecommunications equipment and electrical protection equipment.

9.38 The majority of the plant replacement programmes on the transmission network in RP6 are the continuation and completion of programmes commenced during RP5 or sooner.

9.39 At 110kV, substation mesh structures and some circuit breakers will be replaced and, following the completion of the three large 110kV switchgear projects in RP5, there will be a reduction from 16 to 11 circuit breaker bay replacements in RP6. The substation works to effect these changes are complex, requiring equipment and support change-outs in a live substation environment and thus can be outage-intensive. At 275kV, protection and instrument transformers require replacement.

9.40 There are seven 22kV reactors located in 275/110kV substations. They are associated with the 275/110kV interbus transformers and are connected at times of light load to effect voltage control on the 275kV network. They are switched into service on a regular basis by SONI from the Grid Control Centre. They are all overdue replacement due to their assessed condition and as the result of mechanical stresses caused by close-up faults. No less than three close-up failures occurred during RP5, adding to the already poor condition of some units. It was assessed that four reactors required replacement in RP5 but finance was provided for a single replacement only. Three reactors now require replacement in RP6.

9.41 A number of 275kV and 110kV transformers are now due replacement and again this is as a result of phasing replacements over RP5 and RP6. A higher number of 110/33kV transformers are to be replaced in RP6 due to the deferment of some replacements from RP5 with risks being managed by higher levels of condition monitoring. Our RP5 submission explained how the deferment of transformer replacement would be managed. Real-time condition monitoring will continue during RP6 and data acquired may allow some transformer replacements to be postponed from RP7 to RP8.

9.42 Forecast expenditure for RP6 is lower than in RP5 mainly due to the completion of major work on switchgear replacement during RP5. This included work at the 275/110kV substations at Tandragee, Kells and Castlereagh.

Lines

9.43 The NIE Networks transmission overhead line network operates at 275kV and 110kV. The 275kV overhead line network is constructed entirely using lattice structure steel towers whereas the 110kV network has some steel tower circuits, but mainly portal wood pole circuits.

9.44 Tower steelwork, insulators and fittings are prone to atmospheric corrosion, particularly in coastal regions and on high ground. Fittings

can be aged by the movement of the conductors in high winds which causes components to rub together and wear. Wood poles also deteriorate with age depending on the environment. Conductors will corrode over time with an increasing risk of conductor failure.

9.45 Overhead lines can be considered to be a perpetual asset and are not subjected to a wholesale like-for-like circuit replacement across the network. Rather, refurbishment takes place as required and can include replacement of individual steel members of the towers, insulation and fittings and repairs to foundations as required. In some instances, conductor replacement will be required. Each circuit will have a bespoke refurbishment plan put in place following a detailed condition survey.

9.46 The following points are noted in relation to the RP6 plan, which is of comparable level to that in RP5:

- Although there is a reduction in the volume of 110kV insulator replacement in RP6, there are corresponding increases in volumes of decayed pole replacement and in steel tower corrosion protection;
- The 110kV insulator replacement programme in RP6 is limited to the completion of an insulator replacement programme that was ongoing during RP5;
- The number of 110kV pole replacements must be increased by approximately 35% in RP6 due to the increasing numbers of decayed poles being identified through condition surveys. To a degree this is reflective of the increasing age profile of the asset base;
- The cost of corrosion protection coatings at both 275kV and 110kV has increased from RP5. Such coatings are essential to prevent corrosion of the steel tower structures. The coating provides life extension while it remains intact but unprotected steel would corrode rapidly. Based on condition assessments, NIE Networks proposes to adopt GB general practice and move from a 20 year cycle to a 15 year cycle, thereby increasing the annual units. While manufacturers of corrosion protection coatings quote a life of 15 to 20 years, they consider the shorter end of the range is more appropriate where equipment is located near the coast or on high ground.

Cables

9.47 While the majority of the transmission network is carried on overhead lines, it is impractical to route such lines through city centres or other congested areas. In such cases, underground cables are used. However, the cost of cables can be up to 10 times the cost of overhead line circuits.

9.48 The majority of transmission cables operate at 110kV and several important circuits run from the suburbs of Belfast towards the city centre.

9.49 Transmission cables include modern cross-linked polyethylene (XLPE) and traditional fluid-filled cables (FFCs) at 275kV and 110kV. The majority of the transmission cables on the network are in the region of 35 to 60 years old.

9.50 A number of fluid-filled cable sealing ends are in poor condition and it is essential that they are refurbished during RP6. Due to the limited availability of spares, some sealing ends will be replaced with a modern equivalent.

9.51 There is also a requirement to refurbish the hydraulic oil systems associated with the cable insulation and replace obsolete cable-protection accessories.

9.52 Annual expenditure has decreased in RP6 from RP5 as requirements have changed, from complete circuit replacement during RP5 to ancillary equipment refurbishment during RP6. RP5 expenditure included the replacement of 110kV cables between Castlereagh and Rosebank and a 275kV cable at Ballylumford power station.

Protection and monitoring

9.53 At transmission level, the protection

275kV cable at Ballylumford power station.

performance is designed to operate faster due to the higher voltages and currents involved and due to the critical importance and integrity of the transmission network.

9.54 The electrical protection equipment located in substations detects faults on the network and operates circuit breakers to isolate the fault and leave healthy sections of the network in service. Such equipment may not be required to operate for many years but when a fault occurs, it is essential the equipment operates correctly to minimise damage to the network and to keep healthy parts of the network in service.

9.55 There are a number of protection systems on the network that have condition-related problems and are now end-of-life.

9.56 Replacement of these systems with modern equivalent systems will ensure that the networks remain stable under fault conditions and that there will be a reduced risk of damage to network plant and circuits.

9.57 Annual expenditure in RP6 is similar in level to RP5. There is a reduction in protection replacement due to less equipment reaching end of life in RP6. However, there is a substantial quantity of end-of-life substation monitor replacements.

ESQCR

9.58 The requirements for ESQCR compliance are detailed in Chapter 7. There is a lesser requirement at transmission voltages; however £0.2m is required during RP6 to address anti-climbing guards and signage on some transmission towers and wood poles.

e. Network access and commissioning

9.59 This expenditure relates to two direct transmission network activities which are not incorporated into specific projects or projects

outlined in previous sections: (1) commissioning, testing and fault location; and (2) network access.

9.60 Commissioning activities are required each time a new network asset is connected to the network to ensure safe and proper operation. Testing activities are carried out on a routine basis on equipment and protective devices. Fault location is a reactive activity post-failure of a network asset or on operation of a protective device.

9.61 Network access activities relate to switching and commissioning duties on the transmission network. These are necessary to isolate network assets to enable work on the assets, testing of assets, fault finding and the commissioning of new equipment.

9.62 Expenditure during RP6 required to support the network investment plan is £1.3m.

f. Inspection, maintenance, fault and tree cutting

9.63 Operating expenditure incurred in the normal day to day operation of the network, is classified under Inspection, Maintenance, Fault & Trees (IMF&T) expenditure.

9.64 Some of this work, such as rectification of faults and restoration of plant and circuits to service, is naturally unplanned. In setting the budget for this work, a view will be taken of historic costs and trends.

9.65 However the other three categories (Inspection, Maintenance and Trees) all consist of planned expenditure. These programmes are determined based on meeting legislative requirements, analysis of options and on industry best-practice. The principles of Reliability Centred Maintenance (RCM) are applied throughout, with the aim of carrying out the correct work at the optimum time.

9.66 Forecast expenditure for IMF&T is set out in Table 36.

Inspections

9.67 As with the distribution inspection programme (as outlined in Chapter 7) inspections are carried out for a number of reasons.

9.68 Firstly, NIE Networks has a legislative obligation to inspect our assets, to ensure that they do not present any safety hazards to the public, our employees or contractors. Secondly, inspections allow us to gather information on existing or potential defects. If left untreated, these defects could lead to failure (potentially catastrophic) and interruption of supply to customers. Finally, we also gather information which informs us about the condition of the asset. This helps inform our investment decisions, and ensures that the correct assets are replaced or refurbished at the correct time.

9.69 Assets are subject to rigorous inspection routines. The cycles for inspections were traditionally developed based on legislative requirements. Under current legislation (the Electricity Safety, Quality and Continuity Regulations), we assess location and risk, and this in turn informs future inspection cycles for that site.

9.70 In the next regulatory period, we will carry out around 2,800 inspections on transmission sites. In all cases, each inspection will consider multiple assets within a given site.

9.71 Inspection frequencies will continue in line with the frequencies from RP5; at this voltage level, no frequency changes have been identified as necessary. However, overall numbers of inspections during the period will grow, as new transmission substations come on line.

9.72 The number of transmission substations is growing more quickly than before, largely due to the infrastructure being developed to accommodate renewable generation. This high rate of growth brings with it an increased inspection and maintenance burden.

9.73 Individual inspection tasks will vary from traditional visual inspections, through to condition-driven inspections using techniques such as infra-red or partial discharge testing. Under RCM, a robust and reliable inspection programme, delivered by highly trained and experienced personnel, is seen as a cornerstone of good practice.

Maintenance

9.74 Preventative maintenance addresses routine wear and tear, but also helps to identify any emerging issues that may have to be addressed. Maintenance is generally carried out on a regular basis, dictated either by time, or by the operational duty the asset has experienced.

9.75 As with distribution preventative maintenance, we use a Cost Risk Optimisation technique, to determine the correct time-based maintenance cycles. This approach balances the risk of failure (if we do not carry out maintenance), against the cost of actually doing the maintenance. The optimum maintenance cycle is where the total cost is lowest. This approach was developed as part of the MACRO project and NIE Networks has continued to use this model, and recently revised all our maintenance cycles accordingly.

9.76 Maintenance cycles are managed through the asset management IT system, which also tracks the maintenance and movement history of all assets. The system allows us to project maintenance programmes into the future.

9.77 All our transmission maintenance tasks are carried out by trained operatives. They can only work on specific asset types once they have completed the relevant training. Maintenance processes are controlled through our ISO 9001 Quality Management certification.

9.78 During RP6, we will spend £5.5m on the key transmission maintenance categories, delivering over 3,000 units.

9.79 Maintenance covers a wide range of assets, from high voltage cables, through to large power transformers, and on to the circuit breakers that can operate to remove faults from the network. Each of these assets is expensive, and will be supported by a wide range of ancillary equipment, which also requires maintenance.

9.80 Maintenance can also be time-consuming; for example, a power transformer may be unavailable for a period of weeks, while maintenance is carried out. This time will be spent in testing elements of the transformer and its systems, replacing consumable components and materials, and carrying out condition assessment works.

9.81 All of this work will in turn help to assess

Table 36 – expenditure on transmission IMF&T, £m

Costs excluding RPEs (£m at 2015/16 prices)	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Inspections	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.6
Maintenance	0.9	0.8	0.4	0.8	0.8	0.8	0.8	0.8	0.8	5.5
Fault and Emergency	0.5	0.5	0.3	0.5	0.5	0.5	0.5	0.5	0.5	3.5
Tree Cutting	0.0	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	2.2
Network Access & Commissioning	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Income	-0.2	-0.3	-0.1	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-1.9
IMF&T	1.3	1.6	0.8	1.6	1.6	1.6	1.6	1.6	1.6	10.2

Repairing damage to an underground cable

whether or not the transformer needs to be considered for replacement in future. Different assets require different maintenance and testing; circuit breakers will be tested to ensure they operate quickly and within standard, while high-voltage cables will be tested to ensure that their insulating materials remain secure.

Fault and emergency

9.82 Fault and emergency (F&E) activities are regarded as works that are required immediately after a fault has occurred on the system, including the initial on site response. A F&E event is initiated by a fault on the system causing the disconnection of plant or circuits e.g. damage to an underground cable, or a fault having the potential to compromise public safety or system security e.g. an overhead conductor falling below statutory ground clearance requirements.

9.83 Single faults on the transmission network would not normally affect customers due to the network design which provides for redundancy. However, should a second fault occur in a section of network or a single fault where there is coincident planned outages occurring, large numbers of customers could be affected. Individual faults on the transmission network tend to be costly due to the more expensive costs of the assets and components associated with these higher voltages.

9.84 During the first three years of RP5 (i.e. 2012/13, 2013/14 and 2014/15), average costs (direct and indirect) associated with faults were c£0.5m per annum. RP6 expenditure assumes a similar run rate resulting in a total RP6 cost estimate of £3.5m.

