Losses strategy

Our losses strategy which sets out the challenges we face, our approach to losses management to address these challenges, and the principles and themes that guide our thinking.

March 2021

About Electricity North West

Electricity North West Limited is one of 14 electricity distribution network operators (DNOs) in Great Britain. We are responsible for maintaining and upgrading 56,000km of network and nearly 500 major substations across the region. We supply electricity to the diverse communities in the North West of England which extends from Macclesfield all the way up to Carlisle.

We are regulated by the Office of Gas and Electricity Markets (Ofgem) who provide DNOs with their licence to operate and decide what's fair for us to charge our customers for each price control period.

Our current price control began in 2015 and runs to 2023. It's referred to as RIIO-ED1. In full, that stands for Revenue = Incentives + Innovation + Outputs, Electricity Distribution 1. Under this framework, the price we can charge our customers is fixed until the next price control, RIIO-ED2, which will run from 2023 until 2028.

The period of time which the RIIO-ED2 price control covers will see significant change in the way electricity is generated, consumed and stored, driving innovation across the whole energy system both now and into the future.

Review and approval

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Contents

1. Welcome

Welcome to our losses strategy which sets out the challenges we face, our approach to losses management to address these challenges, and the principles and themes that guide our thinking. We expect RIIO-ED2 to be a crucial period in the transition of our network to net zero carbon, and we have set out our future vision for losses management over this period and how our approach can support this transition.

When electricity is generated in a power station, not all of the electrical energy which flows through the power network reaches the customer. This is because power networks, both transmission and distribution, use up some of the energy in the process of transporting the electricity to customers. The energy used in transportation, known as losses, costs customers money and contributes to carbon emissions. These losses can be reduced in various ways but these measures also cost money. We are committed to determining the appropriate balance between investing to reduce losses and saving money for customers, by lowering the energy lost during transportation.

Our industry regulator, Ofgem, helps us to determine this balance by providing guidance on the value that we should place on saving losses when making its calculations. This includes some of the wider benefits which customers obtain through reduced network losses, such as lower carbon and other greenhouse gas emissions.

In this document we outline our strategy to manage losses on our distribution network to the lowest economically reasonable level, taking account of the costs and benefits of a variety of potential actions and initiatives.

The management of losses is not always straightforward. Some losses are associated with the technical characteristics of the electricity network ('technical' losses), while other losses are more to do with measurement and billing ('non-technical' losses). Successful and efficient reduction of losses involves the coordination of many functions and departments across our business, including our engineering, commercial and administrative teams.

In 2019, the UK became the first major economy in the world to pass laws to end its contribution to global warming and achieve net zero carbon by 2050. Net zero will lead to unparalleled changes in the way our customers use our network. It is anticipated that demand for electricity will double as customers turn to electricity to power their cars and heat their homes. At the same time customers will want to generate their own electricity and connect it to the distribution network at unprecedented levels, whereas traditionally, generation was connected at the transmission level as part of a passive one-directional system.

These changes in our customers' behaviour will impact technical losses negatively because the utilisation of our existing network will need to increase to avoid expensive network interventions. Failure to reach renewable energy targets could result in the UK falling short on environmental commitments, hence economic prudence is required on the part of the DNO to balance the management of losses and network transition.

We have examined the potential to reduce network losses through the application of various alternative investment strategies and are adopting, as policy, only those strategies that deliver clear positive benefits for our customers. We also plan to maintain and expand our activities to investigate and minimise non-technical losses, such as theft.

We continually review the potential for reducing the losses on our network. Our thinking is formally presented in this latest detailed strategy for losses management. We hope this document will help you understand how losses management supports our plans for the future of our network. If you have any comments or feedback, please get in touch.

Steve Cox
Engineering and technical director

2. Summary of actions

As part of this strategy we have identified a number of priorities for reducing both technical and non-technical losses. These priorities are summarised in Figure 1.

Figure 1: Summary of actions to manage losses

Investment	Actions	
Technical losses		
Distribution transformers (ground-mounted)	We will proactively replace old (pre-1990) large, ground-mounted, secondary network transformers with capacities of 800kVA and 1000kVA with the latest lower loss EU Eco transformers were cost effective	Proactive
Distribution transformers (pole-mounted) Typically 11kV/LV	Whenever we are required to install or replace one of our larger pole-mounted secondary network transformers, we will do so with a lower loss unit which complies with the latest European Union standard (EU Eco-design) specification where applicable and when the opportunity arises	Opportunistic
Primary transformers Typically 33/11kV	Whenever we are required to install or replace one of our grid transformers, we will undertake a full, dedicated, project-specific assessment to determine the best type of transformer to install for the purpose of managing losses via a ROCBA. New transformers will comply with the latest EU Eco-design specification as a minimum	Opportunistic
Grid transformers Typically 132/33kV	Whenever we are required to install or replace one of our grid transformers, we will undertake a full, dedicated, project-specific assessment to determine the best type of transformer to install for the purpose of managing losses via a ROCBA. New transformers will comply with the latest EU Eco-design specification as a minimum	Opportunistic
Cables (high voltage and low voltage)	We will install large cross-section cables ($300mm^2$) at both high voltage (HV) and low voltage (LV) as standard – instead of the current mix of smaller ($95mm^2$ and $185mm^2$ cables)	Opportunistic
Non-technical losses		
Transactional theft	We will continue to work alongside suppliers to help reduce transactional theft, providing assistance where necessary	Proactive
	We will monitor and share best practice with other DNOs	Proactive
Theft in conveyance	We will continue to develop our theft in conveyance services to ensure that we have the processes and reporting in place to ensure compliance with Ofgem requirements	Proactive
	We will increase the number of investigations undertaken through a more systematic approach to identifying cases. For example, we will follow-up with 'potential customers' who applied for a connection, but then didn't complete the connection process	Proactive
	We will monitor and share best practice with other DNOs	Proactive
Unmetered supplies	We will continue to undertake regular audits of the unmetered supply inventories to check for accuracy	Proactive
Latest information		
Innovation	We will review and analyse the details of innovation projects, particularly where valuable insights on the management of losses have been identified	Proactive

3. Introduction

3.1 Losses strategy objectives

In this document we outline our strategy to manage losses on our distribution network to the lowest economically reasonable level, taking account of the costs and benefits of a variety of potential actions and initiatives. Producing a losses strategy is part of our license requirement and we are required to report losses to our industry regulator, Ofgem. To make sure we are applying best practice, we continually review current and future interventions to help manage losses on our network.

3.2 Document structure

This document has been written to provide the reader with an overall appreciation of our approach to losses management. The document starts with providing a background to how losses are produced and split into different categories namely 'technical' and 'non-technical' losses. This is followed by details of our methodology and how we are contributing to the knowledge base for losses management. Our final section details our current activities for managing losses providing details on our robust cost benefit analysis (CBA) process.

4. Background

In this section we describe how losses are produced and broken into technical (network) and non-technical (commercial) losses. It also serves to provide an understanding of the difficulty in measuring losses within an electrical network and gives an overview on the issues UK DNOs will face in terms of losses management as we transition towards net zero carbon in 2050.

