electricity north west

Bringing energy to your door

The future

Losses Strategy

April 2015

VERSION HISTORY

Version	Date	Author	Status	Comments
Version 1	April 2015	Ian Povey	Withdrawn	
Version 2	June 2015	Ian Povey	Current	Correction of minor data transposition errors.

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SUMMARY OF THE ELECTRICITY NORTH WEST LOSSES STRATEGY

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. At Electricity North West we act on behalf of our customers to determine the appropriate balance between spending money on reducing 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 greenhouse gas emissions.

In this document we outline our strategy to reduce 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 reduction of losses is not always straightforward. Some losses are associated with the technical characteristics of the electricity network ('technical' losses), whilst other losses are more to do with measurement and billing ('non-technical' losses). Successful and efficient reduction of losses involves the coordination of the many functions and departments across our business. This includes not only our engineers but also our commercial and administrative teams.

We continually review the potential for reducing the losses on our network. Our thinking is formally presented in our published losses strategy document. This document contains our latest strategy for loss reduction; in detail for the period 2015 – 2023, and in outline for the period beyond.

We have examined the potential to reduce network losses through the application of various alternative investment strategies during the period 2015–2023 (known as RIIO-ED1) – 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 – and also continue work to establish a more reliable losses reporting baseline within RIIO-ED1.

We are committed to the continued review and update of this important strategy. Any changes to the strategy will be reflected in this document and published annually, and also as an annex to our annual environment reporting submission – as required by Ofgem.

Based on the initiatives put forward in this losses strategy document we anticipate technical losses will be reduced by 288,240 MWh over the period 2015-2023, which is equivalent to a reduction of 125,435 tCO2 emissions.

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 Table 1.

Table 1 – Summary of actions to reduce 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 lower loss EU Eco Design 2015 specification transformers.	Proactive
Primary transformers	Whenever we are required to install or replace one of our primary transformers, we will aim to do so with a lower loss unit which complies with the latest European Union standard (EU Eco Design 2015) specification.	Opportunistic
Grid transformers	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 reducing losses. Where it is shown to be beneficial to do so we will install a lower loss transformer unit. All new transformers will comply, as a minimum, with the latest European Union standard (EU Eco Design 2015) specification.	Opportunistic
Distribution transformers (pole-mounted)	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 2015) specification where applicable and when the opportunity arises.	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 also monitor and share best practice with other DNOs.	Proactive
Theft in conveyance	We will continue to develop our theft in conveyance services through the RIIO-ED1 period to ensure that we have the processes and reporting in place to ensure compliance with new Ofgem requirements.	Proactive
	We will contribute to the development of the National Revenue Protection Code of Practice to set out, in more detail, our activities associated with theft in conveyance.	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 also 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
Low Carbon Networks Fund strategy		
LCN FUND	We will review and analyse the details of the Low Carbon Networks Fund (LCN Fund) innovation projects – particularly where valuable insights on the management of losses have been identified	Proactive

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1 BACKGROUND INFORMATION ON LOSSES

In this section we present an introduction to electricity losses. Firstly, we explain what losses are – discussing the difference between technical and non-technical losses and secondly, we discuss why losses are important to our business and our customers.

1.1 What are losses?

In the broadest sense, distribution network losses are the difference between the electrical energy entering the distribution network, and the electrical energy that leaves it. Within this broad description two categories of losses are defined. These are:

- *Technical* losses; and
- *Non-technical* losses.

When a generator produces electricity, not all of this electrical energy reaches the customer. This is because power networks – both transmission and distribution – use-up some of the energy during transportation. The energy used is usually referred to as *technical* loss. In addition, not all of the energy leaving the distribution network may be measured or otherwise properly accounted-for; and this too presents itself as 'lost energy'. This unaccounted-for proportion of the losses is known as *non-technical* or *commercial* loss.

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

1.2 Technical losses

Technical losses occur as a direct result of the physical characteristics of the electrical equipment – the cables, lines and transformers – used to transfer, or distribute, electricity to and from customers. Some level of technical loss is inevitable as no power system can be 100% efficient in its delivery of electrical energy. Power loss usually results in cables, lines and transformers getting hot. Technical losses can be further segregated into those losses whose level changes according to the amount of electricity supplied ('variable' losses), and those that remain largely the same irrespective of the electrical loading on the network ('fixed' losses).

1.2.1 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 generate 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.

1.2.2 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.

Electrical power can be distributed more efficiently at higher voltage; because for a given amount of power a higher voltage means lower current, and therefore lower losses. This is why 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 and 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 low voltage (LV) circuits and the number of transformers.

Whilst a large proportion of the total variable losses on the network occur at LV, the lines, cables and equipment at the higher voltages have to be capable of supplying the losses incurred in the LV network in addition to the current (load) needed by customers. The losses (technical plus non-technical) at each voltage level on our network are shown in *Table 2*.

Table 2 – Loss levels by voltage

Voltage level	Typical percentage of total energy
132kV	0.05%
33kV	0.13%
HV	1.04%
LV	4.19%
Total	5.41%

*based on typical percentage of total energy purchases

1.3 Why are technical losses important to Electricity North West?

Lost energy costs customers money. Measures to reduce losses also costs customers' money. We have to determine the appropriate balance between *spending* money on reducing losses and *saving* money for customers by reducing losses. 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 our calculations. This is includes consideration of some of the societal benefits which customers obtain through reduced network losses – such as lower carbon and greenhouse gas emissions.

1.4 Non–technical losses

Non-technical losses are associated with the energy which is not able to 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 errors in measuring and recording energy, as well as illegal abstraction of electricity (ie theft).

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

1.4.1 Theft

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. 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. Other forms of theft occur where the meter has been interfered with so that it is recording a lower amount of energy than is actually being consumed.

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

- Transactional theft; and
- Theft in conveyance.

Transactional theft

All metered customers purchase electricity from a supplier and are allocated a unique Meter Point Administration Number (MPAN). Transactional theft is the illegal abstraction of electricity within the boundary of a customer's property. Electricity suppliers have primary responsibility for reducing transactional theft but we work alongside them to provide support including any necessary evidence to support a prosecution. In addition, we proactively detect and provide evidence to suppliers where it is believed that transactional theft may be taking place.

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 re-connection takes place (eg after a formal disconnection). Theft in conveyance can also sometimes occur where the connections process is incomplete.

From 1 April 2015 a new licence obligation came into force which requires all distribution network operators (DNOs) to take steps in order minimise theft in conveyance.

1.4.2 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 5% 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 both 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 un-metered 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 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.