Tree cutting

9.85 Overhead lines are susceptible to damage from growing trees, falling trees and windborne vegetation. Climbable trees near overhead lines also pose a danger where physical contact with conductors is possible.

9.86 Safety clearance distances are specified within industry standard ENA TS 43-8 at a minimum of 4.6m clearance for climbable trees and 2.4m for all others (for 275kV lines).

9.87 In addition to safety clearance requirements,

Regulation 21 of ESQCR outlines the requirement to ensure that trees or other vegetation do not interfere with or cause interruption of an electricity supply.

9.88 The length of transmission lines is much shorter than that of distribution lines; conductors are generally higher than distribution conductors and span lengths are longer so that trees do not cause so many problems. Nevertheless, tree clearances must be maintained to ensure safety and reliability.

9.89 RP6 cost estimate for routine tree cutting programmes on the transmission network is £2.2m.

Network access and commissioning

9.90 In a similar manner to the requirements for the network investments the IMF&T plan also require expenditure for (1) network access and (2) testing and fault finding.

9.91 Network access activities relate to switching duties on the transmission network. These are necessary to isolate network assets to enable inspection, maintenance and fault repair work on the assets. It also covers for the activities of commissioning and testing post-repair to enable safe return to service.

9.92 The investment during RP6 required to support these activities is £0.3m and is consistent with RP5 levels of expenditure.

Income

9.93 Income relates to monies received for third party damage to the network and is forecast at £1.9m for RP6.

g. Indirects

9.94 NIE Networks' indirect and non operational capex cost base supports the distribution and transmission businesses. Due to the nature of the indirect functions, all of the category descriptions summarised in Chapter 7 will also apply to the transmission business. As such, commentary in this section is limited to analysis of key movements.

9.95 The forecast expenditure for transmission indirect costs in RP6 is as follows:
See Table 37.

9.96 In overall terms NIE Networks is forecasting an 8% decrease in overall indirects costs in RP6 when compared to the RP5 average. These cost reductions are seen primarily in engineering management.

Table 37 – summary of expenditure on transmission indirects, £m

Costs excluding RPEs (£m at 2015/16 prices)	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Engineering management	3.7	3.1	1.6	3.1	3.1	3.1	3.1	3.1	3.1	20.3
Vehicles, IT, property & engineering equipment	1.4	1.4	0.7	1.3	1.4	1.4	1.4	1.4	1.4	9.0
Corporate and business support	1.2	1.2	0.6	1.1	1.1	1.1	1.1	1.3	1.1	7.6
Wayleaves	0.4	0.4	0.2	0.4	0.4	0.4	0.4	0.4	0.4	2.8
Operational training	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	1.3
Non Operational Premises	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Indirects	6.9	6.3	3.1	6.3	6.3	6.3	6.3	6.5	6.3	41.3

Engineering management

9.97 Engineering management costs are forecast to be 15% lower than the RP5 average. This reduction is due to the transfer of the transmission planning function to SONI and the efficiency initiatives implemented in RP5.

9.98 Engineering management and clerical expenditure include costs associated with providing advice, support and technical input to SONI on transmission projects.

Vehicles, IT, property and engineering equipment

9.99 Vehicle and transport costs are forecast to reduce by 9% over the RP6 period reflecting the overall reduction in fleet costs achieved through the retendering of the fleet contract in RP5.

9.100 Specialist tools and equipment costs of £0.1m per annum are included in this category.

9.101 IT and telecoms operational costs are forecast to increase by 16% due to additional hardware support and associated operating system licence costs.

Business support

9.102 Business support costs are forecast to fall by 4% on RP5 average. This reflects lower company overheads and lower salary costs in this area.

Wayleaves

9.103 Wayleave payments for transmission assets are forecast to increase slightly in RP6 as a result of ongoing major transmission projects.

Operational training

9.104 Operational training costs in this area are forecast to remain flat over the RP6 period.

Non-operational premises

9.105 These costs are typically capital spend on minor building enhancements or refurbishment and are forecast to remain at RP5 levels.

h. Non-network IT

9.106 The forecast expenditure for Transmission Non-network IT costs in RP6 is shown in Table 38.

9.107 Non-network IT costs are as described in the relevant section of Chapter 7. Costs have been apportioned between transmission and distribution based broadly on RIGs apportionments.

i. Other expenditure within the price control funded through TSC

9.108 Other transmission expenditure is as described in the relevant section of Chapter 7.

Table 38 – expenditure on transmission non network IT, £m

	RP5 average per year	RP6 average per year	Spend profile in RP6							Total RP6
			6 months to Mar-18	18/19	19/20	20/21	21/22	22/23	23/24	
Infrastructure	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.0	0.1	0.6
Telecoms	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Applications	0.1	0.3	0.3	0.3	0.5	0.3	0.1	0.1	0.2	1.9
Total	0.2	0.4	0.4	0.4	0.7	0.5	0.2	0.2	0.3	2.7

TRANSMISSION EXPENDITURE – POTENTIAL ADDITIONAL INVESTMENT

a. Introduction

10.1 This chapter describes potential transmission load-related projects that are to be considered, and potentially approved and funded, by the Utility Regulator (UR) on a project by project basis.

10.2 SONI is responsible for the planning and design of these projects which can take many years to proceed to construction through a number of key stages, including an initial identification of the need; a detailed process of evaluating technical design options; extensive consultation with stakeholders and the public; and a rigorous assessment of environmental impact. This is an integrated process that can involve the acquisition of property, planning applications and other important consents before construction can begin.

10.3 Following completion by SONI of the work required to provide NIE Networks with a functional specification, NIE Networks is responsible for the detailed design and specification, procurement, construction and commissioning.

10.4 During RP5, a process of project by project approval by the UR has operated for these projects. It is proposed that this mechanism continues during RP6 and we will not incur any expenditure in relation to these projects without the UR's approval.

b. General drivers for transmission load projects

10.5 The transmission network carries power to and from interconnector circuits and between generating stations and the distribution network. The power flows in the network will change as flows on the interconnector circuits with GB and RoI change, as the pattern of generation changes and also as load and generation on the distribution network changes.

10.6 It is therefore necessary for SONI to keep the level of future power flows on the transmission network under review to ensure that the network remains compliant with the relevant licence standards. If prospective non-compliance situations are identified, for example, the inability to resupply load following a fault, it is necessary for SONI to bring forward projects to reinforce the network. Such projects may be designed to increase line or transformer capacity, install additional plant to improve voltage or to control power flows. In some situations, a new line or substation may be required.

c. Potential projects

10.7 The interactions between SONI and NIE Networks around transmission load related projects are defined in the Transmission Interface Arrangements (TIA). Under the TIA, SONI maintains a Transmission Investment Plan. NIE Networks provides information to inform the development of this plan. This is a living document, which will change over time. Table 39 overleaf shows the current list of potential network reinforcement projects identified by SONI with project values greater than £2.5m. This listing of load related projects has been extracted from the current Transmission Investment Plan, which has been prepared by SONI.

10.8 Whilst the total value of these projects is in excess of £250m, the amount that will be incurred during RP6 is anticipated to be considerably less than this amount and will depend on:

- the validation of the case of need and optimal solution for each project;
- the pace at which SONI is able to progress the necessary pre-construction, taking account in particular of the very significant uncertainties around securing landowner and statutory permissions; and
- the level of expenditure incurred on the construction of the proposed North-South Interconnector.

Major transmission projects will be considered on a project by project basis

10.9 NIE Networks recognises the critical importance of the North-South Interconnector project, and we are working closely with SONI, Eirgrid and ESB Networks to ensure that this strategically important project is delivered successfully.

10.10 The inclusion of these projects in this submission is not a request for funding for them. As and when individual projects are deemed to be required to proceed by SONI, we will submit individual funding requests to the UR.

10.11 The projects detailed should not be considered to be a definitive listing of what will be submitted to the UR for consideration. Before issuing a functional specification to NIE Networks, SONI will undertake more in depth analysis of the case of need for each project as well as developing the optimal solution. This could result in SONI deciding that some of these projects are not required, or that alternative solutions are more economic. It may also decide that other, as yet unspecified projects are required.

10.12 Other smaller projects (costing less than £2.5m) include:

- replacement of a section of 110kV cable between Castlereagh and Knock substations;
- replacement of Cregagh B transformer isolators;
- substation security of supply improvements at Kells substation;
- uprating of a section of 275kV cabling at Coolkeeragh; and
- replacement of the NW special protection scheme.

Table 39 – potential transmission load related projects

Project	Description	Investment Driver
Proposed North-South Interconnector	Construction of new 400kV circuit from a new substation at Turleenan in Northern Ireland to Woodland in the Republic of Ireland.	This project is designed to: ▪ increase the net transfer capacity between Northern Ireland and Republic of Ireland; ▪ reduce constraints which restrict the efficient operation of the Single Electricity Market; ▪ improve security of supply; and ▪ facilitate the connection of renewable generation.
Voltage Support	Installation of voltage support at three locations: Omagh, Coolkeeragh and Tamnamore.	A loss of a 275kV double circuit would result in power being transferred onto 110kV circuits with the potential that voltage performance would not be acceptable for the stable operation of the network or for the equipment operated by customers.
Armagh Main	Establishment of new 110/33kV substation at Armagh.	Analysis shows that the total demand on the Armagh 33kV network will exceed firm capacity by 2017. In the event of certain outages this could cause overloads and unacceptable voltage levels. A new main substation is required to provide load relief and additional network capacity to improve the quality, security and reliability of supply to customers.
Kells – Rasharkin	Establishment of a second 110kV circuit from Kells to Rasharkin.	In the event of the loss of the Coolkeeragh to Magherafelt 275kV double circuit, during periods of high wind generation in the northwest, significant power is transferred onto the underlying 110kV network, resulting in the potential overload of the 110kV circuit between Kells and Rasharkin.
Northwest 110kV circuit uprating	Uprating of 110kV circuits connecting Coolkeeragh to Strabane (via Killymallaght) and Coolkeeragh / Limavady / Coleraine.	In the event of the loss of the Coolkeeragh to Magherafelt 275kV double circuit, during periods of high wind generation in the northwest, significant power is transferred onto the underlying 110kV network. There is the potential risk of overloads occurring on the 110kV circuits. The extent of uprating will however be dependent upon the pace of growth in renewable generation and the timing of the establishment of a new circuit between Kells and Rasharkin.
Ballylumford – Eden – Carnmoney – Castlereagh 110kV circuit upgrade	Change and uprating of conductor on the 110kV double circuit Ballylumford – Eden – Carnmoney – Castlereagh circuit.	This circuit contributes to security of supply in the greater Belfast area for certain 275kV outage situations. Under certain generation dispatch scenarios these circuits are at risk of overload following a 275kV outage. There is also a need to replace the steel-cored copper conductor on one side of the towerline due to poor condition, for which a like for like replacement cost has been included in the transmission asset replacement plan. This load-related project relates to the uprating element of that circuit replacement as well as the replacement of the other circuit with a similarly uprated conductor.
Coolkeeragh to Trillick	Establishment of new 110kV circuit between Coolkeeragh (or Springtown S/S supported by uprating of circuitry between Coolkeeragh and Springtown) and Trillick (S/S in Republic of Ireland).	In addition to increasing levels of wind in Northern Ireland, there is increasing levels of wind generation in Donegal. The optimal development of the transmission system includes a cross border 110kV connection between Coolkeeragh and an existing 110kV substation at Trillick.