4.1 What are losses

Distribution losses are a measure of the electrical energy entering the distribution network, and the electrical energy that is consumed by customers. Distribution losses can be broken into two categories:

- Technical losses
- Non-technical losses.

Technical losses are a measure of the amount of electrical energy used up in the transportation of power for distribution networks. Non-technical losses, also known as commercial losses, refers to energy leaving the distribution network which is not measured or accounted for; this is presented as lost energy.

Electrical power losses are usually measured in kilowatts (kW) or megawatts (MW). The lost energy associated with this loss is usually measured in kilowatt-hours per year (kWh/year) or megawatt-hours per year (MWh/year).

4.2 Technical losses

Technical losses are a measure of the amount of electrical energy used up in the transportation of power for distribution networks. Cables, overhead lines and transformers used to transfer or distribute electricity to and from customers have resistance and therefore use up electrical power, usually through getting hot.

As a result, no electrical system can be 100% efficient in its delivery of electrical energy. Technical losses can be further segregated into losses that remain largely the same, irrespective of the electrical loading on the network ('fixed' losses), and those whose level changes according to the amount of electricity supplied ('variable' losses).

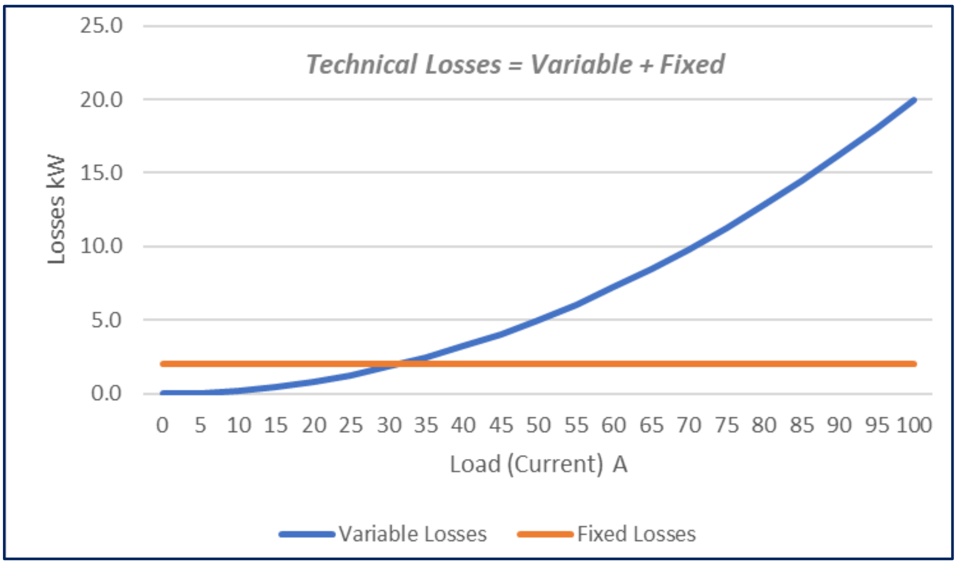
4.2.1 Fixed losses

Some electrical energy is used by network components and equipment as a result of being connected to the network and made 'live' (energised). These losses are independent of how much electrical energy the network delivers. An example of this is power transformers which produce energy losses even when not loaded or carrying current; as long as they are connected to the live network they will consume energy creating losses internally and contribute to overall system technical losses. Transformers represent a significant source of *fixed* losses on the distribution network, but they also give rise to losses which are dependent on the amount of load, or current, which is being delivered through the equipment.

4.2.2 Variable losses

Variable losses are those which increase as the electrical load or current on the network increases. Variable losses are mainly due to the electrical resistance of the network. The higher the current carried by a cable, line or transformer, the higher the variable losses. In fact, the relationship between current and the level of variable power loss is such that if the current doubles, the power loss is four times higher.

Figure 2: Graphical representation of variable and fixed losses



Electrical power can be distributed more efficiently at higher voltages; because for a given amount of power a higher voltage means lower current, and therefore lower losses. This is why the distribution of large amounts of energy in bulk from town-to-town occurs at high voltage (HV). The vast majority of customers cannot use HV electricity, so we need to install transformers to reduce the voltage to a level which can be readily used by our customers. These transformers also produce losses and so we need to carefully design our network so as to 'optimise' losses through balancing the length of HV and LV circuits and the number of transformers.

Typical losses (technical plus non-technical) at each voltage level on our network are shown in Figure 3.

Figure 3: Typical losses breakdown per voltage level

Voltage level	Typical losses as percentage of total energy
132kV*	0.7%
33kV+	1.0%
HV+	1.2%
LV+	3.1%
Total	**6.0%**

*excludes losses from supergrid transformers and transmission network
+include losses from the indicated voltage level and immediate upstream transformation level (e.g. figure shown for 33kV comprises losses at 33kV and 132/33kV transformers)

4.3 Non-technical losses

Non-technical losses are associated with the energy which cannot be accounted for once the technical losses have been fully considered. These losses relate more to commercial activity than to the physical technical characteristics of the network and include illegal abstraction of electricity (i.e. theft), as well as errors in measuring and recording energy.

Non-technical losses are more difficult to measure because they result from behaviour that is not always known about, or accounted for, by us. There are two main sources of non-technical losses, theft and unmetered supplies.

4.3.1 Theft

We take theft of electricity extremely seriously. Electricity which is stolen is not accounted for and is not part of the national energy settlement system. There are several ways in which electricity can be taken from the network illegally. An illegal connection to our network is one which is not known about, or authorised, by us and which provides electricity, often unsafely, without account or payment. Other forms of theft occur where the meter has been interfered with so that it records a lower amount of energy than is being consumed.

There are two distinct areas of electricity theft that we actively manage. These are:

- Transactional theft
- Theft in conveyance.

Transactional theft

All metered customers are allocated a unique Meter Point Administration Number (MPAN) and purchase electricity from a supplier. Transactional theft is where electricity is illegally abstracted from a connection point, within the boundary of a customer's property, that is registered to a supplier.

Electricity suppliers have primary responsibility for reducing transactional theft. We work with them to provide support to reduce this activity.

Theft in conveyance

Theft in conveyance is our responsibility and is defined as any illegal abstraction of electricity for use other than at premises where any metering points or metering systems are registered by a supplier.

Theft in conveyance can occur where new connections are unauthorised or where illegal reconnection takes place (e.g. after a formal disconnection). Theft in conveyance can also sometimes occur where the connections process is incomplete.

4.3.2 Inaccurate information associated with unmetered supplies

There are many items of electrical equipment where it is neither practical, nor cost-effective, to measure energy consumption using conventional meters. Examples include street furniture (street lighting columns, bollards, traffic signals), car-park lighting, automatic vehicle number plate recognition, car-park ticket machines, advertising boards etc. An 'unmetered supply' relates to any item of equipment that takes a supply of electricity from the network without a meter recording its energy consumption.

Of the total energy we distribute each year, approximately 1-1.4% is attributed to (authorised) unmetered connections.

In the case of unmetered supplies (UMS), the energy used is determined from information on the electrical power rating of the equipment (kW), together with an assessment of the time for which the equipment is taking a supply of electricity (hours). This enables the total estimated energy (kWh) to be calculated, and provides the basis for billing, and for the allocation of losses to unmetered supplies.