2 REDUCING LOSSES

In this section we describe how losses can be reduced – both technical (network) losses, and non-technical (commercial) losses. We also set out our business target for reducing technical losses and what the benefits of this might be. 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.

2.1 Business target

Based on the initiatives put forward in this losses strategy document we anticipate technical losses will be reduced by 288,240 MWh (which is approximately the energy distributed across our network over the course of one week) over the period 2015-2023 of the total, which is equivalent to a reduction of 125,435 tCO2 emissions.

2.2 The benefit to society of reducing losses

Ofgem estimates that approximately 6% of the electrical energy generated is lost within the GB distribution networks each year. Ofgem estimates this to be worth approximately £1 billion and is equivalent to approximately 10 million tonnes of carbon dioxide (tCO_2). These losses are factored into settlements between energy suppliers and as a result the costs of these losses are shared by all customers through their electricity bills. Consequently any reduction in losses, apart from the environmental and climate benefits, may have a positive benefit for end customers.

2.3 How can technical network losses be reduced?

There are different ways in which both technical losses and non-technical losses can be reduced, depending on the nature of the losses be addressed.

2.3.1 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 – ie 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.

2.3.2 Network planning and operations

An alternative (and complementary) way of reducing losses is to plan and design the network differently – that is, change the way the equipment is connected and operates together. The opportunity for DNOs to do this does not frequently arise. As an example, and as part of the 'Capacity to Customers (C_2C) project, we are exploring the opportunity to configure and operate parts of the network – both LV and HV – in parallel (sometimes referred to as 'mesh'). The potential for this to reduce network losses is being considered as part of the project.

Changing the way the network operates on a day-to-day basis can also change the way the power flows on the network and therefore reduce losses. Some of these operational changes can be changed daily, or even hourly, to suit the customer demand. Other changes can be more permanent – such a moving the location of switches that are normally open so as to change the way in which the power flows through the lines, cables and transformers.

2.3.3 Reducing variable losses

Variable, or load-related, losses are reduced in one of two ways: either by reducing the current passing through the network items, or by installing equipment having a lower resistance.

As the level of current on the network is largely determined by customers, we do not have direct control of network variable losses. The main way in which we can reduce variable network losses is to use bigger lines and cables which have a lower resistance. Lines and cables having 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 cost more 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 (ie at peak demand), encouraging customers to use more electricity at times of lower network loading will 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 it will deliver benefits to customers.

2.3.4 Reducing 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 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 transformers. The way in which the transformer is used will also affect this decision.

Transformer fixed losses can also be reduced by switching off transformers at time when they may not be needed. For example, it may be possible to switch off one of the two transformers at larger substation sites when the demand is very low. At the larger substation sites, the switching-off of transformers can often be done remotely. This is important as the second transformer may be needed to provide a back-up in case the first transformer fails and may therefore need to be switched back on quickly in order to minimise interruption to customer electricity supplies. This managed switching of transformers is reviewed regularly and implemented where it will deliver benefits for our customers.

2.4 How can non-technical losses be reduced?

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. For example, improving the accuracy of inventories for unmetered supplies can be achieved by checking and auditing the processes used by the local authority for updating inventories; or ensuring that records are updated more frequently.

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.

2.5 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 loss reduction initiatives (cost-benefit analysis, or 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 Table 3.

Table 3 – 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.

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 methodology for the CBA shows that Ofgem is focussing on the potential benefit of making longer-term investments.

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3 OUR EXISTING APPROACH TO MANAGING LOSSES

In this section we describe the measures we have taken to reduce losses prior to the new RIIO-ED1 regulatory period.

3.1 Technical losses

Our existing approach to the management of technical losses has been:

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

As part of our on-going 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)[1].

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 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 improve voltage may also have the benefit of reducing technical losses.

3.1.1 EcoDesign

The EU EcoDesign 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 has 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; and
- peak efficiency requirements for large power transformers.

To comply with the EcoDesign 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 existing policy has been to ensure that the equipment used in the replacement of transformers and cables meets the 2015 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.

3.1.2 Electricity North West’s involvement in Europe

We have worked alongside National Grid as part of the Energy Networks Association (ENA) to represent GB network businesses in the development of the content 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.

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1 The detailed specification of new 132/33kV transformers are considered on a site-by-site basis but will always comply with EU losses specification as a minimum.

We continue to be an active participant on the European stage in the development of standards for transformer losses including work which has recently started on the specification for smaller distribution transformers as part of the preparation for the review of the EcoDesign 2020 transformer standard.

3.2 Non-technical losses

We take the theft of electricity very seriously and continue to invest in this area by operating a 'Revenue Protection Service' for the majority of electricity suppliers in our distribution service area. We also work closely with the police and other agencies in tackling electricity theft.

3.2.1 Transactional theft

'Transactional theft' is where electricity is illegally abstracted from a connection point that is registered to an energy supplier. We work alongside all suppliers to help reduce transactional theft. We provide supporting evidence when requested, as part of supplier-led investigations and proactively approach suppliers where transactional theft has been identified. We will also make follow-up visits to properties, at the request of the supplier, to ensure that any instances of transactional theft at the property have discontinued.

Transactional theft investigations can also be 'police-led'; for example, where a customer is found to be engaged in wider criminal activity (eg cannabis farms were the meter is likely to be by-passed in an attempt to illegally avoid high electricity costs). In these cases we work alongside the police to support criminal cases. In support of the ongoing development of this relationship our Revenue Protection Manager has presented at the United Kingdom Revenue Protection Association (UKRPA) training seminar on theft in conveyance; the training session was for police, fire services and environmental health services. We also continue to hold regular and frequent meetings with other agencies to discuss transactional theft and theft in conveyance.

3.2.2 Theft in conveyance

Theft in conveyance is where electricity is consumed and unaccounted for but where there is no registered supplier.

We are entitled to recover the value of electricity illegally taken and in August 2011 we registered a scheme under Schedule 6 of the Utilities Act 2000 which provides for recovery of the value of electricity stolen as a consequence of theft in conveyance. This scheme, and our approach to unauthorised electricity supplies, is described and published in our document 'Scheme in Respect of Unauthorised Electricity Supplies'[2].

The costs and revenues associated with theft in conveyance activities are currently reported, in regulatory terms, as what is termed an 'Excluded Service'[3]. We recently started to capture the specific costs related to theft in conveyance activities. This approach makes it easier 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 our new 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:

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2 http://www.Electricity North West.co.uk/docs/charging/scheme-in-respect-of-unauthorised-electricity-supplies-(pursuant-to-schedule-6-of-the-electricity-act-1989).pdf?sfvrsn=2

3 We report theft in conveyance and 'revenue protection' activities for third parties in combination with in the 'Regulatory Reporting Pack' and the revenue 'Regulatory Instructions and Guidance'.