Project	Description	Investment Driver
Airport Road 110/33kV	Establishment of a new 110/33kV substation to service demand in Titanic Quarter, the Harbour Estate and in central Belfast.	Significant demand growth is forecast in Belfast city centre and the Belfast Harbour area due to land redevelopment. This demand cannot be supplied within the requirements of the Planning Standards due to potential overloading of certain 110kV and 33kV circuits.
Omagh Main to Omagh South Uprating	Uprating of 110kV double circuit between Omagh Main and the proposed Omagh South substation by means of conductor replacement.	The proposed Curraghmulkin windfarm cluster is planned to be connected to the existing Omagh to Enniskillen 110kV double circuit. A new substation (Omagh South) will be constructed to facilitate that connection. In the event of the loss of one of the circuits between Omagh Main and Omagh South, following the connection of the generation at Curraghmulkin, there will be risk of overloading of the remaining in-service circuit during periods of high wind generation.
Turleenan to Tamnamore 275kV uprating	Uprating of 275kV double circuit between Turleenan and Tamnamore by means of conductor replacement.	Turleenan substation is to be connected to the double circuit line between Tamnamore and Tandragee substations. Studies indicate that under an outage of one side of the double circuit between Turleenan and Tamnamore, there would be an overload of the residual in-service circuit under certain generation dispatch/demand conditions.
Increased 110/33kV capacity	Increased capacity at a number of 110/33kV substations either by uprating existing transformers or by the installation of an additional transformer.	Due to increasing levels of renewable generation as well as a risk of reduced demand, a risk of 110/33kV transformer overload at four substations: Coleraine, Strabane, Limavady and Omagh.
Magherafelt to Coolkeeragh reinforcement	Additional circuit to secure against the loss of the existing Magherafelt to Coolkeeragh 275kV double circuit. Consideration on voltage level has still to be determined. This will be influenced by the level of wind generation anticipated beyond that which is already committed to connect.	In addition to a risk of 110kV circuit overload and voltage collapse, the loss of the Magherafelt to Coolkeeragh 275kV double circuit also results in a risk of the resultant phase angle being in excess of a level that will permit safe and secure restoration of the 275kV connection.
Tandragee 275kV bus coupler	Establishment of a second bus coupling circuit breaker.	The 275kV switchboard at Tandragee has only two protected busbar sections. For any busbar outage it is therefore possible that a fault on the remaining in-service section could result in the loss of all of the 275/110kV transformers, the Louth interconnector, and the four 275kV circuits. This project is required to increase security of supply for customers.
Transmission protection	Application of SONI transmission protection philosophy and policy to protection assets.	SONI has prepared a transmission protection philosophy and policy, the aim of which is to ensure that all major system nodes are resilient against a single protection failure and a circuit breaker failure and that faults are cleared from the system in as short a time as possible. It is anticipated that this policy will require some enhancements to existing protection schemes and associated primary equipment.
Delivering a Secure, Sustainable Electricity System (DS3).	There may be a requirement for investment in the transmission system to facilitate the achievement of the aims and objectives of SONI's DS3 Programme.	The aim of SONI's DS3 Programme is to meet the challenges of operating the electricity system in a secure manner while achieving the 2020 renewable electricity targets. The DS3 Programme is designed to ensure that we can securely operate the power system with increasing amounts of variable non-synchronous renewable generation over the coming years.

UNCERTAINTY AND INCENTIVE MECHANISMS

a. Dealing with uncertainty

11.1 The proposals in this plan have been derived by using the most up-to-date information. However there are some areas of uncertainty which need additional funding mechanisms due to the external nature of the uncertainty and its potential impact.

Transmission and distribution capex asset replacement

11.2 The expenditure forecasts in this plan in respect of transmission and distribution asset replacement reflect our best view at this point in time. However, RP6 will run until 31 March 2024 and inevitably the priority to replace particular types of assets may change during that time. For example a new investment stream may be required as a result of asset type failures not included in the plan or a higher volume of replacement than predicted may be required.

11.3 To deal with this uncertainty, it is proposed that there should be flexibility within the RP6 price control structure to substitute higher priority outputs/projects for outputs/projects which have a lower priority and can be deferred to a future period with no financial penalty to NIE Networks. Excluding the high volume rolling programmes in respect of which costs and volumes are predictable, for example, the various overhead line refurbishment programmes and the programme to replace secondary plant equipment, the majority of asset replacement projects are unique and defined by the specific investment requirements of a particular substation or part of the network.

11.4 We propose that there should be a cap on substitutions equal to 15% of the overall RP6 asset replacement programme (excluding the rolling programmes).

Distribution reinforcement including Low Carbon Technologies (LCTs)

11.5 There are significant uncertainties over the forecast of load growth associated with the uptake of LCTs. The Transform model used by NIE Networks to predict future investment requirements associated with LCTs considered three potential uptake scenarios i.e. low, medium and high. Our forecast expenditure has taken a conservative approach by adopting the investment requirement associated with the low scenario.

11.6 However, this approach does leave us open to the risk that should the development of LCTs and their actual uptake turn out to be higher than our prediction, we will have insufficient funding to safely manage the network and maintain a level of performance acceptable to our customers.

11.7 To deal with the uncertainties associated with investment in distribution reinforcement and in particular that which is driven by LCTs, we propose that an approach similar to the Ofgem re-opener for RIIO-ED1 is adopted. This re-opener operates around a 20% dead band (i.e. allowance +/- 20%), where efficient costs incurred either side of the dead band can be either funded through additional allowances or returned to the customer.

11.8 Our modelling has shown that the impact of the forecast growth in LCTs will be seen on the secondary distribution network i.e. 11kV, 6.6kV and LV. Our investment requirement in this area is detailed in Section 7 of our business plan and the associated costs of £21.5m are shown in Table 11. It is our view that the re-opener would apply to the investment associated with the sections of the network directly affected by LCT uptake and it is our assessment at this time that this will be the secondary network.

11.9 We propose that there is an opportunity mid way through RP6, if required, to demonstrate that incurred efficient costs are expected to deviate by 20% or more versus the combined allowances for load related work. The Utility Regulator (UR) would then be able to adjust the allowances up or down. Expenditure incurred within the dead band will be subject to the normal efficient spend mechanism.

Distribution reinforcement associated 33kV network congestion resulting from further generation connection

11.10 There is a greater level of uncertainty over the potential level of investment associated with the further reinforcement required to facilitate the connection of generator applications currently waiting to be processed. An independent assessment undertaken by consultants has provided indicative costs for this work, set out in the table below.

See Table 40.

11.11 This assessment is based on the generation in the application process as at December 2015 and in reality, the investment need will further increase if market incentives continue to encourage ongoing applications. The proposed closure of the Northern Ireland Renewables Obligation (NIRO) scheme in 2017 will undoubtedly have a major bearing on the volume of generator connection applications in the future.

11.12 SONI is also in the process of reviewing the overall capacity of the transmission network and its capability for managing system stability in light of the total committed and planned generation wishing to be connected to the network. This may result in a requirement to lower the threshold and the extent at which generation is required to be controlled, and thereby questioning the future commercial viability of individual schemes.

11.13 It is also difficult for NIE Networks to control the increasing level of micro generation being connected (currently running at approximately 1.5MW per month) because the existing rules allow customers to install micro generation equipment without our prior consent. The only obligation on customers is to ensure the equipment is compliant with relevant protection requirements, and to inform us of their installation afterwards (under the 'fit and inform' process).

11.14 NIE Networks also recognises that there are alternative options for managing and / or reducing this potential investment. These fall under three broad headings:

- NIE Networks has control over all future generation, including ability to refuse offers;
- the generators are required to pay for all additional reinforcement; and
- the additional reinforcement is funded by the general customer.

11.15 We therefore believe that as there are possible alternatives to the probability of ongoing network reinforcement, combined with the level of uncertainty associated with this investment, it is inappropriate that it should now be included in our core investment plan at this stage. However, it is our expectation that if funding is required, the UR will be minded to approve such funding.

11.16 It is our opinion that this decision requires further engagement with the UR to review all potential solutions and possible funding options with a view to going out to consultation to all stakeholders. It is our plan to conclude this process before the commencement of the RP6 period.

Table 40 – cost of reinforcement to accommodate further generation, £m

Driver	Network risk	Reinforcement option	Investment category	Reinforcement cost £m
Future connection of generation currently in the planning queue as at December 2015.	A risk to the safe operation of the network if we are required to make connection offers without changes to chargeability rules and/or full control of generator connections.	Invest in additional network infrastructure to increase the available headroom for the connection of further generation.	Uncertainty	8.0

Transmission load projects

11.17 As explained in Chapters 9 and 10, the expenditure forecasts in this plan exclude costs (both direct and indirect) associated with potential load related projects which are uncertain and have not yet been approved by the UR. SONI is responsible for the planning and design of these projects which can take many years to proceed through a number of key stages, including an initial identification of the need; a detailed process of evaluating technical design options; extensive consultation with stakeholders and the public; and a rigorous assessment of environmental impacts.

11.18 Potential projects which may commence during RP6 are summarised in Chapter 10. The UR will assess the relative merits of these projects on a case by case basis having regard to the project costs and benefits. No expenditure will be incurred without the UR's approval.

11.19 During RP5, a process of project by project approval by the UR has operated for such projects. It is proposed that this mechanism continues during RP6 and NIE Networks will not incur any expenditure in relation to these projects without the UR's approval.

Transmission protection philosophy

11.20 SONI has responsibility for the development of the protection philosophy and policy on the transmission network. It is presently in consultation with NIE Networks on a revision to the current philosophy which may have implications for the current protection asset replacement works planned by NIE Networks during RP6. There may also be further ramifications for primary equipment on the network should the protection philosophy be agreed and adopted.

11.21 SONI will be required to provide the business case for any enhanced works beyond those which NIE Networks has planned and will be funded under the RP6 price control.

11.22 In the event of a change to the protection policy which requires such enhanced works to be carried out by NIE Networks during RP6, we propose that the UR considers including a reopener mechanism which would allow additional funds to be approved for this purpose.

Cluster developments for connection of renewables

11.23 As explained in Chapter 9, the expenditure forecasts in this plan also exclude costs associated with future cluster infrastructure potential projects which are uncertain and have not yet been approved by the UR.

11.24 The purpose of grouped or 'clustered' connections is to reduce the number and length of new overhead lines needed for the connections. The clustering approach facilitates the connection of renewable generation to the electricity grid efficiently whilst respecting Northern Ireland's landscape and cultural heritage.

11.25 Clustering large generators also offers advantages in managing information and control related to that part of the system and could permit single point rather than distributed solutions to other engineering problems arising from high levels of renewable energy penetration.

11.26 NIE Networks has already developed and connected one cluster during RP5 and three more clusters are currently in construction and expected to be connected by March 2017. We expect the future demand for clusters will be affected by the early closure of the NIRO incentive arrangements and changes to the requirements for generation applications along with grid capacity shortfall. This may lead to some current applications being withdrawn. Furthermore there is the possibility that developers will proceed to build clusters as contestable works following the opening of contestability for greater than 5MW connections at the end of May 2016.

11.27 During RP5, a process of project by project approval by the UR has operated in respect

of clusters. It is proposed that this mechanism continues during RP6 and NIE Networks will not incur any expenditure in relation to new cluster developments without the UR's approval.

Public Realms and large scale road schemes

11.28 Public Realms schemes are projects undertaken by Department of Social Development (DSD) and local councils where the streets and footways are replaced by high amenity surfacing such as granite and stone to provide enhanced pedestrian walkways and vehicular areas together with lands and public spaces. When these schemes are undertaken, utility assets are affected.

11.29 NIE Networks assesses assets affected by standard public realms schemes and determines if they can be accommodated within asset replacement, load related or investment programmes coordinated through the NI Road Authority and Utility Committees (NIRAUC). As such small schemes affecting small towns and villages are generally accommodated in these core investments.

11.30 However, there are additionally a number of large scale road schemes either under way or in planning which cannot be predicted with certainty and are therefore excluded from our investment plan.

11.31 In Belfast a number of large scale schemes are either underway or in consideration:

- Belfast Streets Ahead – Phase 3 – Royal Avenue / York Street. This scheme is in planning and due to be delivered between February 2017 and February 2019.
- Bedford Street / Dublin Road.
- Great Victoria Street.

11.32 It is unclear just how many large scale schemes are likely during the RP6 period but in addition to the three mentioned above, DSD has indicated there could be a further two or three schemes in Belfast alone. In addition the historic run rate may increase further if we are pursued for additional costs associated with betterment, deferral of time of renewal and excavation works carried out by third party contractors in accordance with the Streetworks Order.

11.33 To deal with these uncertainties, we propose that we can seek additional funding to cover unpredictable but potentially large scale public realms schemes and NIRAUC road schemes (i.e. those greater than a £100k contribution from ourselves). These could be considered on a scheme by scheme basis or where timing allows, grouped together into an overall proposal.

Market operations

11.34 During RP5 the price control allowances for metering installations and replacements have been based on per unit allowances. Structuring the allowances in this way mitigates against uncertainty in forecasting the annual volume of activity through the regulatory period and it is proposed that this mechanism is retained during RP6.