The estimation of network losses is affected by any inaccuracy in the information on the number, or power rating, of unmetered equipment connected to the network. If, for example, a number of street lighting columns are missing from the information records, then the energy used in these lamps will be accounted for as network losses. Records can become inaccurate if the party responsible for populating the records loses track of what is installed, removed or modified. For street lighting, the party responsible for the records is often the local authority or council.

Where a single UMS customer has a large number of unmetered connections, for example a highway authority, then energy consumption is calculated on a half-hourly (HH) basis. This HH data is then treated in the energy settlement system in the same way as conventional HH metering. These larger HH UMS customers are required to provide detailed inventories of all UMS equipment to us every month.

Non-half-hourly (NHH) UMS customers are made up of a large number of smaller unmetered connections, such as street-lighting for smaller parish councils, car-park lighting, automatic vehicle number plate recognition, car-park ticket machines, advertising boards etc. NHH customers are still required to hold accurate inventories of their unmetered equipment and these form the basis of an 'UMS Certificate' which includes estimated annual energy consumption. This estimate of annual energy consumption is updated every year and is subject to numerous quality checks to help ensure all UMS energy is accounted for. This is important as the cost of all losses, including any unknown UMS, are paid for by metered customers.

4.4 Measuring losses

There are a number of factors which affect the accuracy of quantifying losses. Firstly, losses are not measured directly but are determined by comparing the electrical energy generated onto the network minus the value of energy billed to our customers. Hence, losses are the difference between two large numbers which are subject to their own measurement tolerances, making it difficult to quantify losses accurately. This is compounded by the different standards of metering accuracy across the voltage levels, ranging from highly accurate metering at our grid supply points (GSPs) and power station outputs to HV connections and smaller LV domestic metering where the statutory compliance limits for accuracy have a tolerance of +2.5/-3.5%. Overall this creates a large tolerance on losses which are small.

Secondly, the smart meter rollout (SMETS 2) may provide greater accuracy in understanding network power flows with fewer approximations, but the utilisation of such a solution will be dependent on the availability and disaggregation of data provided to DNOs. Also, smart meters may consume more energy than their traditional counterparts which may not be accounted for.

4.5 Influences on losses/future losses

As the UK's electrical network transitions further towards the use of low carbon and renewable technologies, DNO networks are set to increase the utilisation of assets. As a result, our technical losses will increase as heat pumps, electric vehicles and low carbon distributed generation connected at LV, HV and 33kV become more commonplace, and are managed via smart solutions as an alternative to more expensive traditional reinforcement.

Increasing the uptake of low carbon technologies (LCTs) is essential to avoid the UK falling short on environmental commitments, therefore understanding the impact of increased LCT penetration on losses will be key to informing losses management. Losses will become more dependent on consumer LCT adoption and participation in smart flexible services (e.g. demand side response). Economic prudence on the part of the DNO will have to balance the cost of losses against smart solutions that act as alternatives to traditional reinforcement as both impact the cost to the customer.

4.6 Techniques for managing controllable losses

It is important to note that losses are complex and subject to the amount of electricity customers consume or generate. Factors such as network topology, LCT uptake and distributed generation penetration can affect the amount of variable losses on the system. The application and profile of electricity consumption depend on customers and are not controllable by the DNOs, but there are a number of techniques employed for managing controllable losses.

A common way of managing network losses is to replace individual items of network equipment with equivalent assets that are more efficient i.e. have lower losses. This most commonly applies to underground cables and transformers which represent the largest source of losses. Network switches and other types of switchgear do not generally create losses and so do not usually form part of any plan for the reduction of losses.

Another way of managing losses is through smart solutions that actively manage the network in real time to achieve optimal running performance. This can be achieved through techniques like voltage management or flexible services that utilise and/or constrain loading/generation to prevent undesirable running conditions (i.e. overloading).

We are continuing to undertake a proactive and opportunistic asset replacement programme of higher loss equipment with a lower loss specification (e.g. transformers adhering to the latest EU specification and mainline cables with larger cross-sectional areas to reduce resistance and hence losses).

We are also undertaking a number of trials within the area of voltage optimisation which will be utilised to contribute to the knowledge base.

5. Losses strategy methodology

In this section we describe how losses, both technical (network) and non-technical (commercial) can be best managed. We discuss the strategy outlined for ED1 and look to future targets and provisions within ED2. Finally, we provide details of how the industry regulator, Ofgem, recommends that we quantify our work to reduce losses through an analysis of expected costs and benefits.

5.1 Losses strategy in context of the EAP and preparation for ED2

The losses strategy describes how targeted asset replacement and innovation will help address the challenges of the energy system transition towards net zero carbon, while maintaining a safe and reliable network. This strategy aligns with our Environmental Action Plan (EAP) and provides guidance on our interventions in ED2.

5.2 Ways of managing losses

Our existing approach to the management of technical losses is:

- To specify low loss transformers as part of normal business policy
- To plan, design and operate the network in a way that helps minimise losses.

As part of our ongoing connection, asset replacement and reinforcement activities, we have installed or replaced a significant number of transformers. Our current policy ensures that new transformers installed on our network are low loss units and comply with, or exceed, the energy efficiency standards required by the European Commission (EU). The detailed specification of new 132/33kV transformers are considered on a site-by-site basis but will always comply with the EU losses specification as a minimum.

We are also undertaking the opportunistic replacement of mainline cable and uprating it to 300mm^2 as standard. This has the added benefits of reducing losses and providing capacity for future connections to the network.

Switchgear and other plant have been excluded from any consideration of losses reduction as these assets have negligible losses in normal operation.

As part of our normal business practice we design our networks so that the voltage levels stay within the required limits. The relationship between voltage level and power losses on the network means that this also ensures that losses stay within reasonable limits, particularly at lower voltages where measures taken to manage voltage may also have the benefit of reducing technical losses.

5.2.1 Eco-design

The EU Eco-design Directive (2009/125/EC) establishes a framework which sets out the ecological requirements for energy-using and energy-related products sold in the EU member states. As part of this Directive the European Commission implemented regulation from June 2014 in regard to small, medium and large transformers. This regulation includes:

- Minimum energy performance requirements for medium-sized power transformers
- Peak efficiency requirements for large power transformers.

To comply with the Eco-design Directive, manufacturers will have to reduce the level of losses inherent in their products. It is also essential that the revised equipment is of the same (physical) size as existing equipment so that it can be easily installed into existing substations.

Our current policy is to ensure that the equipment used in the replacement of transformers and cables meets the latest specifications set out in the European Directive as a minimum. In some cases, this has resulted in equipment that exceeds the minimum performance requirements with the associated cost justified by CBA. The new 2020 specification for eco-transformers will become available in 2021. For the purposes of this document, our CBAs use the 2015 standard transformer specification. Once the costs for the 2020 specification become known to the business and the ED2 CBA is published, we will consider applying the new transformer specification.

5.2.2 Technical losses

Replacement of assets

A common way of reducing network losses is to replace individual items of network equipment with equivalent assets that are more efficient i.e. have lower losses. This most commonly applies to underground cables and transformers which represent the largest source of losses in distribution networks. Network switches and other types of switchgear do not generally create significant losses and so do not usually form part of any plan for the reduction of losses.