    - the estimated consumption of the types of the equipment being used by the customer;
    - evidence from customers with a similar energy consumption profile; and
    - 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; and
- ancillary costs arising from:
    - disconnection;
    - any damage to our distribution system, meters, plant or equipment;
    - the investigation; and
    - pursuing actions for electricity theft under the relevant legislation.

There are 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, and 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 Revenue Protection team and helps ensure that all sites have a registered supplier – thereby reducing the likelihood of theft; the cost of which would otherwise be borne by metered customers.

Under-declaration of unmetered supplies

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

We recently migrated the management system (eg reporting / recording of consumption) of non –half-hourly un-metered supplies to the same system used for the management of half hourly un-metered supplies. Previously NHH customers were managed through a variety of individual systems reflecting the diverse sources of the information. The move to a central single system has allowed more accurate NHH inventory management benefitting all of our customers.

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4 FUTURE DRIVERS

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

4.1 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.

As a result of changes in the priorities of both 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 (CCS), 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** to put the UK on a path consistent with its European Union (EU) 2020 renewables target and the longer-term target to reduce carbon emissions by at least 80% of 1990 levels by 2050.
- **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.

4.2 Drivers for the distribution companies

The implementation of our new regulatory arrangements (RIIO–ED1) signals a significant change in the challenges and responsibilities we face as a DNO. The new 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 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, we, along with the other DNOs, may find that we need to consider undertaking 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.
- **Incentives to reduce network losses**: with an increased focus on energy efficiency and reducing carbon emissions, we will have a greater responsibility to ensure that losses are minimised. 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. Reducing electricity losses, 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.

4.3 Drivers which may affect losses

Ultimately the national policy objectives, and the obligations they place on the DNOs, will drive the need to reduce losses on the 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.

- **Incentive regulation** – difficulties in accurately measuring losses during the last regulatory period (Distribution Price Control Review 5) has led Ofgem to remove the direct financial incentive in the regulatory arrangements associated with losses. However, Ofgem has made clear its preference to return to incentivised loss reduction scheme for the next regulatory period (RIIO-ED2). There is a belief that changes during RIIO-ED1, such as the move towards smart metering, will allow for much greater accuracy in measuring losses. This may signal a shift towards regulation based on a 'prescribed level of losses' similar to schemes in other countries.
- **Smart meters** – smart meters are likely to change the way in which the system as a whole operates. DNOs may use the data to better understand the load on their networks. The Transmission System Operator (TSO) 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 (eg 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.
- We are leading industry work to establish new incentive and best-practice arrangements for the use of smart meter data in losses reduction initiatives.
- **Distributed, intermittent and unpredictable generation** – the move away from centralised to decentralised and/or more intermittent generation on the system will affect losses and also change the balance of losses between the transmission and distribution networks. This trend may be increased with current Government incentives – such as the capacity payment – which incentivises the growth in distributed flexible generation on the system. Although much of the new generation which will connect to our network will be renewable generation – such as photovoltaic panels and wind-turbines – any additional losses on our network as a direct result of this generation will still represent a cost to customers.
- **Electrification of heat and transport** – the electrification of heat and transport has the potential to substantially increase the electricity demand on the network in the future. Networks are likely to see higher use; thereby generating more losses.
- **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. Whilst 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 Governments and industry regulators.

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5 RIIO-ED1 AND BEYOND

The 'future drivers' described in Section 4 have helped us to build on our existing approach to the management of network losses (Section 3) and to develop a pro-active and more focused approach to the reduction of losses as we move into the (RIIO-ED1) regulatory period. In this section we describe our new strategic plan for losses reduction, including both technical and non-technical losses. All of our new plans are supported by appropriate analysis of the costs and benefits of specific investment decisions. Relevant parts of the technical detail are provided in Annex A.

5.1 Opportunity to reduce losses through replacement of network equipment

Installing lower loss equipment can be undertaken as a dedicated one-off 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 anyway due to its condition or because of growth in load. We refer to the first situation as 'pro-active replacement' and the second as 'opportunistic intervention'.

Some types of electrical equipment lend themselves to being replaced proactively, whilst 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.

5.1.1 Investment decisions

In Table 4 we provide a list of the assets we plan to replace, identifying whether we have made the decision to replace these assets through 'pro-active replacement' or 'opportunistic intervention'.

If the benefit of replacing an asset on a pro-active basis outweighs the costs, 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.

Table 4 – Overview of our investments decisions

Distribution equipment (asset)	Pro-active replacement?	Opportunistic intervention?
Larger (300mm^2) HV cable	✘	✓
Larger (300mm^2) LV cable	✘	✓
Overhead lines	✘	✘
1000kVA ground-mounted transformers	✓	✓
800kVA ground-mounted transformers	✓	✓
200kVA pole-mounted transformers (2015)	✘	✓
200kVA pole-mounted transformers (2020)	✘	✘
100kVA & 50kVA pole-mounted transformers (2015 & 2020))	✘	✘
Grid transformers (132/33kV)	✘	✓
Primary transformer (33kV/HV)	✘	✓
Capacitive compensation (LV/HV/33kV)	✘	✘

5.2 Pro-active replacement

Lower loss network items – eg 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.

5.2.1 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.

5.2.2 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 during the period 2015-2023.

5.2.3 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, whilst 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 pro-active replacement.

Our CBA does, however, support the pro-active replacement of our older and larger distribution (local) transformers for the sole purpose of reducing losses and hence our business plan contains the replacement of 489 and 163 1000kVA and 800kVA ground-mounted transformers respectively.

5.2.4 Summary of CBAs undertaken for the proactive replacement of assets

This includes replacement of existing assets based on the Ofgem losses CBA methodology (see Table 5 for a summary of the results). 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.

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.