11.35 Our expenditure forecasts in this plan assume no change in relation to NIE Networks' metering obligations during RP6. In particular, no provision has been made for the potential roll out of smart meters to customers in Northern Ireland. This is a government policy consideration. The introduction of smart metering could have a potentially significant impact on our metering, meter reading and IT costs. In the event that the Department for the Economy decided to introduce smart meters, we expect that the RP6 market operations allowances would be adjusted accordingly.

Integrated Single Electricity Market (I-SEM)

11.36 New wholesale electricity market arrangements are currently being designed to replace the existing Single Electricity Market (SEM), which applies across the island of Ireland. The introduction of I-SEM is a requirement arising from changes to European legislation designed to harmonise cross border trading arrangements across all European electricity markets. The I-SEM market will take effect from the end of 2017.

We work closely with local councils on public realm schemes to reduce the impact on local communities

11.37 Changes to our market operations systems and processes will be required to facilitate I-SEM. These changes are outside NIE Networks' control and it is proposed that any costs we incur associated with the development of I-SEM or other market developments during RP6 should be allowed through the price control.

11.38 Apart from the impact on market operations, we expect that there will be little or no impact on the distribution network from the implementation of I-SEM, beyond the wider investment work programme set out in our RP6 plan. However, it is difficult at this point to forecast if new requirements could emerge after the "go live" date. This will be discussed with the UR during the RP6 process. If specific requirements do emerge, additional funding may be required subject to approval from the UR.

Injurious affection

11.39 NIE Networks has received a number of compensation claims from landowners in respect of the diminution in the value of their property (injurious affection) caused by the existence or use of public works carried out under, or in the shadow of, compulsory powers. NIE Networks has appealed the decisions in respect of four injurious affection test cases which were heard by the Lands Tribunal in November 2014.

11.40 The outcome of the appeal process will establish important guidelines for dealing with injurious affection claims.

11.41 The RP5 price control provides for the UR to amend the price control to include an allowance for injurious affection claims whenever the cost can be forecast with more confidence. It is proposed that this mechanism is retained during RP6 pending the outcome of the initial claims.

Business rates

11.42 Business rates are periodically revalued. Our most recent revaluation was carried out on 1 April 2015 and the next revaluation is due around 2020. The rates valuation is the responsibility of Land

The provision of a high level of service for our customers is a core business objective

and Property Services (LPS) which is part of the Department of Finance and Personnel (DFP).

11.43 The RP5 price control included an upfront allowance of £15m per annum for NIE Networks' rates liability. This allowance was in line with our rates liability up to 31 March 2015. However, following the revaluation on 1 April 2015, the rates liability increased to circa £18m per annum, which resulted in a £3m per annum shortfall in the allowance for the last two and a half years of RP5.

11.44 The rates liability is determined by reference to (a) the Net Annual Valuation (NAV); and (b) the district and regional rates (poundage rates) which are applied to the NAV by the ratings office.

11.45 NIE Networks has no control over the approach adopted by LPS in setting the NAV. LPS changed its approach in the 2015 valuation from one specified by the DFP to a "conventional" assessment based on income and expenditure. This change in approach followed the GB Distribution Network Operators (DNOs) and National Grid Transmission who moved to conventional assessment in 2005.

11.46 The approach which the LPS adopts to the valuation is outside NIE Networks control, as too are the poundage rates which are applied to the valuation. We propose therefore that the appropriate regulatory treatment during RP6 is that rates should be allowed on a pass through basis.

Wayleaves

11.47 A wayleave permits NIE Networks to install electricity lines and associated equipment on, over or under private land and to have access to that land. The landowner is then compensated in the form of wayleave payments. NIE Networks' policy is to make wayleave payments based on the rates

paid by Scottish Power which are in line with the rates recommended by the Electricity Networks Association (ENA) which acts on behalf of the UK electricity network companies.

11.48 We do not believe it is in customers' interests to depart from this policy which mitigates against potentially lengthy and expensive negotiations each year. The current annual cost of wayleaves is around £5.5m per annum. However, depending on what happens in the UK, there is a risk that this cost could change during RP6 for reasons outside NIE Networks' control. We propose therefore that the RP6 allowance for wayleaves should be reviewed if the cost increases or decreases by more than 10% compared to the current level.

Corporation tax

11.49 We propose that our allowance for corporation tax should be based on the applicable tax rate in Northern Ireland as specified from time to time. Any changes to the tax rate are outside our control.

Pension historic deficit repair

11.50 We propose that the principles established in RP5 to split the deficit between historic and incremental deficits using Ofgem PDAM methodology should be retained.

11.51 The historic deficit repair allowance should match the deficit repayment profile that we have agreed with the trustees of the pension scheme.

UR licence fees

11.52 The UR funds its activities by charging licence fees. We propose that the appropriate regulatory treatment is that licence fees should be allowed on a pass through basis.

Change of law

11.53 The RP5 price control contains a provision that serves to allow for amendments to be made to the price control in the event of a change of law that triggers a change in required expenditure levels. The purpose of this provision is to ensure the company is left no better or worse off than if the change of law had not occurred.

11.54 We propose that the change of law provision is retained during RP6.

RPI indexation

11.55 We propose to use the Retail Prices Index (RPI) to adjust allowances for economy-wide inflation / deflation.

11.56 This principle is established within regulatory mechanisms and we do not propose any changes to it.

Guaranteed Standards

11.57 NIE Networks is currently required to meet a series of standards concerning aspects of its service to customers. These standards are specified in a determination that the UR made under Article 43 of the Electricity (NI) Order 1992 and in Regulations made under Article 42 of the same Order.

11.58 The standards give customers experiencing shortfalls against standards a right to specified amounts of compensation.

11.59 Our business plan has been developed on the assumption that these standards would not change during RP6. Additional allowances would be required if higher standards are imposed on us, and we propose a reopener mechanism to allow for this.

b. Incentives

11.60 In the context of a price control, incentives are mechanisms that incentivise a regulated company to provide additional benefits to customers over and above its core plan.

Cost risk-sharing

11.61 During RP5, a 50:50 cost risk-sharing mechanism has operated on the basis that to the extent NIE Networks' costs exceed its regulatory allowances, then 50% of the excess cost is charged to customers and 50% is borne by NIE Networks.

Similarly, to the extent NIE Networks' costs are lower than its regulatory allowances, then 50% of the saving is rebated to customers and 50% is retained by NIE Networks. The 50:50 cost-risk sharing applies to both capex and opex.

11.62 The mechanism provides an incentive for NIE Networks to improve the efficiency of its operations and we propose that the mechanism is retained during RP6.

Measures to tackle risks from deferral of planned network investment projects

11.63 The RP5 price control includes a mechanism to protect customers from the risk of facing charges for further work which has already been funded.

11.64 The mechanism aims to ensure that there is no double funding of deferred expenditure and also provides an incentive for NIE Networks to avoid expenditure which is no longer necessary. We propose that the mechanism is retained during RP6.

Inefficient spending

11.65 The RP5 price control includes a provision which enables the UR to make adjustments to the price control to protect customers from exposure to any costs that the UR has found to be demonstrably inefficient or wasteful.

11.66 We are content for this provision to be retained during RP6. The "inefficient spend clause" is consistent with the approach adopted in network price controls by Ofgem.

Revenue protection

11.67 The term 'revenue protection' is used in the electricity industry to describe activities to detect and deter cases of illegal abstraction of electricity (and electricity theft) and to collect money owed in relation to that illegal abstraction.

11.68 The price control structure for RP5 includes an incentive mechanism whereby NIE Networks retains 50% of the revenues recovered from premises that are not registered with a supplier. These arrangements were designed to cover the costs of our revenue protection activities and also to incentivise us to maximise the recovery of monies relating to the illegal abstraction of electricity. However, the arrangements were limited to the small number of cases /scenarios where we find unauthorised supply to premises that are not registered with a supplier. Such instances are relatively rare and make up only a small proportion of our revenue protection activities. For example, where a supply has been de-energised according to market procedures but is subsequently found to have been re-energised illegally by the occupier.

11.69 In the great majority of cases, our role in recovery of monies is focused in terms of units of electricity illegally abstracted and the application of a unit adjustment to customers' account. In such cases, NIE Networks calculates the extent of illegal abstraction in terms of units of electricity and applies a unit adjustment to the account and has no role in financial resettlement. This unit adjustment then flows through routine retail and wholesale market resettlement processes and any monies due are recovered directly from the customer by the supplier (not NIE Networks).

11.70 We believe there to be a robust case for strengthening the revenue protection incentive during RP6. It clearly is in customers' interest to promote the earlier detection of illegal abstraction at as many sites as possible and therefore avoid customers bearing the cost of any further illegal abstraction that would otherwise have occurred but for the intervention of the revenue protection services.

Network reliability incentive

11.71 We believe there is merit in introducing an incentive in relation to network performance in RP6. We propose that the baseline for the incentive is the ten year rolling average Customer Minutes Lost (CML) excluding severe weather events. The incentive scheme would be symmetric so that if our CML were below the baseline we would receive an incentive and if we were above the baseline we would be penalised.

CONNECTIONS

a. What our connections business does

12.1 As the owner of the distribution network NIE Networks is responsible for providing connection services to customers who wish to connect to the network. This will include customers who require a new electricity supply. These connections are called 'load' or 'demand' connections, and these terms are used interchangeably in the industry and have the same meaning. They are so called because these connections increase the electricity load on the network, which is the same as saying they increase electricity demand.

12.2 Also, generators who generate electricity and may need to export it into the network may need to connect to the network (generation connections).

12.3 The majority of connections work we undertake relates to demand / load connections.

These can cover a range of services including:

- providing new connections to homes, businesses and farms, and housing developments;
- altering existing connections including replacing electrical equipment, installing new earthing or diverting equipment;
- increasing or decreasing the load of electrical equipment to cater for new requirements on a site like new machinery at a farm which requires more power to run it;
- disconnecting supplies both permanently and temporarily;
- replacing meter backboards or meter boxes; and
- investigating voltage complaints from customers and carrying out any remedial works.

12.4 We have typical demand / load connection volumes of around 7,000 customers per annum.

12.5 The level of generation connections is less predictable and will depend on factors such as government policy, i.e. the level of support / subsidy for renewable energy. Generation connections fall into three broad categories – large scale, small scale and micro.

- Large Scale Generation (LSG) (typically 5-40MW) mainly takes the form of wind farms but solar farms are likely to play a more significant part in the future. LSG is connected to the transmission network (at 110kV) and the distribution network (typically at 33kV).
- Small Scale Generation (SSG) (typically 20-500kW) takes the form of single wind turbines, anaerobic digesters and small solar installations. SSG is connected to the distribution network normally to LV and 11kV lines fed from 33kV/11kV primary substations.
- Micro generation (4-12kW), typically photovoltaic (PV) panels on domestic rooftops, normally connects directly to customer premises at 230V single phase or 400V three phase.

12.6 The cost of new demand and generation connections is fully chargeable to the customer in accordance with the NIE Networks Statement of Connection Charges (SoCC). NIE Networks has a licence obligation to publish a SoCC on an annual basis setting out, the methodology to be applied when assessing the cost of any new connection, along with indicative costs. Accordingly we revise the SoCC every year with any changes being approved by the Utility Regulator (UR).

12.7 The cost of the connection will depend on the requirements of the customer seeking the connection and will include:

- the cost to connect the customer's assets to the distribution network including, as appropriate, civil works, electrical lines, electrical plant, meters, telemetry and data processing equipment;
- the cost to reinforce the distribution network at the connection voltage level and one voltage level above; and
- in the case of a customer connecting at 33kV, those assets required to reinforce the transmission network at 110kV.

b. Contestability in connections

12.8 Historically, NIE Networks was the only party in Northern Ireland that could design and build connections to the distribution network. However the UR wishes to open up the market to competition for all types of new connections, thereby creating a "contestable" market.

12.9 Under contestability an Independent Connection Provider (ICP) may undertake elements of the provision of a new connection to either the transmission or distribution network. Contestability will provide choice for customers and should ultimately drive companies to improve service and become more efficient.

12.10 A Working Group chaired by the UR with representation from NIE Networks, SONI and industry stakeholders has been established to support the introduction of contestability in this market. The consultation process began in autumn 2014 and the UR published its decision paper in July 2015. Further consultation will continue to be required to establish the rules and processes governing a fully contestable market that will operate successfully for all parties.

12.11 In the event that contestable works are installed by an ICP, then at commissioning (and providing certain conditions are met):

- the ownership of the contestable works will be transferred to NIE Networks, and
- NIE Networks will assume operational responsibility for connections to the distribution network and SONI will assume operational responsibility for connections to the transmission network.