It is important that the network operator is prudent in determining which assets to replace and when. An economic business case is required to justify replacing an asset on the basis of losses as it must be cost-effective to prevent undue costs being passed on to customers.

From assessing the replacement of an asset from a cost perspective, its delivery can be broken into two segments, namely proactive and opportunistic. Proactive replacement is when an asset's level of losses alone justifies a replacement to a more efficient model. We will actively seek out these projects and have already delivered savings to customers throughout ED1 and look to continue this in ED2. Opportunistic replacement is when we are already undertaking the work e.g. transformer replacement based on asset end-of-life which we can replace with a more efficient alternative.

Network planning and operations

An alternative (and complementary) way of reducing losses is to plan and design the network differently i.e. change the way the equipment is connected and operates together. The opportunity for DNOs to do this does not often arise. However, we have successfully trialled a number of voltage management schemes which can successfully aid in managing losses in networks with an increased LCT penetration. This works on the basis of reducing the supply voltage to customers to an optimum level, a technique known as conservation voltage reduction. By optimising voltage across high and low voltage networks in this way, we can improve the energy efficiency of customers' electrical appliances, reduce energy bills and lower network losses. We currently have a number of schemes and trials ongoing which are discussed in more detail in Section 5.3.

Managing fixed losses

Fixed losses, found largely in the iron core of power transformers, can be reduced by replacing old transformers with newer, more efficient units. Specifying more efficient, lower loss, transformers for new extensions to, and reinforcement of, the existing network will also help reduce network fixed losses in the future. Lower loss transformers can sometimes have higher variable losses and so it is important to carefully determine the balance required between the fixed and variable losses in a transformer. The way in which the transformer is used will also affect this decision.

Managing variable losses

With the increased penetration of LCTs onto the UK's energy system, the loading requirements on a DNO's assets are set to increase. This will impact the amount of current passing through our network and will require complex network management to achieve the optimum running configuration for losses. Another common method of managing variable, or load-related, losses can be achieved by installing equipment with a lower resistance such as bigger lines and cables. Lines and cables with a larger cross-sectional area will not only reduce losses but will also be more able to deal with any higher loading requirements in the future. However, these larger items are more expensive, and it is important that we carefully consider the most cost-effective option.

We can also encourage customers to use less electricity which will also reduce variable losses. Because variable losses are much higher when the network carries high levels of current (i.e. at times of peak demand), encouraging customers to use more electricity at times of lower network loading will also reduce variable losses.

There are other ways in which we can make the network work more efficiently by effectively reducing the current on the network but delivering the same power to customers. These methods often require the installation of additional specialist equipment and can be more or less effective, and more or less costly, depending on where on the network they are used. We continually review all of these options and invest where they will deliver benefits to customers.

Installation of capacitors

The installation of capacitors increases the efficiency of the network by providing the same amount of power to customers at a lower current. A lower current means fewer losses. The effectiveness of capacitors in providing this type of compensation is significantly dependent on the efficiency ('power factor') of the customer equipment connected to the network. Where this load 'power factor' is already high, the opportunity for the installation of cost-effective capacitive competition equipment diminishes.

We continue to scan the network with a view to identifying opportunities for improvement of the network power factor. Where appropriate we will conduct detailed analysis of the potential benefits of installing capacitors on the network for the purpose of reducing losses.

Our analysis to date has been based on three representative networks: Atherton bulk supply point (BSP), Longsight BSP and a representative average model BSP group from our network. For each group we have analysed the benefits of installing reactive (capacitive) compensation at each voltage level. Our studies indicate that the installation of capacitive compensation equipment is presently most beneficial on the LV network, but that the system power factor has been steadily improving over recent years and therefore the potential savings offered by reactive compensation appear to be reducing. We will, however, continue to monitor the situation and amend our policy as necessary.

5.2.3 Non-technical

As these losses relate more to the commercial activity than to the physical technical characteristics of the network, most of the methods for reducing non-technical losses are focussed on processes, systems and procedures.

Reducing illegal connections, and other types of illegal abstraction (theft) of electricity, can be achieved by improving processes and coordination between energy suppliers, police and other community and social services.

5.3 Contributing to the knowledge base

As we transition into ED2, it is important to continually assess the current strategy and see if there are alternative and/or complementary methods that contribute to losses management. On top of this, it is important to share knowledge once a method of losses management has been discovered and can be applied across other electrical networks. We are trialling a number of power management schemes that have proposed losses reduction as part of their benefits. We will assess these benefits and report on them as we move to the closing stages of the trials.

This section details several projects that could contribute to the evidence base for losses management going forward.

5.3.1 QUEST

To cater for the increased uptake of LCTs, and subsequent increase in demand on our network, we have deployed a number of discrete voltage management techniques. These techniques have been successful in helping us to manage the network but have some limitations, as they are not currently co-ordinated.

The QUEST project will identify and trial novel methods to holistically integrate the techniques in use across the network into an overarching control system. It will explore co-ordinated operation to enable a reduction of the built-in operating margins, creating capacity for our customers.

QUEST will build upon learning and outputs from previous projects to deliver a business-ready solution to co-ordinate multiple voltage management techniques, enabling whole distribution system voltage optimisation. It will develop and introduce a distribution network-wide, fully co-ordinated, voltage control system, with an appropriate balance between centralised and decentralised control hierarchy.

The project will produce a new holistic voltage control methodology, optimising the system voltage and minimising losses. This new methodology will boost the benefits available from existing voltage management techniques, facilitate the increased connection and use of LCTs, and maximise benefits to customers through energy reduction.

The benefits quantified in the business case focus on extending voltage optimisation, and are divided into:

- **Release of network capacity:** owing to the relationship between current and voltage, identified in the CLASS and Smart Street Low Carbon Networks Fund projects, reducing system voltages reduces demand on the network, which can result in a reduction in peak loads at critical sites. This releases latent thermal capacity, allowing DNOs to defer or mitigate the need for reinforcement or, where available, other capacity-creating methods such as flexible services. QUEST will release over **2,200MVA** of capacity, delivering a financial benefit of **£266.7m across GB by 2050**.

- Reduction **in system losses:** reducing demand reduces the total energy required to flow through the network and consequently the system losses attributable to that energy flow. This reduction in losses will provide a financial benefit of **£65.4m across GB by 2050**.

5.3.2 Smart Street

Smart Street is a step change in the co-ordination and operation of electricity networks in Great Britain and is the first demonstration of a fully centralised low voltage network management and automation system.

Using new controllable switching devices, called the Weezap and Lynx, integrated into our network management system, and controlled by Siemens Spectrum Power 5 (SP5), Smart Street stabilises voltage and prevents it rising above or falling below statutory limits.

Supply voltage to customers can then be reduced to an optimum level (conservation voltage reduction). By optimising voltage across high and low voltage networks in this way, Smart Street improves the energy efficiency of customers' electrical appliances, reduces energy bills and lowers network losses.