Table 5 – Summary of the NPVs for the proactive investments

Investment	Investment decision	NPV (45 years)	Table reference (annex)
HV cable (based on the replacement of 1km)	Rejected	-£0.1 millions	Table 9
LV cable (based on the replacement of 1km)	Rejected	-£0.1 millions	Table 10
1000kVA ground-mounted transformers	Accepted	£6.8 millions	Table 11
800kVA ground-mounted transformers	Accepted	£1.3 millions	Table 12
200kVA pole-mounted transformers (2015)	Rejected	-£0.4 millions	Table 13
200kVA pole-mounted transformers (2020)	Rejected	-£0.1 millions	Table 13
100kVA pole-mounted transformers (2015)	Rejected	-£0.5 millions	Table 14
100kVA pole-mounted transformers (2020)	Rejected	-£0.3 millions	Table 14
50kVA pole-mounted transformers (2015)	Rejected	-£0.5 millions	Table 15
50kVA pole-mounted transformers (2020)	Rejected	-£0.4 millions	Table 15
Grid transformers (132/33kV)	Rejected	-£0.6 millions	Table 16
Primary transformers (33kV/HV)	Rejected	-£0.3 millions	Table 17

5.3 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 pro-active 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 (ie the cost of the low-loss item is less). In this case the decision to install the lower loss item of equipment is straightforward.

5.3.1 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 whilst 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 (eg 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, eg 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.

5.3.2 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

5.3.3 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.

5.3.4 Summary of CBAs undertaken for the opportunistic investments

As part of our on-going connection, asset replacement and reinforcement activities, we will install or replace a significant number of assets in the RIIO-ED1 regulatory period. 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. Table 6 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 bespoke basis.

Key actions:

- Whenever we are required to install or replace one of our primary transformers, we will do so with a lower loss unit which complies with the latest European Union standard (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 European Union standard (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 European Union standard (EU Eco Design 2015) specification.
- Where necessary 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)

Table 6 – Summary of the NPVs for the opportunistic investments

Investment	Investment decision	NPV (45 years)	Table reference (annex)
HV cable (based on RIIO-ED1 investment)	Accepted	£19.4 millions	Table 19
LV cable (based on RIIO-ED1 investment)	Accepted	£37.9 millions	Table 20
Primary transformers (33kV/HV)	Accepted	£1.6 millions	Table 21
200kVA pole-mounted transformers	Accepted	£0.3 millions	Table 22
100kVA pole-mounted transformers (2015)	Rejected	£0.0 millions	Table 23
100kVA pole-mounted transformers (2020)	Rejected*	£0.1 millions	Table 23
50kVA pole-mounted transformers (2015)	Rejected	-£0.1 millions	Table 24
50kVA pole-mounted transformers (2020)	Rejected	-£0.1 millions	Table 24

*Although positive, this investment is rejected due to uncertainty surrounding cost and availability of the EU 2020 standard technology

5.4 Opportunity to reduce losses through special loss-reduction initiatives

There are several projects and initiatives which we have undertaken, and we continue to explore and pursue initiatives specifically aimed at reducing losses.

5.4.1 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 low voltage (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.

5.4.2 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 (Table 7). This analysis has identified that the installation of reactive compensation is presently not justified at any voltage level.

Table 7 – Summary of the NPVs for the loss specific investments

Investment	Investment decision	NPV (45 years)	Table reference (annex)
Capacitive compensation (LV)	Rejected	£0.0 millins	Table 18
Capacitive compensation (HV)	Rejected	£0.0 millions	Table 18
Capacitive compensation (33kV)	Rejected	£0.1 millions	Table 18

5.5 Non-technical losses

Reducing non-technical losses will continue to be a priority during the RIIO-ED1 period. 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. The remainder of this section will outline our methodologies for reducing non-technical losses.

5.5.1 Transactional theft

We continue to work alongside suppliers to help reduce transactional theft providing assistance when necessary. We anticipate that the number of cases will increase as a result of the new obligation imposed on suppliers by Ofgem to reduce the level of losses from transactional theft. In addition Ofgem is consulting on a requirement to introduce a central service to profile the risk of theft at individual premises.

We will monitor the schemes put forward by other DNOs to identify the best practice. For example, another GB DNO is currently trialling a project to fit monitoring in sub-stations to detect the presence of heat lamps used to produce cannabis. This type of technology obviously has the potential to reduce non-technical losses.

Key actions:

- Continue to work alongside Suppliers to help reduce transactional theft providing assistance where necessary
- We will also monitor and review the best practice from other DNO's

5.5.2 Theft in conveyance

Theft in conveyance continues to be a priority for us. We will continue to develop the service through the current regulatory period (RIIO-ED1) to ensure that we have the processes and reporting in place to ensure compliance with the new Licence obligation. In addition we will contribute to the development of the national revenue protection code of practice to cover-off in more detail the activities associated with theft in conveyance.

We have continued to increase the number of investigations through a more systematic approach to identifying cases. For example we will follow-up with 'potential customers' who had applied for a connection, but then didn't complete the connection process. In many cases we have identified individuals who have subsequently engaged with a third party to make an illegal connection to our network. In addition we continue to make use of information received in the form of 'tip-offs' from our revenue officers, energy suppliers and members of the public.

These processes have allowed us to increase the number of cases identified as theft in conveyance through more detailed monitoring and this is reflected in the quantity of money recovered from these ‘customers’. We identified and pursued 121 cases of ‘theft in conveyance’ during 2014/15; with an associated value of £277,155. This amounts to 2,162,660kWh for the year-to-date. We have received payments of £116,200 (~40%). This represents a year-on-year increase in the monies recovered from 2012/13 (£46,000) and 2013/14 (£91,000).

The increase in the number of cases is the result of an increase in the number of proactive investigations by our staff.

However, the outstanding debt remains significant (approximately 60%). As a result we have been exploring other options to secure recovery. We have recently commenced proceedings on a civil recovery basis in a number of cases where amounts owing are substantial.

We are also taking advice on privately funded criminal proceedings in certain circumstances.

We have recently been capturing the specific costs for the theft in conveyance activities making it easier to understand the true cost of this service and align with the necessary treatment of such a service under the new special condition.

We will also seek to implement improvements in the treatment of theft in conveyance at an industry level through the various agreements. This is an area where we have been active in the past through involvement in the development of the Revenue Protection Code of Practice. This will set minimum standards for theft investigations and, outline industry best practice.

Finally we will monitor and review the best practice from other DNOs. For example, we are aware of the ‘addresspoint scheme’ introduced by another DNO. This scheme uses Ordnance Survey maps which apply a unique property reference number to all properties on the map. These map references are then cross-checked with the DNO’s own grid reference details and any discrepancies between the two are used to identify properties that exist, but which have no electricity supplied to them. It is our intention to monitor this scheme to understand both its success and applicability for our own use.

Key actions:

- We will continue to develop the Theft in Conveyance services through the current regulatory period to ensure that we have the processes and reporting in place to comply with the new licence obligation.
- We will contribute to the development of the national revenue protection code of practice to set out in more detail our activities associated with Theft in Conveyance.
- 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.
- We will also monitor and review the best practice from other DNOs.