12.12 The market will be opened in a phased approach, with Phase 1 including only the largest connections (i.e. greater than 5MW) delivered in the summer of 2016, and Phase 2 (all other connections) to be delivered by the end of 2017.

12.13 The UR has defined which elements of the connections process are to be contestable, and which will remain exclusively the responsibility of NIE Networks.

12.14 NIE Networks and SONI have jointly produced a Contestability Guidelines document which further defines and establishes the principles of contestability outlined in the UR Decision Paper. It provides guidance on how contestability will work for electricity connections in Northern Ireland.

c. What we will do for demand customers in RP6

12.15 Stakeholders are very clear that demand connections is an area where NIE Networks can continue to improve the service we deliver to customers and we have therefore developed a number of key improvements we intend to deliver in the lead up to and during the RP6 price control.

12.16 In general the feedback on the connections service we provide is that connections should be completed quicker. During RP5 we committed to reducing the time to get demand connections delivered and physical works completed by 20%, and in RP6 we intend to reduce this figure by a further 20% through process improvements.

12.17 One such process improvement will be introducing the facility for load customers to apply for a budget cost or a feasibility study in advance of applying for a formal connection offer. We understand that there are times when customers are unsure about the requirements for their connection or about the best way to connect. We believe this service will allow customers to become better informed when they come to apply for a connection, which will mean a quicker application process for customers and ultimately reduce the time to provide connection offers.

12.18 We also intend to improve the visibility of the costs for connections and the availability of network

NIE Networks has been working closely with stakeholders to enable grid connections for renewables

capacity. We will introduce a connections job 'illustrator' on the website which will allow customers to estimate upfront the cost of their connection and highlight any network capacity issues.

12.19 During the RP5 period we appointed a dedicated account manager to liaise with business customers to better understand their connection requirements and improve accountability for delivering against their timelines. We have also improved our link with Invest NI to ensure that we are aware of new potential customers, whether indigenous or foreign direct investment. This helps planning for new electricity connections from the very outset of these projects.

12.20 We recognise that major connection customers in particular have a requirement for more detailed interactions with us. We intend to enhance our customer account management for customers with large jobs or those who have multiple jobs. We believe this will improve the information provided to these customers and ultimately create a better, more streamlined customer experience when applying for a connection.

12.21 During RP6, we intend to improve our communication with customers through providing more frequent and timely communication to update customers on the progress of their job. We intend to introduce an online tracking system for jobs which will allow customers to apply for connection, and to check online the current status of their job. In addition to this we are looking at ways that we can provide a facility for customers to make online payments for jobs.

12.22 Continuous feedback is important so that we can identify what customer priorities are and highlight areas where we can do better. We will carry out customer surveys and connection questionnaires to assess the most common

issues. We also propose to extend the use of local 'surgeries' where connection customers can attend events hosted at local offices to learn about the connections process, discuss issues and meet the NIE Networks staff they interact with.

12.23 Our Guaranteed Standards set out the minimum service standards that NIE Networks must meet for customers. Where a standard is not met, the customer is entitled to compensation. We will improve our quotation and construction timescales for connections in line with GB distribution network operators (DNOs) during RP6, and we will continue to maintain zero failures against our Guaranteed and Overall Standards of Performance.

12.24 We are already working to facilitate the introduction of contestability in connections in Northern Ireland and plan to open all connections for contestability by the end of 2017. We will continue to work closely with the market to understand new and emerging third party providers as the contestable market matures and we will work closely with the UR to support attempts to widen the scope of contestability as far as practically possible.

Connection process improvements
- Improve the overall time to deliver a demand connection by 20%.
- Enhance feasibility study and budget quote options for load connections which will allow us to work with customers to develop the optimum connection solution.
- Create a job 'illustrator' online to allow customers to estimate costs and network access.

Customer self service
- Introduce an online system to allow customers to track jobs and get status updates.
- Create a facility for customers to make online payments for jobs.

Improve customer service
- Enhance customer account structure for larger customers.
- Take feedback from customers through surveys and connection surgeries.

Customer standards of performance
- Zero failures against the connection guaranteed and Overall Standards of Performance.

Contestability in connections
- Facilitate contestability in connections for all connections by the end of 2017.

d. Generation connections

12.25 At NIE Networks we connect both renewable and non-renewable generators of electricity to our network. Historically large power stations connected at high voltage generated most of the electricity transported on the system, but this has changed dramatically over the last few years to see generators dispersed or 'embedded' throughout the network at different voltages and locations.

12.26 In recent times, NIE Networks has experienced a surge in renewable generators seeking to connect to the grid, driven mainly by the incentive schemes in place to support renewable generation (namely, the Northern Ireland Renewables Obligation or NIRO scheme). Whilst this new trend in distributed generation has introduced a number of technical challenges that need to be overcome, very significant progress has been made in Northern Ireland in respect of the installation of renewable generation.

Progress to date

12.27 NIE Networks has been working closely with stakeholders to enable grid connections for

renewables, in line with meeting the NI Assembly's 2020 target of 40% of electrical consumption from renewables, through the Strategic Energy Framework (SEF). The 40% target equates to some 1,600MW of installed electrical capacity. (The ultimate figure will depend on the mix of generation types.)

12.28 The SEF includes an interim target of achieving 20% of electricity consumption from renewables by 2015. The interim target was achieved and there is 880MW (25%) of renewable generation currently connected and 700MW 'committed' to connect. Of the 880MW connected, some 136MW relates to small scale generation and 70MW to micro generation.

See Figure 17.

12.29 The achievement of government targets is dependent on a vibrant renewables industry in Northern Ireland. The attainment of the 2015 target was also supported by the work done by NIE Networks and SONI to connect projects to the electricity network.

12.30 NIE Networks plays a key role in ensuring effective coordination and communication on renewables issues. We are involved in inter-organisational working groups with government departments, the UR, the Consumer Council, and SONI. The coordination of these groups is overseen by the Electricity Stakeholders Group, chaired by the Department for the Economy. This group continues to play a key role in ensuring all organisations work together to deliver the very challenging targets specified in the SEF.

12.31 There are different processes for connecting generation, depending on the type and size of the generation:

- For customers wishing to install small amounts of generation below 4kW single phase or 12kW three phase, this is called micro generation. Micro generators can connect via a process called 'Fit and Inform' where the customer fits their generation to the system and then informs NIE Networks which then registers the connection and changes the meter to record export on to the system.
- For customers installing more than 4kW and less than 5MW of generation, this is called small-scale generation. These types of connections can be new connections to the system or integrated into an existing customer connection and will usually require some reinforcement works to connect

Figure 17 – level of renewable generation connected to the network

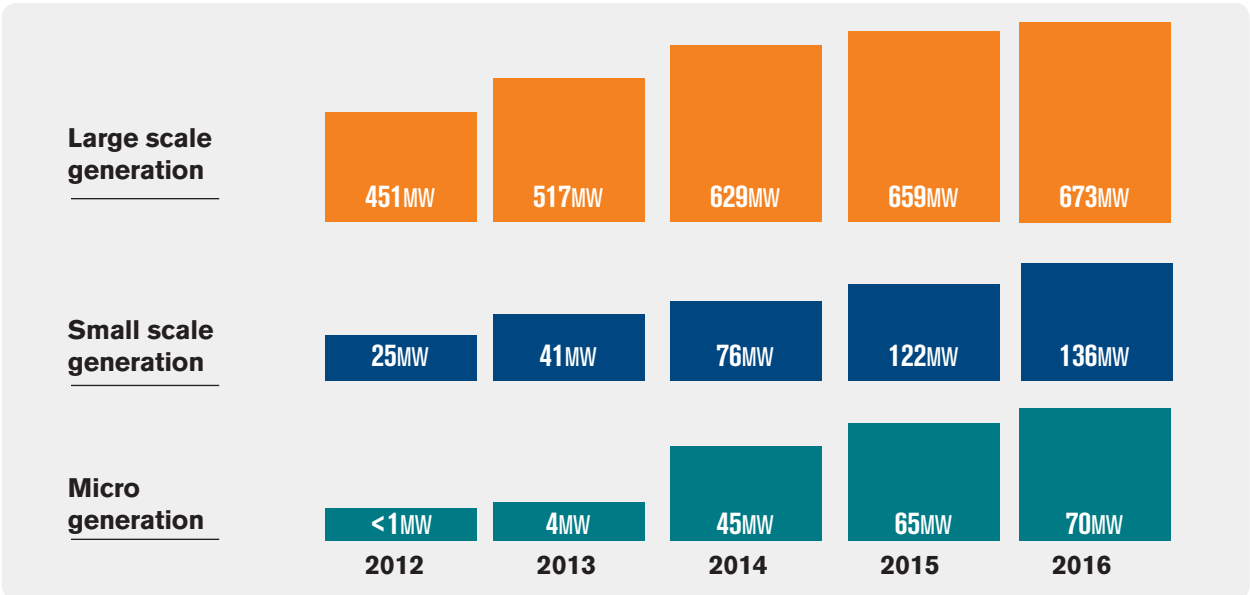
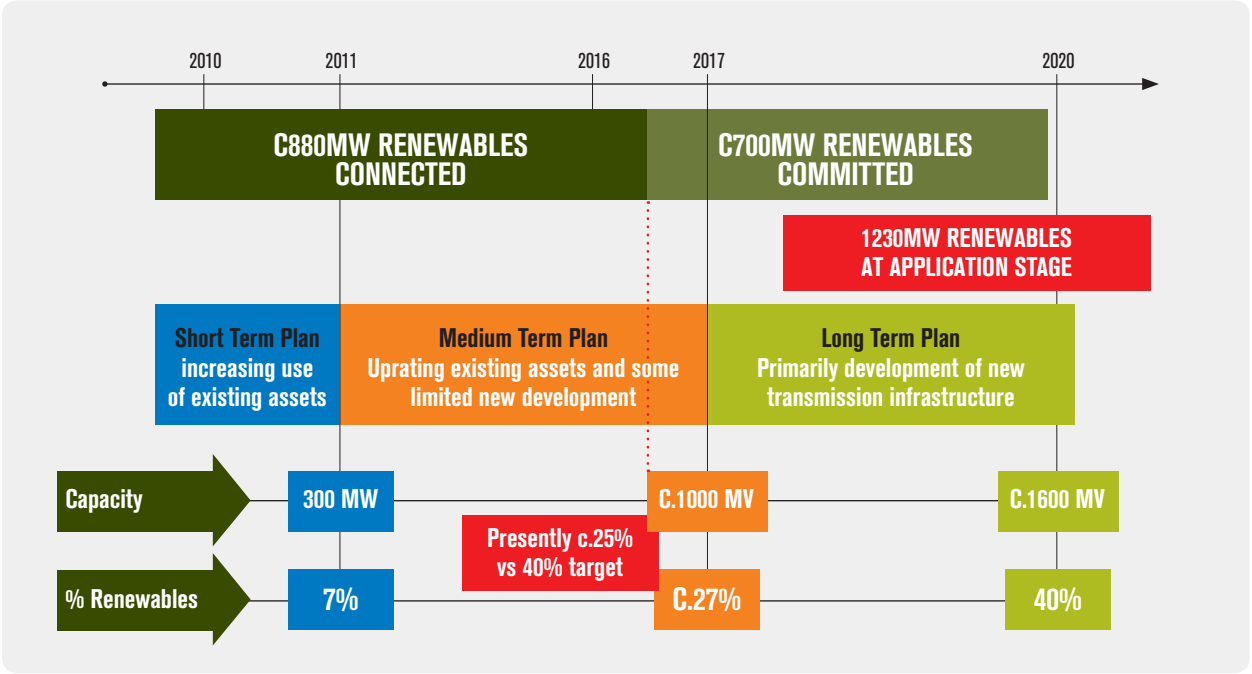


Figure 18 – meeting the 40% renewable generation target



the generator safely along with any new build to connect to the generator. Single wind turbines (typically 250kW) and anaerobic digesters (typically 500kW) represent a significant proportion of this market.

- For customers connecting 5MW or more of generation, this is called large scale generation. These are much more complex connections and the generators have additional requirements to comply with. At NIE Networks we are required to connect these generators as efficiently as possible and use clusters to connect large-scale generators where appropriate (see paragraph 12.46).