5.4 National working group

We will continue to take an active part in the network losses taskforce for the Energy Networks Association (ENA) that has been responsible for commissioning two papers on losses management in ED1:

- **ENA Working Group Project**: Impact of Low Carbon Transition – Technical Losses (2017)
- **CEP023 Technical Losses Mechanism Study**: Development of a Losses Incentive Mechanism – Phase 1 (2019).

Both papers were delivered by WSP consultancy and provided a technical overview of losses, the incentive mechanisms from previous price reviews including ED1, and provided detailed studies on the impact of our low carbon transition to losses management.

We have also worked alongside National Grid as part of the ENA, to represent GB network businesses in the development of the EU Directive associated with the regulations for transformer losses. This has been widely acknowledged to be a very productive process and has ensured that all of the distribution business in GB, and GB customers, are fairly and properly represented in the development of the new standards.

We continue to be an active participant on the European stage in the development of standards for transformer losses. This includes providing commentary on the latest Eco-design 2021 standard, and the integration of the Tier 2 standard for all three phase transformers which commences from May 2021.

5.5 Future gazing

There are a number of economic, regulatory and technical drivers which are expected to affect our strategy of managing losses in both the long and short term.

5.5.1 National policy drivers

The over-arching goals of government policy will shape our losses strategy and our internal priorities as we move through the regulatory period to 2023 and into ED2.

As a result of changes in the priorities of domestic and European energy markets, the government has initiated a process to redesign the GB electricity market. At the core of this Electricity Market Reform (EMR) project the government has set out three key objectives. These objectives are to:

- **Ensure a secure electricity supply:** by incentivising a diverse range of energy sources, including renewables, nuclear, plant equipped with carbon capture and storage, unabated gas and demand side approaches. This aims to ensure that the UK has sufficient reliable capacity to minimise the risk of supply shortages.

- **Ensure sufficient investment in sustainable low-carbon technologies:** in 2019 the UK became the first major economy to legally commit to the target of net zero greenhouse gas emissions by 2050. A significant part of this journey is the revolution of our electricity industry, the way energy is generated, stored, transported and traded. In the North West, local leaders have set more challenging targets to achieve net zero much sooner. It is our job to support these ambitious plans, as set out in our Leading the North West to zero carbon plan.

- **Maximise benefits and minimise costs to taxpayers and consumers:** to the economy as a whole and also to taxpayers and consumers, maintaining affordable electricity bills while delivering the investment needed.

These drivers are designed to reflect the challenge of ‘keeping the lights on’, at an affordable price, while decarbonising the power system. So, it is with these drivers in mind, that we consider our role going forward and how these drivers might affect our responsibilities as a DNO.

5.5.2 Drivers for the distribution companies

The implementation of our regulatory arrangements within RIIO–ED1 signalled a significant change in the challenges and responsibilities we face as a DNO. The regulatory agreement focuses on setting revenues for all DNOs which will enable the cost-effective and reliable delivery of electricity to customers, and with the potential for new roles and responsibilities associated with the decarbonisation of the electricity industry.

This change in focus reflects the government's changing objectives for the energy market. Based on the government's three key objectives, we outline the following high-level drivers which we think will have the greatest impact on the way we operate our business.

- **Security of supply**: as a result of the increased integration of renewable energy sources, increased use of electricity for heat and transport and a greater number of smaller (distributed) generators connected to our network, along with a greater role for customers.

- **Increased complexity**: with increased penetration of renewable generation, electrification technologies, demand response and electricity storage on the system, DNOs will need to move into new roles and responsibilities to support a reliable and cost-effective low carbon energy system. This will increase the interaction and complexity of the interactions between us and other energy market stakeholders.

- **Management of network losses**: with an increased penetration of LCTs, focus on energy efficiency and reducing carbon emissions, we will have a greater responsibility to ensure that losses are managed within an acceptable limit. This will lead to a reduction in emissions and in the overall cost to consumers.

The discussion above highlights the increasing responsibilities we face as a DNO in the coming years and our transition to distribution system operation. Managing electricity losses to within an acceptable limit, and reducing our carbon footprint more generally, is clearly one of the core challenges. In the next section we focus on how anticipated changes in the market might impact on the level of losses on our distribution system.

5.5.3 Drivers which may affect losses

Ultimately the national policy objectives, and the obligations they place on DNOs, will drive the need to reduce losses in distribution networks. These overarching objectives lead to a number of drivers which are likely to impact on the level of losses in the future.

In this section we describe the specific drivers which we believe are most likely to have the greatest impact on the way in which we operate as a DNO and which are most likely to have a significant impact on the magnitude of electrical losses on the system.

- **Losses regulation:** difficulties in accurately measuring losses during the Distribution Price Control Review 5 regulatory period led Ofgem to remove the direct financial incentive in the regulatory arrangements associated with losses. With the forecasted uptake of LCTs and smart technologies alongside the electrification of heat and transport, we expect to see a greater utilisation of distribution assets from a loading perspective. This will increase technical losses but is fundamental to the desired outcome of integrating renewable distributed generation to reduce total carbon output from a net zero point of view. Therefore, regulatory approaches for losses must recognise increasing LCT uptake and encourage economic prudence on the part of the DNO, who will have to balance the cost of losses against smart solutions that act as alternatives to traditional reinforcement as both impact the cost to customers.

- **Smart meters:** smart meters are likely to change the way in which the system operates as a whole. DNOs may use the data to better understand the load on their networks. The transmission system operator may use flexible demand connected to the DNO networks to manage the system, and suppliers may use smart meters to provide additional customer price signals (e.g. time of use tariffs) to help them to manage their wholesale energy costs. The potential change in demand profile resulting from large numbers of customers responding to price signals may change the pattern of load on the distribution network, thereby affecting the way in which DNOs and the transmission owner, National Grid, manage their network assets.

- **Demand side participation:** the additional demand from electrification of heat and transport may be managed through network operators or suppliers incentivising customers to move demand away from peak periods to other times of the day. While this may help to reduce the need for investment in additional network capacity, the increased use of lines and equipment is likely to increase the amount of losses on our network.

- **Energy efficiency:** some level of losses on the distribution network is unavoidable. However, we still have the opportunity to ensure that our network is designed, constructed and operated to be as efficient as economically viable. As a result, energy efficient targets and incentives will continue to drive improvements in network losses, provided the cost of improvement remains below the value placed on lost energy by industry regulators.

5.6 How we developed our strategy

We developed our losses strategy through a number of initiatives. Firstly, through industry best practice and engagement with national working groups on losses management. Secondly, through stakeholder engagement to make sure that our priorities and principles align with our customers' ambitions. As part of our well justified business plan in ED1 we have outperformed our initial losses reduction target of 44,000 MWh and are forecasted to deliver 134,304 MWh through investment efficiencies in our targeted asset replacement programme.

We will continue with the current re-investment strategy and examine new initiatives that will bring further improvement on our losses performance. This will include engagement with stakeholders to ensure our plans meet desired outcomes and provide value added proposals as we transition into ED2.

5.6.1 Stakeholder input (ED2 sustainability panel and customer survey)

Communication with stakeholders will be an important part of our ongoing losses strategy. Therefore, during the process to evaluate our losses strategy we will provide an opportunity to engage with interested parties. As part of this strategy we will specifically target stakeholders who have an interest in the outcome of our strategy, and those who have the expertise to peer-review our thinking and provide recommendations where necessary.