5.5.3 Under-declaration of unmetered supplies

We are not proposing additional schemes to target losses for unmetered supplies during the RIIO-ED1 incentive period. However we will continue to undertake regular audits of the inventories submitted in order to check the accuracy of the information.

We have also moved to a central single system for the management of both non-half hourly and half hourly unmetered customers. This has allowed for an increase in the accuracy of inventory management. We expect this system will continue to improve the identification of unmetered losses in our area.

Key actions:

- Continue to undertake regular audits of the unmetered supplies inventories to confirm accuracy

5.6 Review and update of losses strategy within RIIO-ED1

In Section 5 we have described our initiatives, such as the proactive replacement of distribution transformers driven by losses benefits, and we have allowed for the use of low-loss transformers across the programme. During this current regulatory period we will monitor and critically examine the forecasts and assumptions underpinning our losses reduction strategy – continually checking and updating our CBA as necessary.

Including CBA into our assessments and scheme designs will ensure that our investments are economic – including losses. This approach will also ensure that as new technologies, such as voltage optimisation and power electronics, mature they are appropriately included alongside demand-side response and more traditional techniques. We continue to work to develop our approach in this regard.

Any changes in our approach as a result of revised CBA will be reflected in the subsequent updates of this losses document.

5.6.1 Review the Low Carbon Networks Fund strategy

We will continue to review and analyse the details of the Low Carbon Networks Fund (LCN Fund) innovation projects where valuable insights on the treatment of losses have been identified.

Our 'C_2C: Capacity to Customers' and Smart Street Tier 2 initiatives are exploring the introduction of dynamic operating regimes for network connection offers. We believe that this represents the greatest opportunity for losses reduction particularly in relation to the increase in Distributed Generation. We believe these techniques will mature fully in the RIIO-ED1 period, and will be enabled and supported by our investments in network management systems and smart applications.

Another relevant LCN Fund project includes the 'Low Energy Automated Networks'. This project consists of two methods to reduce electrical losses on the 33kV and 11kV distribution networks. The Transformer Auto Stop Start method will switch off one in a pair of transformers in selected substations to reduce fixed losses. The Alternative Network Topology method will be deployed alongside the first method where appropriate, to further reduce losses and maintain network supply integrity. We will continue to explore how the learnings from this project might inform the development of the loss-reduction policies in our business.

We will also review the outcome from the LV templates and FALCON projects. One DNO plans to use these projects to set a baseline for losses. The data from the LV templates project will be used to provide a baseline for different network types.

Key actions:

- We will review and analyse the details of the Low Carbon Networks Fund (LCN Fund) innovation projects – particularly where valuable insights on the treatment of losses have been identified.

5.7 Approach to establish a reliable baseline of losses during RIIO–ED1

Work on establishing a reliable baseline position for network losses will not be possible without a much richer understanding of the load flows across our network and particularly the Low Voltage networks. This understanding will be enabled by smart meter data and by the next generation of system modelling tools now being developed and trialled.

A particular area of our current development work is the use of time-series load-flow modelling within a new generation of modelling tools. Our LCN FUND Tier 1 project on LV network modelling is designed to develop this capability further. Bringing these technologies to maturity will require cross sector collaboration.

The improved understanding of losses through network and smart meter information will be explored as part of our work; however we believe that the presence of unmetered load may frustrate its full deployment. It will however provide a valuable calibration technique for the time-series modelling techniques.

Having a better understanding of how smart metering can be used to improve the processes underpinning the management of losses will be important to develop under RIIO-ED1. Although smart meters will enable better modelling of power flows, they may not provide all of the solutions to losses management. An industry-wide move to half-hourly settlement would improve the accuracy of customer consumption profiles. This might be especially important given the anticipated increase in the use of electric vehicles, heat pumps, storage, distributed generation, demand-side response etc. which will further challenge the accuracy of the 'standard' profiles currently used.

We are leading the development of smart meter based losses incentives to stimulate industry and stakeholder debate. The work considers the potential for smart meters to help drive the efficient reduction of losses for customers through the identification of a number of viable options. The work also identifies the questions that might be considered in the design of the incentive mechanism itself.

5.8 Stakeholder engagement

Communication with stakeholders will be an important part of our on-going Losses strategy. Therefore during the process to evaluate our losses strategy we will provide an opportunity for the engagement of interested parties. As part of this strategy we will specifically target stakeholders who have an interest in the outcome of 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.

SUMMARY OF CBA UNDERTAKEN

We have conducted a series of detailed Cost Benefit Analysis to test the potential benefits of reducing network losses by replacing individual items of network equipment with equivalent assets that are more efficient – ie have lower losses.

In total we undertook twelve CBAs covering all three approaches to asset replacement; ie

- proactive asset replacement;
- opportunistic intervention; and
- special loss-reduction initiatives and projects.

A summary of the CBA is provided and Table 8 below and tables presenting the key results from the CBA are presented in *Table 11* through to Table 24.

Table 8 – Summary of CBA results

Investment	CBA	Decision
Proactive	300mm^2 HV cable	Rejected
Proactive	300mm^2 LV cable	Rejected
Proactive	1000kVA ground-mounted transformers	Accepted
Proactive	800kVA ground-mounted transformers	Accepted
Proactive	200kVA pole-mounted transformers	Rejected
Proactive	100kVA pole-mounted transformers	Rejected
Proactive	50kVA pole-mounted transformers	Rejected
Proactive	Grid transformers (132/33kV)	Rejected
Proactive	Primary transformer (33kV/HV)	Rejected
Loss-specific	Capacitive compensation (LV)	Rejected
Opportunistic	300mm^2 HV cable	Accepted
Opportunistic	300mm^2 LV cable	Accepted
Opportunistic	Primary transformers (33kV/HV)	Accepted
Opportunistic	200kVA pole-mounted transformers	Accepted
Opportunistic	100kVA pole-mounted transformers	Rejected
Opportunistic	50kVA Pole-mounted transformers	Rejected