12.32 Importantly, each category connects at different voltage levels and presents very different challenges in terms of grid connection.

Capacity constraints and the impact on connections

12.33 All DNOs are facing the same challenges in that historically, networks were designed to bring electricity from large, centrally located power stations in one direction through the networks, ultimately to customers' premises. That model is changing rapidly, with the increasing prevalence of smaller scale generators scattered across the networks, multi-directional power flows, and other emerging demand-side and/or supply-side approaches such as energy storage, Aggregated Generation Units (AGUs) and Demand Side Units (DSUs). This will require much more active management of the network in the future.

12.34 In Northern Ireland this challenge is magnified on the network for two reasons.

12.35 The first reason is the very high existing and projected level of penetration of renewables in Northern Ireland, coupled with the nature and capacity of the distribution network.

12.36 Whilst the network serves 'demand' customers well, it is inherently less receptive to dispersed in-feeds of renewables generation than is the case with most GB DNOs. During rural electrification in the 1950s and 1960s, Northern Ireland adopted a modest approach to serving low rural load densities – for example through lighter

overhead line construction and greater use of single phase versus three phase lines. NIE Networks has 3.5 times the total distribution overhead line per connected customer compared to the GB average, because of the dispersed population.

12.37 The second reason arises from the location of large-scale renewable generation. While other technologies are starting to emerge, wind has historically been the key contributor in Northern Ireland. The best locations for wind energy in Northern Ireland are mostly in the west; however the population (load) centres are concentrated in the east. As a result, the backbone transmission network requires strengthening to cope with the transport of wind energy from west to east.

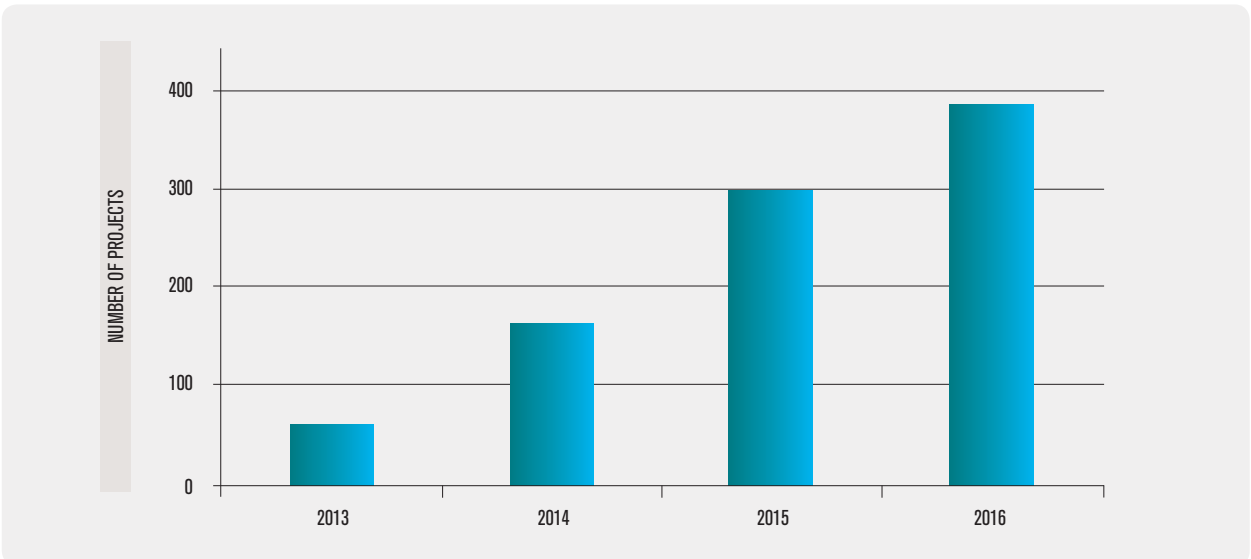
12.38 Transmission network reinforcements designed to enable up to 27% penetration versus the 40% target are advancing to plan. Further investment in the transmission network to enable moving beyond the 27% figure needs to be defined. SONI as Transmission System Operator has this responsibility, with inputs from NIE Networks. The costs are likely to be very significant. NIE Networks will work closely with SONI and the UR to define options, as shown in Figure 18.

12.39 The North-South interconnector project must also be realised. While SONI is responsible for bringing the project to consented stage, NIE Networks (together with ESB Networks for the Republic of Ireland portion) has responsibility for construction of the interconnector.
NIE Networks is currently working with ESB Networks, the UR and the Commission for Energy Regulation (CER) to define a strategy to minimise the build phase.

12.40 Significant issues, however, have also emerged on the distribution network, which is now saturated across much of Northern Ireland, particularly in the north and west.
As a result, significant network investment is required to connect at some locations, which is driving up the cost and time to connect for many customers.

12.41 NIE Networks has significantly ramped up the delivery of small-scale generation projects over the last four years as can be seen in Figure 19. This increase in connected and committed generation on the distribution network has lead to capacity constraints from network saturation in many locations.

Figure 19 – small scale generation connections



12.42 Apart from the investment required, there will be difficult technical challenges to overcome since the levels of renewable penetration in Northern Ireland are already at the limits of what such systems normally have to deal with.

12.43 NIE Networks continues to seek innovative solutions to problems. For example, through the 'Project 40' initiative which commenced in May 2014, NIE Networks has been exploring alternative connection arrangements whereby the output of a generator is controlled to avoid local network capacity limits being reached.

12.44 As part of this initiative, NIE Networks is carrying out research to develop a 'managed connection' which, if successful, will allow more capacity to be squeezed out of the existing network and thus allow more generation to connect than would otherwise be the case without further network investment.

12.45 In addition, NIE Networks has worked closely with the industry to find ways to further develop charging arrangements for cluster substations; to expedite the delivery of clusters and to complete technical analysis to confirm the suitability of using longer cable lengths in connections which may help to expedite timelines for delivery.

Cluster development

12.46 In March 2010 NIE Networks consulted on the principle of clustering large generators as a suitable method of connecting groups of generators that are located in the same vicinity. The purpose of grouped or 'clustered' connections is to reduce the number and length of new overhead lines needed for the connections.

12.47 It was concluded that, where appropriate, the clustering approach would facilitate the connection of renewable generation to the electricity grid efficiently whilst respecting Northern Ireland's landscape and cultural heritage.

12.48 Clustering large generators also offers advantages in managing information and control related to that part of the system and could permit single point rather than distributed solutions to other engineering problems arising from high levels of renewable energy penetration.

12.49 NIE Networks, in conjunction with SONI, plans, designs and builds clusters to connect large generators in groups or "clusters" so that they will share network infrastructure.

What we will do for generation customers in RP6

12.50 As we move into RP6 the NIRO will end. However, the demand for generation connections is likely to continue though the level of demand along with any future incentive arrangements are not yet clear. Also there remains a considerable level of work to deliver before the early part of 2018.

12.51 We will continue to develop clusters and deliver cluster connections across Northern Ireland and we will work to expedite the delivery timelines for clusters.

12.52 We have been looking at alternative connection methods for small-scale generation developers currently affected by capacity issues on the distribution network. In GB the Low Carbon Network Fund allowed up to £500m to support projects sponsored by the DNOs to try out new technology, and operating and commercial arrangements. No similar fund has been made available to Northern Ireland. With grid capacity in Northern Ireland now very scarce, new ways must be explored to exploit and maximise remaining capacity.

12.53 Considerable work has already been completed by NIE Networks on a new method of connecting generation customers called 'managed connections'. We will continue to develop work on this and look at the impact of other 'smart' trials that will allow further generation to connect. We expect that customers generally will look to improve energy efficiency on site through a combination of load reduction and the smarter technology approach.

This also will lead to more customers seeking zero export connection arrangements for renewables.

12.54 Ultimately both 'export' connections and 'zero export' connections rely on existing load on the grid to balance power flows. If customers pursue energy-efficient approaches, including zero export, this effectively erodes existing load ('load erosion') from the grid and, given the high levels of generation already committed on the grid, leads to power flow constraints being reached at grid substations and investment decisions being required. Our investment plan for RP6 includes investments to address this issue.

12.55 We will continue to develop our policies for connecting customers and will consult with the industry to make sure we can deal efficiently and consistently with the increased demands on scarce capacity and how that remaining capacity can best be utilised. We are proposing the reinforcement of the 33kV primary network to ease existing congestion limits allowing greater access for existing customer load reduction schemes and participation in ancillary services markets such as Demand Side Units (DSUs). This also will facilitate zero export connection arrangements for renewables.

12.56 We recognise that major connection customers in particular have a requirement for more detailed interactions with us. We intend to introduce customer account managers for customers with large jobs or those who have multiple jobs. We believe this will improve the information provided to these customers and ultimately create a better more streamlined customer experience when applying for a connection.

12.57 We will continue to work with customers and stakeholders to improve our communications about the connection process and improve the information we have in our application forms and on our website.

12.58 As previously highlighted, we are already working to facilitate the introduction of contestability in connections in Northern Ireland. The initial phase of the market opening will be for projects of 5MW or greater therefore we expect there to be much interest from the large scale generation developers and we will work closely with the industry on this. We will also provide a portal for ICPs to access all the necessary information relating to design and build of contestable network connections.

Connection timelines

- We will focus our efforts upon expediting the delivery of cluster infrastructure to enable generation connections.

Enhance the capability of the distribution network for generation connections

- Reinforce 33kV network to ease congestion and remove constraints associated with zero export connections, Demand Side Units (DSUs) and Low Carbon Technologies (LCTs).
- Complete trials to assess the viability of 'managed connections' to facilitate additional network access for customers.

Improve customer service

- Strengthen our customer service and account management for project developers seeking connections to the electricity network.
- Improve information sharing on the website including the amount of available capacity upon the network.
- Ensure information provided in documentation and online meets the needs of our customers.

Contestability in connections

- Facilitate contestability in connections for all generation connections by the end of 2017 with the initial phase of connections of 5MW and greater open to contestability at the end of May 2016.

FINANCING THE BUSINESS PLAN

a. Financeability

13.1 Our proposed core expenditure during RP6 is set out in Chapters 7 and 9. This expenditure will be financed through operating cash flows from revenue receipts, raising of new debt and retention of earnings as required. We estimate that our borrowings will increase to around £950m by the end of RP6 and that we will need to raise an additional £500m of new debt. To calculate our allowed revenues we have assumed a weighted average cost of capital (WACC) of 4.1%.

13.2 Under its licences NIE Networks must ensure that it has sufficient resources to meet its regulated activities and maintain an investment grade credit rating.

13.3 To ensure NIE Networks can meet these obligations the Utility Regulator (UR) is required to have regard to the need to secure that NIE Networks is able to finance its regulated activities. This is commonly referred to as the "financing duty".

13.4 NIE Networks will finance its activities through a mixture of debt and equity. It follows that this should be provided through a reasonable cost of equity and cost of debt in the WACC.

13.5 GB and European regulatory precedent indicates that a strong investment grade credit rating of A- / BBB+ is appropriate for a high performing network operator. NIE Networks is currently rated by Fitch (BBB+) and Standard & Poor's (BBB+).

13.6 Retention of at least a BBB+ credit rating is essential if NIE Networks is to compete effectively for new funding in the market.

13.7 Frontier Economics has assessed the long-term impact to Customers of differing credit ratings for distribution network operators (DNOs). It found that it is beneficial to customers as a whole that DNOs maintain a strong investment grade rating as it results in lower long term financing costs, which means lower bills for customers over the long term.

13.8 A satisfactory overall price control incorporating a WACC at the level set out below will support a strong investment grade rating over RP6 and allow NIE Networks to raise debt efficiently over the RP6 period.

b. Weighted Average Cost of Capital (WACC)

13.9 We have engaged economic advisers, Frontier Economics, to estimate the appropriate WACC for RP6. Based on its advice, the proposed financing cost associated with the Regulated Asset Base (RAB) is shown below.

Table 41 – WACC assumptions

	RP6
WACC (Real)	
Cost of Debt	2.6%
Cost of Equity	5.6%
Gearing	50.0%
Vanilla WACC	4.1%

13.10 The WACC (also referred to as the rate of return) reflects the cost of funding the RAB based on NIE Networks' average cost of debt; and equity.

13.11 The proposed RP6 vanilla WACC of 4.1% reflects gearing of 50%, the pre tax cost of debt and the post tax cost of equity.