We anticipate interacting with stakeholders though a variety of formal and informal approaches, for example structured questionnaires, bilateral discussions and workshops.

5.6.2 Ofgem's guidance on determining the costs and benefits of losses reduction

Managing network losses efficiently requires an understanding of the balance between the cost of lost energy and the investment cost of the network infrastructure required to reduce losses.

In order to provide a consistent approach to the evaluation of losses, Ofgem has set out a number of assumptions to be used by DNOs in undertaking analysis of the costs and benefits of losses reduction initiatives (CBA). These assumptions are designed to enable Ofgem to easily compare the losses strategies proposed by the various DNOs. The key assumptions are presented in Figure 4.

Figure 4: Ofgem assumptions for the CBA

Factor	Requirement
Cost-benefit analysis	Straightforward discounting
Discounting	Applied equally across all costs and benefits
Treatment of capital costs	Capital costs are converted to annual costs using pre-tax Weighted Average Cost of Capital (WACC)
Assessment period	45 years
Discount rate	3.5% for the first 30 years and 3% for the following 15 years
Value of losses	£48.42/MWh (2012/2013 prices)

The methodology for the assessment of an investment requires us to carry out the CBA using a discount rate of 3.5% for 30 years and then 3% for the last 15 years of the 45-year life of assets with a value for energy of £48.42/MWh (2012/13 prices).

The value of losses reference price (£48.42/MWh) provides a basis for the assessment of investment in lower loss equipment, including some benefits outside of our business. It does not represent any payment or financial benefit to us. Nevertheless, it is worth noting that the £48.42/MWh is an *average price* and as a result will not reflect the *actual* costs of losses, which will be greater during periods of peak demand and the resulting peak electricity prices.

5.7 Implementation of losses strategy and reporting

A common way of reducing network losses is to replace individual items of network equipment with equivalent assets that are more efficient i.e. have lower losses. This most commonly applies to underground cables and transformers which represent the largest source of losses. This underpins our losses strategy and is implemented through the application of our Real Options Cost Benefit Analysis (ROCBA) approach. The use of a long-term CBA approach tends to justify higher expenditure in the short term in return for lower costs over the longer term. This CBA methodology shows that Ofgem is focusing on the potential benefit of making longer-term investments.

As part of this, during the planning stages of a reinforcement scheme we will also assess the validity of a like-for-like replacement over uprating the asset to a larger size, based on losses impact through CBA.

This approach is an efficient and measured way of accessing losses within a distribution network and uses the losses reference price (£48.42/MWh) to provide a basis for the assessment of investment in lower loss equipment, including some benefits outside of our business. This method gives specific targets which have measurable outputs. The delivery is attainable through standard asset replacement and once implemented is cumulative in its losses reduction.

6. Activities for managing losses

This section outlines the initiatives we employ for losses management and provides a summary of the underlying CBAs undertaken to inform our interventions.

6.1 Technical

6.1.1 Summary

While smart solutions are still undergoing trials, and the uptake of LCTs is still set to see significant increases, managing technical losses has largely been delivered through asset replacement activities. Installing lower loss equipment can be undertaken as a dedicated one-off losses-driven activity or can be done at a time which may be both more convenient and less costly, such as when the equipment is being replaced due to its condition or because of a need to change its capacity. We refer to the first situation as 'proactive replacement' and the second as 'opportunistic intervention'.

Some types of electrical equipment lend themselves to being replaced proactively, while for others it might be prohibitively expensive or too disruptive for customers. The main items of electrical equipment which can be replaced for the purpose of reducing network losses are underground cables and transformers.

Investment decisions

In Figure 5 we provide a list of the assets we plan to, and have actively replaced, throughout ED1, identifying whether we have made the decision to replace these assets through 'proactive replacement' or 'opportunistic intervention'. All investment decisions will be reviewed upon changes to the dominant factors in our analysis, for example significant adjustment in the value of losses, costs of interventions or network usage affecting the level of losses.

If the benefit of replacing an asset on a proactive basis outweighs the cost, then it follows that this same asset type would be replaced opportunistically (at a lower cost but for the same benefit), should the situation arise. For example, if work is required to replace an 800kVA ground-mounted transformer due to its condition or as part of a new extension to the network, then the opportunity may be taken to install a lower loss transformer unit.

Figure 5: Overview of our investment decisions based on losses drivers

Distribution equipment (asset)	Pro-active replacement?	Opportunistic intervention?
Larger (300mm^2) HV cable	✘	✓
Larger (300mm^2) LV cable	✘	✓
Overhead lines	✘	✘
1000kVA ground-mounted transformer	✓	✓
800kVA ground-mounted transformer	✓	✓
200kVA pole-mounted transformer (2015)	✘	✓
100kVA & 50kVA pole-mounted transformer (2015)	✘	✘
Grid transformer (132/33kV)	✘	✓
Primary transformer (33kV/HV)	✘	✓
Capacitive compensation (LV/HV/33kV)	✘	✘

6.1.2 Pro-active replacement

Lower loss network items, e.g. cables, lines and transformers, can sometimes be replaced or installed at a location and at a time that is determined (and justified) purely on the basis of reducing losses. Actively replacing assets with lower loss equivalents is efficient if the benefits of reducing the losses outweigh the cost of the replacement work.

We have established that since proactive replacement work of this type is usually undertaken on assets which are otherwise operating satisfactorily, and at a time when no other work is scheduled, it is often only beneficial to do this where the improvement in loss performance is comparatively high and where the cost of the work required to replace the asset is comparably low.

Cables

An example of where proactive replacement on the basis of losses is not economic is underground cables. Our analysis shows that the benefit of the reduction in network losses from installing a larger, lower resistance cable is significantly lower than the cost of digging up an underground cable which, in all other aspects, is operating perfectly satisfactorily. This is the case for both HV and LV cables which have been analysed separately.

Overhead lines

Our analysis does not support the installation of larger cross-section overhead lines for the purpose of loss reduction. We do not therefore plan to undertake any such work, neither proactively nor opportunistically.

Transformers

There are a large number of older power transformers that have a relatively high level of fixed technical losses, largely as a result of old and comparatively inefficient design, construction and core material. Modern transformer units have losses that are significantly lower than these older units and the work and costs associated with replacing the transformer can often be less than the benefit associated with the subsequent improvement in losses performance.

However, where the transformer units are large and complex, the cost of replacing the unit usually exceeds the benefit, as is the case for both our grid and primary transformers, and it is not economic to undertake proactive replacement.

Similarly, for much smaller distribution transformers, while the cost of replacement is modest, the benefit gained in the reduction of losses is comparatively small. This is the case for our pole-mounted transformers where our analysis does not support proactive replacement.

Our CBA does, however, support the proactive replacement of our older and larger distribution (local) transformers for the sole purpose of reducing losses, resulting in the replacement of 281 and 319 1000kVA and 800kVA ground-mounted transformers respectively over ED1.

Summary of CBAs undertaken for the proactive replacement of assets

Figure 6 presents a summary of the results of the CBAs of the replacement of existing assets based on the Ofgem losses CBA methodology. Within this strategy we have analysed circuit assets and transformer assets, but we have excluded switchgear and other plant as these assets have negligible losses in normal operation.