Table 9 - Proactive replacement with 300 mm^2 HV cable

	Results
Investment (asset class)	300mm^2 HV cable
Rationale for investment	To investigation the installation of 300mm^2 HV cable
Discount rate (%)	3.5% for 30 years 3% for next 15 years
Investment period (years)	45 years
Value of losses (£/MWh)	£48.42
Length of cable upon which assessment is based:	1km
Estimated replacement:	992km
Annual losses for the asset class – no additional investment (MWh)	46 MWh
Anticipated annual losses for the asset class – including investment (MWh)	30 MWh
Anticipated loss energy savings per annum (MWh)	15 MWh
Total reduction in losses over RIIO – ED1 (MWh)	122 MWh
Total reduction in losses over investment period (MWh)	686 MWh
Net benefit / loss over RIIO – ED1 (£m)	-£0.0 millions
Net benefit / loss over investment period (£m)	-£0.1 millions
Total emission saving over RIIO – ED1 (tCO2e)	55 tCO2e
Total emission saving over investment period (tCO2e)	138 tCO2e
Decision	Rejected

Table 10 - Proactive replacement with 300 mm^2 LV cable

	Results
Investment (asset class)	300mm^2 LV cable
Rationale for investment	To investigation the installation of 300mm^2 LV cable
Discount rate (%)	3.5% for 30 years 3% for next 15 years
Investment period (years)	45 years
Value of losses (£/MWh)	£48.42
Length of cable upon which assessment is based:	1km
Estimated replacement:	1270km
Annual losses for the asset class – no additional investment (MWh)	74 MWh
Anticipated annual losses for the asset class – including investment (MWh)	50 MWh
Anticipated loss energy savings per annum (MWh)	23 MWh
Total reduction in losses over RIIO – ED1 (MWh)	186 MWh
Total reduction in losses over investment period (MWh)	1045 MWh
Net benefit / loss over RIIO – ED1 (£m)	-£0.0 millions
Net benefit / loss over investment period (£m)	-£0.1 millions
Total emission saving over RIIO – ED1 (tCO2e)	84 tCO2e
Total emission saving over investment period (tCO2e)	210 tCO2e
Decision	Rejected

Table 11 – Proactive replacement of 1000kVA ground mounted transformers

	Results
Investment (asset class)	1000kVA ground mounted transformers
Rationale for investment	Pro-actively replace pre-1990 1000kVA transformers with 2015 EU specification transformers
Discount rate (%)	3.5% for 30 years 3% for next 15 years
Investment period (years)	45 years
Value of losses (£/MWh)	£48.42
Number of assets	489
Projected number of replacements	489
Annual losses for the asset class – no additional investment (MWh)	25,133 MWh
Anticipated annual losses for the asset class – including investment (MWh)	15,088 MWh
Anticipated loss energy savings per annum (MWh)	10,045 MWh
Total reduction in losses over RIIO – ED1 (MWh)	60,270 MWh
Total reduction in losses over investment period (MWh)	441,983 MWh
Net benefit / loss over RIIO – ED1 (£m)	£0.0 millions
Net benefit / loss over investment period (£m)	£6.7 millions
Total emission saving over RIIO – ED1 (tCO2e)	26,423 tCO2e
Total emission saving over investment period (tCO2e)	81,249 tCO2e
Decision	Accepted

Table 12 - Proactive replacement of 800kVA ground mounted transformers

	Results
Investment (asset class)	800kVA ground mounted transformers
Rationale for investment	Proactively replace pre-1990 800kVA transformers with 2015 EU specification transformers
Discount rate (%)	3.5% for 30 years 3% for next 15 years
Investment period (years)	45 years
Value of losses (£/MWh)	£48.42
Number of assets	163
Projected number of replacements	163
Annual losses for the asset class – no additional investment (MWh)	6,508 MWh
Anticipated annual losses for the asset class – including investment (MWh)	3,984 MWh
Anticipated loss energy savings per annum (MWh)	2,523 MWh
Total reduction in losses over RIIO – ED1 (MWh)	10,095 MWh
Total reduction in losses over investment period (MWh)	113,566 MWh
Net benefit / loss over RIIO – ED1 (£m)	-£0.2 millions
Net benefit / loss over investment period (£m)	£1.3 millions
Total emission saving over RIIO – ED1 (tCO2e)	4,271 tCO2e
Total emission saving over investment period (tCO2e)	18,146 tCO2e
Decision	Accepted

Table 13 - Proactive replacement of 200kVA pole mounted transformers

Results		
Investment (asset class)	200kVA pole mounted transformers	
Rationale for investment	Proactively replace pre-1990 200kVA transformers with 2015/2020 EU specification transformers	
Discount rate (%)	3.5% for 30 years 3% for next 15 years	
Investment period (years)	45 years	
Value of losses (£/MWh)	£48.42	
Number of assets	100	
Projected number of replacements	100	
Eco Design specification	2015	2020
Annual losses for the asset class – no additional investment (MWh)	1,044 MWh	1,044 MWh
Anticipated annual losses for the asset class – including investment (MWh)	960 MWh	738 MWh
Anticipated loss energy savings per annum (MWh)	84 MWh	306 MWh
Total reduction in losses over RIIO – ED1 (MWh)	591 MWh	2,144 MWh
Total reduction in losses over investment period (MWh)	3,802 MWh	13,785 MWh
Net benefit / loss over RIIO – ED1 (£m)	-£0.2 millions	-£0.1 millions
Net benefit / loss over investment period (£m)	-£0.4 millions	-£0.1 millions
Total emission saving over RIIO – ED1 (tCO2e)	263 tCO2e	953 tCO2e
Total emission saving over investment period (tCO2e)	725 tCO2e	2,628 tCO2e
Decision	Rejected	Rejected

Table 14 - Proactive replacement of 100kVA pole mounted transformers

Results		
Investment (asset class)	100kVA pole mounted transformers	
Rationale for investment	Proactively replace pre-1990 100kVA transformers with 2015/2020 EU specification transformers	
Discount rate (%)	3.5% for 30 years 3% for next 15 years	
Investment period (years)	45 years	
Value of losses (£/MWh)	£48.42	
Number of assets	100	
Projected number of replacements	100	
Eco Design specification	2015	2020
Annual losses for the asset class – no additional investment (MWh)	608 MWh	608 MWh
Anticipated annual losses for the asset class – including investment (MWh)	595 MWh	448 MWh
Anticipated loss energy savings per annum (MWh)	13 MWh	159 MWh
Total reduction in losses over RIIO – ED1 (MWh)	90 MWh	1120 MWh
Total reduction in losses over investment period (MWh)	580 MWh	7199 MWh
Net benefit / loss over RIIO – ED1 (£m)	-£0.2 millions	-£0.2 millions
Net benefit / loss over investment period (£m)	-£0.5 millions	-£0.3 millions
Total emission saving over RIIO – ED1 (tCO2e)	40 tCO2e	498 tCO2e
Total emission saving over investment period (tCO2e)	110 tCO2e	1372 tCO2e
Decision	Rejected	Rejected