13.12 An overview of the key parameters of the WACC calculation is set out below.

Inflation – 2.8%

13.13 An inflation assumption is needed to convert the nominal coupon on our debts into a real value. Regulators have tended to use either the published forecasts from the Office of Budgetary Responsibility (OBR) or implied break even inflation

as derived from the difference in yield to maturity between index linked gilts and standard gilts as calculated by the Bank of England.

13.14 The current OBR forecast is 3.0% compared to a forecast break even inflation of 2.6%.

13.15 We consider the break even inflation to be the most appropriate inflation assumption as it incorporates market expectation. However, recognising the regulatory precedent of using the OBR forecast, we consider a reasonable range for the inflation assumption to be 2.6% to 3.0%. Our point estimate is the midpoint of this range, 2.8%.

Cost of debt – 2.6%

13.16 The cost of debt measures the interest rate charged to NIE Networks by banks, corporate bond holders or other lending institutions.

13.17 The total amount of debt held by the company will change over the course of the price control period. New debt will be drawn down at differing rates to historic liabilities. As such, the cost of debt is based on a weighted average cost of existing debt and new debt to be issued in RP6.

13.18 The cost of debt for NIE Networks' existing bonds is 6.875% (£175m) and 6.375% (£400m) nominal. NIE Networks' £175m bond matures in 2018. Therefore we will incorporate the average rate of 6.527% only for one year and use the coupon rate on the 2026 bond (6.375%) for the remaining years of RP6. This results in a total embedded debt cost during the period of 6.4%.

13.19 We anticipate a requirement to raise £500m of new debt during RP6. The cost of new debt is forecast at 4.65% nominal. This is based on an estimate of the cost of new debt by considering recent short term market evidence on gilt yield and debt spread on any forward projection and including an issuance cost of 30 basis points, consistent with market evidence and recent regulatory precedent.

13.20 Taking the cost of embedded debt and new debt together, the weighted average cost of debt is estimated at 5.43% nominal.

13.21 Applying the inflation assumption detailed above, we estimate the real cost of debt for RP6 to be 2.56%.

Cost of equity – 5.6%

13.22 The cost of equity is the return an equity investor will require to provide equity financing.

13.23 The standard methodology used to calculate the cost of equity is the capital asset pricing model (CAPM).

13.24 The cost of equity comprises a risk-free rate plus a degree of non-diversifiable risk that is inherent to the market.

13.25 The risk-free rate is determined by reference to inflation linked government bonds and regulatory precedents. On this basis, NIE Networks has estimated the risk-free rate at 1.25%.

13.26 In estimating the cost of equity, we have also considered the equity risk premium (ERP) and equity beta. The ERP is the premium expected by shareholders in return for holding risky equities rather than risk free securities. The equity beta reflects the systematic risk of the business sector.

13.27 The ERP is estimated by calculating historical total market returns of equities over an extended period against a benchmarked risk-free asset. On this basis NIE Networks has forecast the total ERP as 5.25%.

13.28 The asset beta (equity beta assuming zero gearing level) is estimated by comparing betas of

listed comparators. NIE Networks has determined the appropriate asset beta is 0.44.

Table 42 – cost of equity assumptions

	RP6
Risk Free Rate	1.25%
Equity Risk Premium	5.25%
Total Market Return	6.50%
Asset Bets	0.44
Cost of Equity	5.6%

13.29 Combining the above using the CAPM methodology results in a post-tax cost of equity of 5.6%.

Gearing – 50%

13.30 Gearing is the proportion of the regulated asset base that is funded through debt.

13.31 When determining an appropriate gearing level for RP6 we have given consideration to: the current level of gearing; the forecast funding requirement; industry precedent; and rating agency guidance.

13.32 NIE Networks has determined that an average gearing level of 50% across RP6 is appropriate.

Vanilla WACC – 4.1%

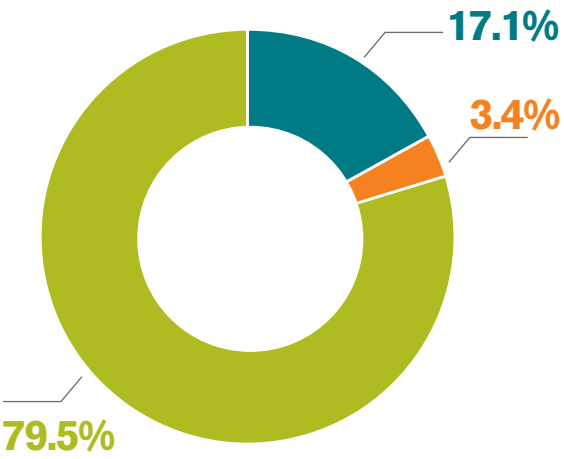
13.33 The Vanilla WACC is derived from the post-tax cost of equity, pre-tax cost of debt and gearing assumptions above.

IMPACT ON CUSTOMERS' BILLS

a. Introduction

14.1 NIE Networks derives its revenue principally through charges for use of the distribution system levied on electricity suppliers and charges for use of the transmission system levied on SONI. Our network charges represented approximately 21% of the final electricity bill, on average, for the 2015/16 tariff year. This percentage will vary each year depending on electricity wholesale prices and other costs which make up the final bill.

Figure 20 – NIE Networks costs as a % of the final bill



- Charges relating to the distribution system (including Market Operations)
- Charges for use of the transmission system
- Generation, transmission system operator and supply costs

14.2 Our network charges have reduced by 33% since privatisation. A study by the Utility Regulator (UR) in August 2014 concluded that network charges in Northern Ireland, Great Britain and the Republic of Ireland are similar.

b. How we set distribution network tariffs

14.3 Distribution tariffs are set annually to recover allowed revenues under the price control. Our distribution licence requires us to set tariffs such that they are (1) non-discriminatory between customer groups, and (2) treat all customers the same irrespective of geographical location.

14.4 To satisfy these requirements we use cost reflective principles for the calculation of charges. There are 49 individual tariffs covering domestic, SME, unmetered and large energy users. The tariffs are determined by customer characteristics i.e. customer type, connected voltage, max capacity and meter type.

14.5 Annual tariff movements will depend on the fixed and variable components of each tariff. There are two main components in each distribution tariff:

- fixed charges levied per customer (standing charges); and
- variable load related charges (kWh, kVarh and kVA).

14.6 Fixed charges recover costs which will not vary with customer load such as meters, meter reading and billing.

14.7 Variable load related charges recover costs associated with providing, operating and maintaining the distribution network. There are three main steps to allocating load related costs:

- **Step 1** – network costs are modelled for each voltage and transformation level;
- **Step 2** – the cost for each network level from Step 1 is allocated to seven time bands. Capital costs are allocated to the times of peak demand;
- **Step 3** – the cost in respect of each time band from Step 2 is allocated to customer groups in proportion to their contribution to the use of the network level (based on customer profiles).

14.8 Under the cost reflective model, customers only pay for the parts of the network they use. Tariffs are set annually for the period 1 October to 30 September. All tariffs are approved by the UR.

c. Transmission network charges

14.9 We recover the cost of the transmission network through charges to SONI via 12 fixed monthly charges.

14.10 SONI is responsible for the billing and allocation of these charges to suppliers and generators.

d. Impact on customers' bills

14.11 In the previous chapters of the plan we have explained and shown forecasts for the following:

- core expenditure – capital expenditure, network operating costs and indirect costs;
- market operations;
- pensions deficit repair payments;
- rates and licence fees; and
- financing costs – cost of debt and cost of equity.

14.12 Our core expenditure costs (totex costs) are split between fast pot and slow pot:

- fast pot costs are allowed in the year in which the expenditure is incurred; and
- slow pot costs are added to the Regulated Asset Base (RAB) and allowed over a number of years to reflect the long term value of network assets.

14.13 Our customer bills are therefore made-up of the following items:

- fast pot costs;
- depreciation on RP6 slow pot costs;
- depreciation on previous price control slow pot costs;
- pensions deficit repair payments;
- rates and licence fees; and
- tax and financing costs.

14.14 Network charges are projected to increase by 1.2% per annum on average during RP6 reflecting increased depreciation and financing costs associated with slow pot costs which are added to the Regulated Asset Base (RAB). The majority of these costs are recovered over 40 years to reflect the long term value of network assets.

14.15 The annual increase in customers' bills is summarised in the table below. **See Table 43.**

14.16 The percentage increase in the retail bill is less than the 1.2% increase in network charges because network charges, on average, only makes up around 21% of the total retail bill which includes electricity generation and supplier costs. Network charges make up around 25% of the total retail for domestic and 22% for small business customers. For large energy users and small- to medium-size enterprise customers, network charges represent between 5% and 18% of the total retail bill.

14.17 Table 44 shows a comparison of average network charges at the end of RP6 (2023/24) compared to the last full year of RP5 (2016/17).

Table 43 – RP6 average annual increase in network charges (2016/17 to 2023/24)

Customer group	Increase in network charges, £/annum	Increase in retail bill, %/annum
Domestic customers	1.5	0.28
Small businesses, max demand < 70kVA	7	0.25
Small and medium sized enterprises, max demand > 70 kVA	109	0.21
Large energy users connected at LV and HV, max demand > 1MW	855	0.12
Large energy users connected at 33kV, max demand > 1MW	2,293	0.07

Table 44 – forecast average network charges in 2016/17 and 2023/24

Customer group	Number of customers	Average networks charges at the end of RP5			Average networks charges at the end of RP6		
		Distribution £/annum	Transmission £/annum	Total £/annum	Distribution £/annum	Transmission £/annum	Total £/annum
Domestic	790,000	115	15	**130**	123	17	**140**
Small business <70kVA	65,000	538	75	**614**	579	83	**663**
SME > 70kVA	5,000	8,187	1,343	**9,530**	8,807	1,485	**10,292**
LV & HV LEU > 1MW	172	54,248	17,789	**72,037**	58,358	19,667	**78,025**
33kV LEU>1 MW	18	96,584	82,711	**179,294**	103,902	91,441	**195,343**

e. Revenue request for RP6

14.18 Our distribution revenue request for RP6 amounts to £1,284.3m in 2015/16 prices as shown in the table below.

Table 45 – distribution revenue request for RP6, £m

Revenue £m at 2015/16 Prices

Distribution	RP5 average per year	RP6 average per year	Revenue Profile in RP6							Total RP6
			6 months to Mar-18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	
Financing Costs	39.6	44.5	20.8	42.5	43.5	44.4	45.2	46.0	46.8	289.3
Depreciation on Slow Pot Costs (RAB)	54.6	64.5	30.1	61.6	62.9	64.2	65.7	67.0	68.0	419.5
Taxation Payments	8.1	7.0	3.7	7.5	7.5	6.6	6.7	6.8	6.8	45.5
Fast Pot Costs	30.4	32.2	15.7	31.5	31.6	31.9	32.3	33.1	33.1	209.2
Rates and Licence Fees	13.4	15.2	7.5	15.2	15.3	15.3	15.3	15.3	15.3	99.1
Pension Deficit Repair Payments	9.7	9.9	4.9	9.9	9.9	9.9	9.9	9.9	10.0	64.5
Total	155.8	173.4	82.8	168.1	170.7	172.2	175.1	178.1	180.0	1,127.1

Market Operations	RP5 average per year	RP6 average per year	Revenue Profile in RP6							Total RP6
			6 months to Mar-18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	
Financing Costs	2.0	2.4	1.1	2.5	2.5	2.5	2.4	2.4	2.4	15.8
Depreciation on Slow Pot Costs (RAB)	11.8	9.1	4.1	9.0	9.3	10.0	10.7	8.1	7.7	58.9
Taxation Payments	1.0	0.2	0.0	0.0	0.2	0.4	0.6	0.1	0.0	1.4
Fast Pot Costs	11.0	12.5	6.2	12.4	12.4	12.4	12.5	12.7	12.7	81.3
Total	25.9	24.2	11.4	23.9	24.4	25.3	26.2	23.3	22.9	157.3

Distribution Use of System (DUoS)	RP5 average per year	RP6 average per year	Revenue Profile in RP6							Total RP6
			6 months to Mar-18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	
Financing Costs	41.6	46.9	22.0	45.0	46.0	46.9	47.6	48.4	49.2	305.1
Depreciation on Slow Pot Costs (RAB)	66.5	73.6	34.2	70.6	72.2	74.2	76.4	75.1	75.7	478.3
Taxation Payments	9.1	7.2	3.6	7.5	7.7	7.0	7.3	6.9	6.8	46.9
Fast Pot Costs	41.5	44.7	21.9	43.9	44.0	44.3	44.8	45.8	45.8	290.5
Rates and Licence Fees	13.4	15.2	7.5	15.2	15.3	15.3	15.3	15.3	15.3	99.1
Pension Deficit Repair Payments	9.7	9.9	4.9	9.9	9.9	9.9	9.9	9.9	10.0	64.5
Total	181.7	197.6	94.2	192.0	195.0	197.5	201.3	201.4	202.8	1,284.3

14.19 Our transmission revenue request for RP6 amounts to £278.2m, as shown in the table below. **See Table 46.**

14.20 Our transmission revenue request excludes costs associated with potential load related projects which are uncertain and have not yet been approved by the UR. Potential projects which may commence during RP6 are summarised in Chapter 10. The UR will assess the relative merits of these projects on a case by case basis having regard to the project costs and benefits.