Cables

- Our analysis indicates that there is no justifiable benefit in replacing cables with larger section cables before the end of their normal operating life. We have not, therefore, included any such work in our investment plans.

Transformers

- We have conducted detailed CBA for loss reduction on ground-mounted distribution transformers. This indicates that there is strong positive benefit in replacing pre-1990 secondary network transformers with capacities of 800kVA and 1000kVA with EU Eco-design 2015 specification transformers. Prior to 1990 the specification for the transformer core used was relatively high-loss and proactive replacement with 2015 EU Eco-design specification is warranted on an economic basis.

- We have conducted a detailed CBA for loss reduction on pole-mounted distribution transformers at 200kVA, 100kVA and 50kVA. This analysis shows no benefit for replacement before the end of useful transformer life.

- We have conducted a detailed CBA for grid transformers and primary transformers. This analysis also shows that there is no benefit in replacement before the normal end of life.

Figure 6: Summary of the net present values(NPV) for proactive investments

Investment	Investment decision	NPV (45 years)
HV cable (based on the replacement of 1km)	Rejected	-£0.1 million
LV cable (based on the replacement of 1km)	Rejected	-£0.1 million
1000kVA ground-mounted transformer	Accepted	£3.74 million
800kVA ground-mounted transformer	Accepted	£2.40 million
200kVA pole-mounted transformer (2015)	Rejected	-£0.4 million
100kVA pole-mounted transformer (2015)	Rejected	-£0.5 million
50kVA pole-mounted transformer (2015)	Rejected	-£0.5 million
Grid transformer (132/33kV)	Rejected	-£0.6 million
Primary transformer (33kV/HV)	Rejected	-£0.3 million

6.1.3 Opportunistic intervention

Taking the opportunity to install lower loss equipment when replacing or installing assets for other reasons, such as new construction, reinforcement of the network or replacement of equipment at the end of its normal operating life, can often be beneficial where proactive investment is uneconomic. This often makes sense as the additional cost of installing low-loss equipment, compared to the cost of installing a ‘standard’ item, is often very low, sometimes even negative (i.e. the cost of the low-loss item is less). In this case the decision to install the lower loss item of equipment is straightforward.

Cables

The reduction in losses through the use of larger lines and cables can be significant. With a high proportion of the cost of installing a cable being associated with excavation and reinstatement of the cable trench, the additional (marginal) cost of installing a larger cable is limited to the difference in the cost of the cable itself. It is for this reason that while proactively replacing cables with lower loss versions rarely makes sense, installing lower loss cables on an opportunistic basis, frequently does.

Our analysis shows that the cost of large-section ($300mm^2$) cable at both 11kV (HV) and LV is now cheaper than the unit cost of the smaller-section cables (e.g. $95mm^2$ and $185mm^2$). This is due, in part, to the increase in supplied volumes of the larger size cable across the industry.

Apart from lower losses, there are additional benefits of installing the larger cable size as standard which reinforce this investment strategy. These include lower stores and stock-holding costs (due to standardisation of cable size, e.g. fewer joint types) and also the provision of additional network capacity to cater for future load growth, as a direct result of cables having a larger cross-sectional area and, therefore, higher load rating.

Overhead lines

Some sections of overhead line will be replaced ('reconductored') and some new lines built as part of our normal business operations to connected new customers, including new connections for distributed generation. The installation of new lines in these cases may well help to reduce losses and we will continue to review this on a case-by-case basis.

Transformers

When installed on an opportunistic basis, the additional cost of installing lower loss transformers at the 'primary' system level is shown to be lower than the anticipated ongoing benefits of the lower losses. Similarly, the losses reduction benefit associated with installing low-loss units at the larger pole-mounted substation sites, is shown to outweigh the additional cost of the low-loss transformers when compared to installing a 'standard' loss unit.

For 100kVA pole-mounted transformers the increase in efficiency gained from the EU Eco-design 2015 low-loss transformers is still insufficient to justify the additional cost. Our analysis shows this to be quite marginal though and the investment decision result could very easily change as the market size for lower loss transformers increases and unit prices fall over time. We will keep this under close review and amend the policy as needed.

For the smaller 50kVA pole-mounted transformers there is no increase in efficiency as a result of installing EU Eco-design 2015 low-loss transformers (compared to our current specification for these units) *and* they are more expensive. We will again keep this under close review and amend our policy as needed.

With the cost of installing low-loss ground-mounted distribution transformers on an opportunistic basis being significantly lower than the costs of doing so proactively (and the benefits of ongoing loss reduction remaining the same), replacing these larger ground-mounted distribution transformers opportunistically is economic and therefore part of our strategy.

Summary of CBAs undertaken for the opportunistic investments

As part of our ongoing connection, asset replacement and reinforcement activities, we will install or replace a significant number of assets. We have carried out a detailed analysis of each asset class to determine whether or not it is justified to install a different specification of asset in order to reduce losses. Figure 7 provides a summary of these results.

Where justified, this variance in cost (over the 'standard' asset), has been factored into the unit costs included in our business plan.

Cables

We have conducted a detailed CBA for loss reduction resulting from purchasing and installing only $300mm^2$ cable instead of purchasing (and installing) the $95mm^2$, $185mm^2$ and $300mm^2$ cables separately. The larger cross-sectional cable ($300mm^2$) produces lower losses at a marginal increased cost. Our analysis clearly shows a benefit is derived from purchasing and installing only the $300mm^2$ cable when the opportunity arises

Transformers

We have conducted a detailed CBA for loss reduction on 23/11 MVA primary (33kV/HV) transformers. This analysis shows a benefit of installing the EU Eco-design 2015 specification when the opportunity arises.

- We have conducted a detailed CBA for loss reduction on the pole-mounted transformers. Our CBA analysis shows the benefit of installing the lower loss Eco-design (2015) unit for the 200kVA size, when the opportunity arises.

- Our CBAs for the 100kVA pole-mounted transformers and the 50kVA pole-mounted transformers show no net benefit of installing the lower loss EU Eco-design (2015) units for these smaller sizes.

- Our current approach to the opportunistic replacement of grid transformer is to undertake project-by-project CBA assessment. This is due to the large cost, and the 'one-off' nature of these projects. As a result, no standard policy decision is included in this strategy for grid transformers which will continue to be assessed on a bespoke basis.

Figure 7: Summary of the NPVs for opportunistic investments

Investment	Investment decision	NPV (45 years)
HV cable (based on RIIO-ED1 investment)	Accepted	£12.26 million
LV cable (based on RIIO-ED1 investment)	Accepted	£3.45 million
Primary transformer (33kV/HV)	Accepted	£1.0 million
200kVA pole-mounted transformer	Accepted	£0.55 million
100kVA pole-mounted transformer (2015)	Rejected	£0.0 million
50kVA pole-mounted transformer (2015)	Rejected	-£0.1 million

Proactive key actions

- We will proactively replace old (pre-1990) large (800kVA and 1000kVA) ground-mounted, secondary network transformers with lower loss EU Eco-design 2015 specification transformers.