Table 15 - Proactive replacement of 50kVA pole mounted transformers

Results		
Investment (asset class)	50kVA pole mounted transformers	
Rationale for investment	Proactively replace pre-1990 50kVA transformers with 2015 / 2020 EU specification transformers	
Discount rate (%)	3.5% for 30 years 3% for next 15 years	
Investment period (years)	45 years	
Value of losses (£/MWh)	£48.42	
Number of assets	100	
Projected number of replacements	100	
Eco Design specification	2015	2020
Annual losses for the asset class – no additional investment (MWh)	335 MWh	335 MWh
Anticipated annual losses for the asset class – including investment (MWh)	373 MWh	271 MWh
Anticipated loss energy savings per annum (MWh)	-18 MWh	83 MWh
Total reduction in losses over RIIO – ED1 (MWh)	-126 MWh	585 MWh
Total reduction in losses over investment period (MWh)	-811 MWh	3763 MWh
Net benefit / loss over RIIO – ED1 (£m)	-£0.2 millions	-£0.2 millions
Net benefit / loss over investment period (£m)	-£0.5 millions	-£0.4 millions
Total emission saving over RIIO – ED1 (tCO2e)	-56 tCO2e	260 tCO2e
Total emission saving over investment period (tCO2e)	-154 tCO2e	717 tCO2e
Decision	Rejected	Rejected

Table 16 - Proactive replacement of pre-1965 grid transformers (132/33kV)

	Results
Investment (asset class)	Grid transformers
Rationale for investment	To investigate the benefits of replacing pre-1965 grid transformers (132/33kV) with a low loss type.
Discount rate (%)	3.5% for 30 years 3% for next 15 years
Investment period (years)	45 years
Value of losses (£/MWh)	£48.42
Number of assets	-
Projected number of replacements	20 (Estimated)
Annual losses for the asset class – no additional investment (MWh)	889 MWh
Anticipated annual losses for the asset class – including investment (MWh)	487 MWh
Anticipated loss energy savings per annum (MWh)	402 MWh
Total reduction in losses over RIIO – ED1 (MWh)	2,816 MWh
Total reduction in losses over investment period (MWh)	18,104 MWh
Net benefit / loss over RIIO – ED1 (£m)	-£0.4 millions
Net benefit / loss over investment period (£m)	-£0.6 millions
Total emission saving over RIIO – ED1 (tCO2e)	1,252 tCO2e
Total emission saving over investment period (tCO2e)	3,452 tCO2e
Decision	Rejected

Table 17 - Proactive replacement of pre-1965 primary transformer (33kV/HV)

	Results
Investment (asset class)	Primary transformers
Rationale for investment	To investigate the benefits of replacing pre-1965 primary transformer (33kV/HV) with a low loss type.
Discount rate (%)	3.5% for 30 years 3% for next 15 years
Investment period (years)	45 years
Value of losses (£/MWh)	£48.42
Number of assets	-
Projected number of replacements	111
Annual losses for the asset class – no additional investment (MWh)	281MWh
Anticipated annual losses for the asset class – including investment (MWh)	215 MWh
Anticipated loss energy savings per annum (MWh)	66 MWh
Total reduction in losses over RIIO – ED1 (MWh)	459 MWh
Total reduction in losses over investment period (MWh)	2952 MWh
Net benefit / loss over RIIO – ED1 (£m)	-£0.2 millions
Net benefit / loss over investment period (£m)	-£0.3 millions
Total emission saving over RIIO – ED1 (tCO2e)	204 tCO2e
Total emission saving over investment period (tCO2e)	562 tCO2e
Decision	Rejected

Table 18 - Special loss-reduction initiatives: Capacitive compensation (LV)

Results			
Investment (asset class)	Capacitive compensation (LV)		
Rationale for investment	To investigate the benefit of reducing losses by the installation of capacitive compensation		
Discount rate (%)	3.5% for 30 years 3% for next 15 years		
Investment period (years)	45 years		
Value of losses (£/MWh)	£48.42		
Number of assets	Not applicable		
Projected number of replacements	Not applicable		
Eco Design specification	LV	HV	33kV
Annual losses for the asset class – no additional investment (MWh)	2,086 MWh	2,086 MWh	2,086 MWh
Anticipated annual losses for the asset class – including investment (MWh)	2,079 MWh	2,462 MWh	1,932 MWh
Anticipated loss energy savings per annum (MWh)	6.5 MWh	54 MWh	153 MWh
Total reduction in losses over RIIO – ED1 (MWh)	46 MWh	383 MWh	1075 MWh
Total reduction in losses over investment period (MWh)	293 MWh	2,462 MWh	6,912 MWh
Net benefit / loss over RIIO – ED1 (£m)	£0.0 millions	£0.0 millions	£0.1 millions
Net benefit / loss over investment period (£m)	£0.0 millions	£0.0 millions	£0.1 millions
Total emission saving over RIIO – ED1 (tCO2e)	20 tCO2e	170 tCO2e	478 tCO2e
Total emission saving over investment period (tCO2e)	56 tCO2e	469 tCO2e	1318 tCO2e
Decision	Rejected	Rejected	Rejected

Table 19 – Opportunistic installation with 300mm^2 HV cable

	Results
Investment (asset class)	300mm^2 HV cable
Rationale for investment	To investigation the installation of 300mm^2 HV cable
Discount rate (%)	3.5% for 30 years 3% for next 15 years
Investment period (years)	45 years
Value of losses (£/MWh)	£48.42
Length of cable upon which assessment is based:	1km
Annual losses for the asset class – no additional investment (MWh)	46 MWh
Anticipated annual losses for the asset class – including investment (MWh)	30 MWh
Anticipated loss energy savings per annum (MWh)	15 MWh
Total reduction in losses over RIIO – ED1 (MWh)	122 MWh
Total reduction in losses over investment period (MWh)	686 MWh
Net benefit / loss over RIIO – ED1 (£m)	£0.01 millions
Net benefit / loss over investment period (£m)	£0.01 millions
Total emission saving over RIIO – ED1 (tCO2e)	55 tCO2e
Total emission saving over investment period (tCO2e)	138 tCO2e
Decision	Accepted
Estimated replacement, profiled over RIIO - ED1 period	992km
Estimated reduction in losses over RIIO - ED1 (MWh) based on estimated profile	66,897
Total emission saving over RIIO - ED1 (tCO2e) based on estimated profile	29,090
Net benefit / loss over RIIO – ED1 (£m) based on estimated profile	£3.1 millions
Net benefit / loss over investment period (£m) based on estimated profile	£19.4 millions