14.21 Rates and pension deficit costs have been allocated between the distribution and transmission businesses based on the size of their respective RABs. The RP5 pensions deficit costs are shown on the same basis for comparison purposes. The RP5 figures for rates post the 1 April 2015 valuation are also allocated based on RAB size. The rates figures for the first three years of RP5 are based on the rates formula which applied pre 1 April 2015. Licence fees have been allocated between transmission and distribution based on headcount.

Table 46 – transmission revenue request for RP6, £m

Transmission Service Charge	RP5 average per year	RP6 average per year	6 months to Mar-18	Revenue Profile in RP6						Total RP6
				2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	
Financing Costs	11.0	14.2	6.6	13.7	14.0	14.3	14.5	14.7	14.7	92.4
Depreciation on Slow Pot Costs (RAB)	13.2	16.8	7.7	16.0	16.4	16.8	17.2	17.6	17.8	109.5
Taxation Payments	1.7	1.4	0.5	1.3	1.4	1.2	1.3	1.4	1.6	8.8
Fast Pot Costs	5.9	3.0	1.4	2.9	2.9	2.9	3.0	3.0	3.1	19.2
Rates and Licence Fees	3.6	4.4	2.2	4.4	4.4	4.4	4.4	4.4	4.4	28.7
Pension Deficit Repair Payments	2.6	3.0	1.5	3.0	3.0	3.0	3.0	3.0	2.9	19.5
Total	38.1	42.8	20.0	41.4	42.1	42.7	43.5	44.1	44.5	278.2

GLOSSARY

Capita	Capita Managed IT Solutions (previously known as Northgate Managed Services Limited) – contracted to NIE Networks to provide managed IT and business process services.
Capital expenditure (Capex)	Expenditure on investment in long-lived distribution assets, such as underground cables, overhead electricity lines and substations.
CCNI	Consumer Council for Northern Ireland.
CMA	Competition and Markets Authority (previously known as the Competition Commission).
Cost benefit analysis (CBA)	A methodology that compares the costs of carrying out an investment against the benefits (such as risk reduction or service improvement) to compare different options and demonstrate value for money.
Cost of debt	The effective interest rate that a company pays for its loans.
Cost of equity	The rate of return on investment required by a company's shareholders.
Customer Interruptions (CIs)	The number of times customers experience supply interruptions of more than one minute duration per 100 connected customers.
Customer Minutes Lost (CMLs)	The average number of minutes customers are off supply per annum.
Department for the Economy	The recently-formed NI government department which encompasses the functions of the former Department of Enterprise, Trade and Investment (DETI) and the former functions of the Department of Employment and Learning (DEL) with the exception of the Employment Service.
DETI	The former Department of Enterprise, Trade and Investment, whose functions are now carried out by the Department for the Economy.
Distributed generation (DG)	Generation connected to the distribution network. It includes wind turbines, domestic solar panels, large scale photo-voltaic farms, hydro-electric power and biomass generators.
Distribution network	33kV and lower voltage networks. The networks forming part of the distribution network, including in each case any electrical plant and/or meters used in connection with distribution.
Distribution network operators (DNOs)	The holders of an electricity distribution licence in GB are commonly referred to as the GB DNOs. There are 14 DNOs in GB, which are owned by six different groups.
Distribution Use of System (DUoS)	These are the charges levied to suppliers for costs that can be recovered from customers. The amount is determined through price control reviews.

EA Technology	EA Technology is a research company that has been contracted jointly by all DNOs to develop and maintain a model (registered name Transform) to assess the cost of the impact of low carbon technologies on the network.
ESQCR	Electricity, Safety, Quality and Continuity Regulations (Northern Ireland) 2012 specify safety standards which are aimed at protecting the general public and customers from danger.
Enduring Solution (ES)	An IT project directed at facilitating the competitive supply market and customer switching.
Fast pot	Fast pot is the revenue that is recovered in the year of expenditure.
Frontier	Frontier Economics Limited. Economic advisers to NIE Networks.
Gearing	A ratio measuring the extent to which a company is financed through borrowing.
GB	Great Britain.
Guaranteed Standards (and Overall Standards) of Performance	Guaranteed and Overall Standards of Performance set minimum service levels to be met across a range of activities covering supply interruptions, appointments and connections.
Health and Safety Executive Northern Ireland (HSENI)	A Government organisation that has the responsibility of enforcing health and safety legislation.
Health Index (HI)	Framework for collating information on the health (or condition) of distribution assets and for tracking changes in their condition over time.
IME3 Directive	Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009.
IMF&T	Inspections, maintenance, faults and tree-cutting.
Injurious affection	The diminution in value to a property caused by the existence and/or use of public works carried out under, or in the shadow of, compulsory powers.
Large scale generation (LSG)	In context of renewable generation, this term is used to describe generator installations typically in the size range 5MW to 40MW. LSG mainly takes the form of wind farms but solar farms feature as well, and are likely to play a more significant part going forward. LSG connects to the transmission network (at 110kV) and the distribution network (typically at 33kV). LSG output is typically under the direct operational control of SONI, with aspects of control being the responsibility of NIE Networks.

Load Index (LI)	Framework, introduced as part of DPCR5, demonstrating the utilisation of individual substations or groups of interconnected substations. It is used as a secondary deliverable capturing the effects of load-related investment.
Low Carbon Technology (LCT)	This is the collective term for devices that reduce the amount of carbon being used for heating, transport and generation. It includes electric vehicles, heat pumps and solar generation.
Micro generation (MG)	In context of renewable generation, this term is used to describe very small generator installations with generation capacity in the range of 4kW to 12kW. Typical examples are photovoltaic (PV) panels on domestic rooftops. MG normally connects directly to customer premises at 230V single phase or 400V three phase. Whereas applications for large scale generation (LSG) and small scale generation (SSG) are assessed in some detail to determine their impact on the NIE Networks distribution network, most MG is connected on a 'fit and inform' basis, in a category referred to as 'G83 connections'. This means that NIE Networks has very limited control over the rise in G83 connections.
NERA	NERA Economic Consulting. Economic advisers to NIE Networks.
NI	Northern Ireland.
NIE Networks	Northern Ireland Electricity Networks Limited.
NIEPS	Northern Ireland Electricity Pension Scheme.
NIRO	Northern Ireland Renewables Obligation. The main support mechanism for encouraging increased renewable electricity generation in Northern Ireland.
Office of Gas and Electricity Markets (Ofgem)	Ofgem is responsible for regulating the gas and electricity markets in Great Britain to ensure customers' needs are protected.
Opex	Operating expenditure. The costs of the day-to-day operation of the network such as staff costs, repairs and maintenance expenditures, and overhead.
PAS 55	Publicly Available Standard 55. A standard developed by the Institute of Asset Management for carrying out asset management. The standard covers 28 elements of asset management including specification of objectives, risk management, performance and condition monitoring, development of work plans, progress monitoring, and continuous improvement, underpinned by the commitment of senior management.

Project 40	Project 40 is an initiative established by NIE Networks in May 2014, to enable further large scale, small scale and microgeneration renewables connections in line with the 2020 targets for energy consumption from renewables. As part of Project 40, NIE Networks is assessing best practice in GB and considering a range of technical and commercial options to optimise network access and the delivery of renewable generation to the network.
RAB	Regulatory Asset Base. The value ascribed by the Utility Regulator to the capital employed in the NIE Networks' regulated businesses. The RAB is calculated by summing an estimate of the initial market value of the regulated asset base at privatisation and all subsequent allowed additions to it at historical cost, and deducting annual depreciation amounts calculated in accordance with established regulatory methods. The revenues NIE Networks is allowed to earn under the price control include allowances for the regulatory depreciation and also for the return investors are estimated to require to provide the capital.
RASW	Road and Street Works legislation.
Real Price Effects (RPE)	Increase in prices, of materials, direct staff or contract labour, over and above increases in the Retail Price Index.
Resilience tree cutting	This is the full removal or extensive cutting of trees that are found to be within the falling distance of overhead power lines. This ensures that they cannot cause damage to the power lines in the event of severe weather.
Revenue = incentives + innovation + outputs (RIIO)	Ofgem introduced a new regulatory framework in 2010 replacing previous RPI-X regime. It places more emphasis on incentives to drive the innovation needed to deliver a sustainable energy network at value for money to existing and future consumers.
RIGs	Regulatory Instructions and Guidance.
RIIO-ED1	This is the first electricity distribution price control by Ofgem under the new RIIO. The price control is set for an eight-year period from 1 April 2015 to 31 March 2023.
RoI	Republic of Ireland.
RP5 (Regulatory Period 5)	This is the name given to the price control for NIE Networks covering the period from 1 April 2012 to 30 September 2017.
RP6 (Regulatory Period 6)	This is the name given to the price control for NIE Networks which will cover the period from 1 October 2017 to 31 March 2024.

RPI	Retail Price Index.
SEF	Strategic Energy Framework, produced by DETI to outline the direction for energy policy in Northern Ireland.
Slow pot	Slow pot is where costs are added to the RAB and revenues allow recovery of the costs over time together with the cost of financing this expenditure in the interim.
Small scale generation (SSG)	In context of renewable generation, this term is used to describe generator installations including single wind turbines, anaerobic digesters or small solar installations in the size range 20kW to 500kW. Popular sizes are 250kW for single turbines and 500kW for anaerobic digesters, which aligned with incentive (ROCs) bands. SSG connects to the distribution network; normally to LV and 11kV lines fed from 33kV/11kV primary substations. SSG output is not controlled.
Smart grid	A generic term for a range of measures that are used to operate electricity networks allowing more generation or demand (load) to be connected to a given electricity circuit without the need for traditional reinforcement (or upgrade) of that equipment.
Smart technology	The application of innovation to develop a smarter electricity network that uses information and communications technology to gather and act on knowledge from the network and customers to improve the efficiency, reliability, economics and sustainability of the transmission and distribution of electricity.
SoCC	Statement of Connection Charges.
SONI	Transmission System Operator for Northern Ireland.
TIA	Transmission Interface Arrangements. A document developed by NIE Networks and SONI, and approved by the UR, which sets out the processes and working arrangements that NIE Networks and SONI will follow and adhere to, when working together on transmission system activities and/or projects.
Transform model	The model developed by EA Technology which uses a representation of the network and calculates the investment needed to accommodate LCTs using either smart grid solutions or traditional network reinforcement. The smart solutions include 'demand side response' as well as additional technology to move load around the network and utilise the full capacity of assets.

Transmission network	110kV and above. The network of high voltage electric lines and cables operating at 110kV and above, which is used for the transmission of electricity.
TSO	Transmission System Operator. In Northern Ireland, this role is carried out by SONI.
Utility Regulator (UR)	The Northern Ireland Authority for Utility Regulation.
Vanilla Weighted Average Cost of Capital (Vanilla WACC)	This is the combined cost rate of funding calculated using a pre-tax cost of debt and post-tax cost of equity weighted by notional gearing.
Vulnerable customers	Customers who are medically dependent upon electricity and have special communication requirements or have other special needs with a dependence upon electricity (e.g. stair lift).
WACC	Weighted average cost of capital. Also referred to as the “rate of return”.
Wayleave	Provides rights for an electricity company to install and retain its apparatus, either underground cables or overhead lines across land with annual payments being made to the landowner and occupier.
Worst-served customers	Customers who experience six or more interruptions within an 18-month period.
WSP-Parsons Brinckerhoff	Engineering advisers to NIE Networks.

Fast resolution of power cuts is important to customers

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