Opportunistic key actions

- Whenever we are required to install or replace one of our primary transformers, we will undertake a CBA. Where the assessment is beneficial, we will install a lower loss transformer unit which complies with the latest EU Eco-design 2015.
- Whenever we are required to install or replace one of our grid transformers, we will undertake a CBA. Where the assessment is beneficial, we will install a lower loss transformer unit which complies with the latest EU Eco-design 2015.
- Whenever we are required to install or replace one of our larger pole-mounted secondary network transformers, we will do so with a lower loss unit which complies with the latest EU Eco-design 2015 specification.
- Where necessary we will install large cross-section cables (300mm^2) at HV and LV as standard, instead of the current mix of smaller (95mm^2 and 185mm^2 cables).

6.1.4 Summary of CBAs undertaken for the special loss-reduction initiatives

We have conducted a detailed analysis of the potential benefits of installing reactive power compensation (capacitive) equipment on our network to reduce losses. Again, we have conducted a detailed CBA for the asset replacement (Figure 8). This analysis has identified that the installation of reactive compensation is presently not justified at any voltage level.

Figure 8: Summary of the NPVs for loss-specific investments

Investment	Investment decision	NPV (45 years)
Capacitive compensation (LV)	Rejected	£0.0 million
Capacitive compensation (HV)	Rejected	£0.0 million
Capacitive compensation (33kV)	Rejected	£0.1 million

6.2 Non-technical losses

We take the theft of electricity very seriously and reducing non-technical losses will continue to be a priority. Given the uncertainty around the measurement of non-technical losses it is important for us to have robust methodologies in place to identify and quantify these losses in an efficient way.

6.2.1 Transactional theft

Electricity suppliers have primary responsibility for reducing transactional theft, where electricity is illegally abstracted from a connection point that is registered to a supplier. Transactional theft can occur where the meter has been interfered with so that it is recording a lower amount of energy than is being consumed.

We will continue to work alongside suppliers to support them to reduce transactional theft. We will proactively approach suppliers where transactional theft has been identified and continue to report to them all cases of possible interference for investigation. We will also provide any necessary evidence to support a prosecution.

Transactional theft investigations can also be ‘police-led’; for example, where a customer is found to be engaged in wider criminal activity (e.g. cannabis farms were the meter is likely to be by-passed in an attempt to illegally avoid high electricity costs). We will continue to provide support and assistance where necessary, working with suppliers and other agencies such as the police, providing an 'emergency service' to support where there are safety concerns or where action is required on our network, and supporting criminal cases.

We will continue to participate in meetings with other agencies to discuss transactional theft and theft in conveyance. We will also monitor the schemes put forward by other DNOs to identify best practice.

Transactional theft key actions

- We will continue to work alongside suppliers to help reduce transactional theft, providing assistance where necessary.
- We will monitor and review best practice from other DNOs.

6.2.2 Theft in conveyance

Theft in conveyance is our responsibility. This occurs when electricity is consumed and unaccounted for but where there is no registered supplier. Theft in conveyance can occur where new connections are unauthorised or where illegal reconnection takes place (e.g. after a formal disconnection). Theft in conveyance can also sometimes occur where the connections process is incomplete. We are entitled to recover the value of electricity stolen as a consequence of theft in conveyance.

We have dedicated team members responsible for managing our theft case-load making it possible for us to understand the true cost of this service versus the benefits secured for customers. It has allowed us to tailor the service in accordance with licence obligations that came into force in April 2015.

The cost that we seek to recover is based on the value of electricity taken, calculated as follows:

- The quantity of electricity taken in relation to the following factors:
  - The estimated consumption of the types of equipment being used by the customer
  - Evidence from customers with a similar energy consumption profile
  - The length of time that the connection is assessed to have been energised

- The average price, derived from the three largest suppliers operating in our distribution service area, during the period identified

- The most suitable supply tariff based on the customer’s type of connection

- Ancillary costs arising from:
  - Disconnection
  - Any damage to our distribution system, meters, plant or equipment
  - The investigation
  - Pursuing actions for electricity theft under the relevant legislation.

Theft in conveyance continues to be a priority for us. We will continue to develop the service to ensure that we have the processes and reporting in place to minimise theft in conveyance in line with Ofgem requirements.

Our theft in conveyance team, operating within our wider business support functions, works in accordance with our company code of practice written based on the experience and expertise from around our business. This code of practice strengthens our processes around investigations and remedial action and sets clear timelines and outcomes for each possible scenario.

Our centralised approach enables us to employ streamlined processes improving our proactive investigations. For example, we review 'unaccepted quotes' from potential customers who have received, but not accepted, a quote for a new connection. As a result we have been able to identify many cases of illegal connections to our network. We review all MPANs for new connections not registered for use within a set time to identify unregistered meters and continue to make use of information received such as 'top-offs' from colleagues, suppliers and members of the public.

In addition to this we employ improved remedial action and billing processes which exist to tackle cases where theft in conveyance has been identified. This enables us to better hold customers to account and reduce the time taken for customers to complete their required action.

There are also some instances where theft in conveyance has occurred and the industry can correct the data by undertaking a retrospective amendment to systems, thereby ensuring that the supplier is able to send a bill to the customer. A simple example of this is where a site has been disconnected in error. Once this is found, depending upon the amount of time which has elapsed since wrongful disconnection, a simple system change can correct the data and the supplier is once again responsible for billing the customer. This work is undertaken by our theft in conveyance team and helps ensure that all sites have a registered supplier, thereby reducing the likelihood of theft; the cost of this would otherwise be borne by metered customers.

We will continue to participate in meetings with other agencies to discuss transactional theft and theft in conveyance. We will also monitor the schemes put forward by other DNOs to identify best practice.

Theft in conveyance key actions

- We will continue to develop our theft in conveyance services to ensure that we have the processes and reporting in place in order to minimise theft in conveyance in line with Ofgem requirements.
- We will continue to increase the number of investigations undertaken through a more systematic approach to identifying cases. For example, we will create a register of known 'offenders' and use this to monitor new build developments within our area.

6.2.3 Under-declaration of unmetered supplies

We manage the inventories for all unmetered supplies. Half-hourly (HH) unmetered supply customers are required to provide an update on their inventories on a monthly basis. For non-half-hourly (NHH) unmetered supply customers an 'Unmetered Supplies Certificate' is produced which includes an estimate of annual consumption. The estimate of annual consumption for NHH unmetered supplies (as shown on the Unmetered Supplies Certificate) must be updated annually.

Our management (e.g. reporting/recording of consumption) of NHH unmetered supplies uses the same system as the management of HH unmetered supplies. Previously NHH customers were managed through a variety of individual systems reflecting the diverse sources of information. The move to a central single system allows more accurate NHH inventory management which benefits all of our customers.

We will continue to undertake regular audits of the inventories submitted in order to check the accuracy of the information.

We also use a central single system for the management of both NHH and HH unmetered customers to provide increased accuracy of inventory management. We expect this system will continue to improve the identification of unmetered losses in our area.

Unmetered key actions

- We will continue to undertake regular audits of the unmetered supplies inventories to confirm their accuracy.
- We will identify any customers who do not provide an up-to-date inventory and instruct them to update us accordingly.