Table 20 – Opportunistic installation of 300mm^2 LV cable

	Results
Investment (asset class)	300mm^2 LV cable
Rationale for investment	To investigation the installation of 300mm^2 LV cable
Discount rate (%)	3.5% for 30 years 3% for next 15 years
Investment period (years)	45 years
Value of losses (£/MWh)	£48.42
Length of cable upon which assessment is based:	1km
Annual losses for the asset class – no additional investment (MWh)	74 MWh
Anticipated annual losses for the asset class – including investment (MWh)	50 MWh
Anticipated loss energy savings per annum (MWh)	23 MWh
Total reduction in losses over RIIO – ED1 (MWh)	186 MWh
Total reduction in losses over investment period (MWh)	1045 MWh
Net benefit / loss over RIIO – ED1 (£m)	£0.01 millions
Net benefit / loss over investment period (£m)	£0.01 millions
Total emission saving over RIIO – ED1 (tCO2e)	84 tCO2e
Total emission saving over investment period (tCO2e)	210 tCO2e
Decision	Accepted
Estimated replacement, profiled over RIIO - ED1 period	1,270km
Estimated reduction in losses over RIIO - ED1 (MWh) based on estimated profile	134,335
Total emission saving over RIIO - ED1 (tCO2e) based on estimated profile	58,540
Net benefit / loss over RIIO – ED1 (£m) based on estimated profile	£6.2 millions
Net benefit / loss over investment period (£m) based on estimated profile	£37.9 millions

Table 21 – Opportunistic installation of pre-1970 primary transformer (33kV/HV)

	Results
Investment (asset class)	Primary transformer
Rationale for investment	To investigate the benefits of replacing pre-1965 primary transformer (33kV/HV) 2015 EU Specification transformers
Discount rate (%)	3.5% for 30 years 3% for next 15 years
Investment period (years)	45 years
Value of losses (£/MWh)	£48.42
Number of assets	Not applicable
Projected number of replacements	111
Annual losses for the asset class – no additional investment (MWh)	16,917 MWh
Anticipated annual losses for the asset class – including investment (MWh)	11,454 MWh
Anticipated loss energy savings per annum (MWh)	5,462 MWh
Total reduction in losses over RIIO – ED1 (MWh)	16,486 MWh
Total reduction in losses over investment period (MWh)	224,067 MWh
Net benefit / loss over RIIO – ED1 (£m)	-£0.7 millions
Net benefit / loss over investment period (£m)	£1.6 millions
Total emission saving over RIIO – ED1 (tCO2e)	7,044 tCO2e
Total emission saving over investment period (tCO2e)	36,913 tCO2e
Decision	Accepted

Table 22 – Opportunistic installation of pre-1970 200kVA pole-mounted transformer

	Results
Investment (asset class)	200kVA pole-mounted transformers
Rationale for investment	To investigate the benefits of replacing pre-1970 200kVA transformers grid transformers with a low loss type.
Discount rate (%)	3.5% for 30 years 3% for next 15 years
Investment period (years)	45 years
Value of losses (£/MWh)	£48.42
Number of assets	Not applicable
Projected number of replacements	57
Annual losses for the asset class – no additional investment (MWh)	595 MWh
Anticipated annual losses for the asset class – including investment (MWh)	547 MWh
Anticipated loss energy savings per annum (MWh)	48 MWh
Total reduction in losses over RIIO – ED1 (MWh)	157 MWh
Total reduction in losses over investment period (MWh)	1,987 MWh
Net benefit / loss over RIIO – ED1 (£m)	£0.1 millions
Net benefit / loss over investment period (£m)	£0.3 millions
Total emission saving over RIIO – ED1 (tCO2e)	67 tCO2e
Total emission saving over investment period (tCO2e)	330 tCO2e
Decision	Accepted

Table 23 – Opportunistic installation of pre-1970 100kVA pole-mounted transformer

Results		
Investment (asset class)	100kVA pole-mounted transformers	
Rationale for investment	To investigate the benefits of replacing pre-1970 100kVA transformers grid transformers with the EU specification.	
Discount rate (%)	3.5% for 30 years 3% for next 15 years	
Investment period (years)	45 years	
Value of losses (£/MWh)	£48.42	
Number of assets	Not applicable	
Projected number of replacements	100	
Eco Design specification	2015	2020
Annual losses for the asset class – no additional investment (MWh)	608 MWh	608 MWh
Anticipated annual losses for the asset class – including investment (MWh)	595 MWh	448 MWh
Anticipated loss energy savings per annum (MWh)	13 MWh	159 MWh
Total reduction in losses over RIIO – ED1 (MWh)	90 MWh	1,120 MWh
Total reduction in losses over investment period (MWh)	580 MWh	7,199 MWh
Net benefit / loss over RIIO – ED1 (£m)	£0.0 millions	£0.0 millions
Net benefit / loss over investment period (£m)	£0.0 millions	£0.1 millions
Total emission saving over RIIO – ED1 (tCO2e)	40 tCO2e	498 tCO2e
Total emission saving over investment period (tCO2e)	110 tCO2e	1372 tCO2e
Decision	Rejected	Rejected

Table 24 – Opportunistic installation of pre-1970 50kVA pole mounted transformers with 2015 EU specification transformers

Results		
Investment (asset class)	50kVA pole-mounted transformers	
Rationale for investment	To investigate the benefits of replacing pre-1970 50kVA transformers grid transformers with the EU specification.	
Discount rate (%)	3.5% for 30 years 3% for next 15 years	
Investment period (years)	45 years	
Value of losses (£/MWh)	£48.42	
Number of assets	Not applicable	
Projected number of replacements	100	
Eco Design specification	2015	2020
Annual losses for the asset class – no additional investment (MWh)	310 MWh	310 MWh
Anticipated annual losses for the asset class – including investment (MWh)	373 MWh	271 MWh
Anticipated loss energy savings per annum (MWh)	-62 MWh	38 MWh
Total reduction in losses over RIIO – ED1 (MWh)	-440 MWh	272 MWh
Total reduction in losses over investment period (MWh)	-2,828 MWh	1,746 MWh
Net benefit / loss over RIIO – ED1 (£m)	£0.0 millions	£0.0 millions
Net benefit / loss over investment period (£m)	-£0.1 millions	-£0.1 millions
Total emission saving over RIIO – ED1 (tCO2e)	-195 tCO2e	120 tCO2e
Total emission saving over investment period (tCO2e)	-539 tCO2e	332 tCO2e
Decision	Rejected	Rejected