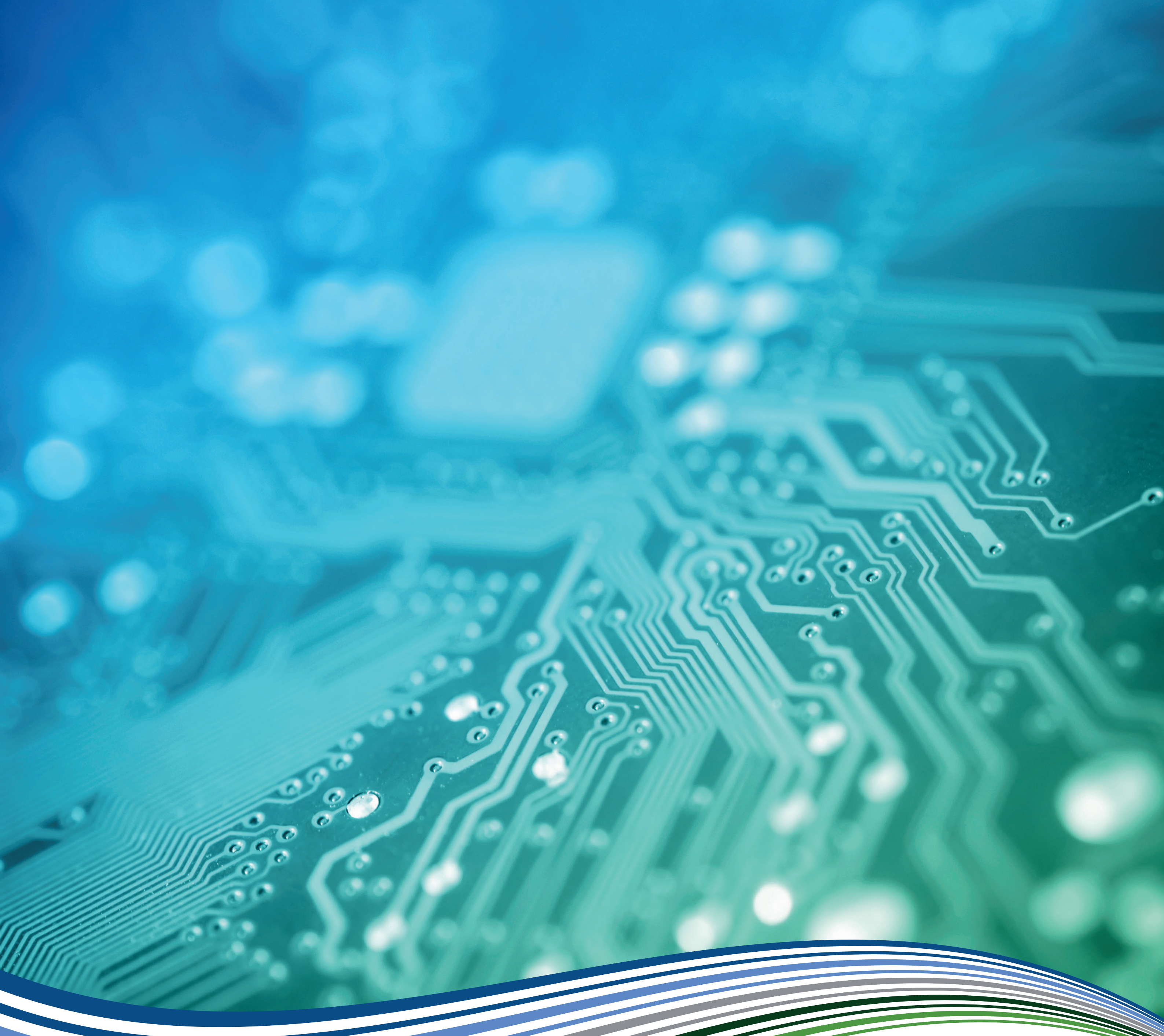
Tranche 3 Losses Submission



Scottish & Southern Electricity Networks

Executive Summary

Scottish and Southern Electricity Networks (SSEN) is fully committed to leading the industry in our understanding of network losses as we move to a more dynamic and decarbonised energy system.

Recognising the urgency for decarbonisation and the transition to Net Zero, our aim is to remove any barriers and empower solutions in a way that benefits the whole system to reduce losses, improve network utilisation, decarbonise and provide economic stimulus.

The work undertaken under tranche 1 and 2 of the Losses Discretionary Reward has established practises which will continue under RIIO-ED2, including:

- developing our understanding of the causes of network losses;
- making losses a key component of our BAU activities;
- engaging with a broad range of stakeholders to increase our knowledge and share best practice;
- identifying methods of utilising new data sources such as smart meter data to manage losses; and
- continuously identifying innovative new solutions for managing losses.

It is clear from our work to date that network losses are a complex issue, driven by a wide range of influencing factors, and losses are largely driven by the demand on the network. SSEN believes that local energy systems will have a crucial role in ensuring that the country meets its decarbonisation targets and this forms a key principle of our strategy for SSEN to transition to a DSO. Whilst this use of local renewables will increase local network utilisation (and hence losses), it can often defer or avoid expensive network upgrades, therefore producing an overall system benefit. Tranche 1 and 2 submissions have informed SSEN's understanding of losses, how they will be impacted by the widespread adoption of low carbon technologies and emerging local energy systems, and the need to consider losses more fully within our decision-making processes.

Through tranche 1 and 2 we explored various approaches to achieve the best result for losses optimisation; this evolution has enabled us to now embed losses performance across our network planning and operation. Our approach to losses will become more complex as decarbonisation and local energy targets encourage a move away from centralised generation and long-range transmission. We are well prepared to utilise new data sources to inform our approach to losses, in particular as we see increasing penetration of LV substation monitors as well as increasing volumes of data from smart meters.

Our engagement with existing and new stakeholders has intensified through tranche 1 and 2, and our now regular #NotWorthTheRisk campaign is highlighting the dangers of electricity theft, and ways to report this to an ever-increasing audience. Delivering a direct impact on customers' bills, reducing electricity theft will remain a key goal driven by our Network Protection team.

Andrew Roper
Distribution System Operations Director, SSEN

Embedding a holistic approach to network losses in our business

Scottish & Southern Electricity Networks

In this submission, we describe our achievements from the previous tranches and set out our plans for continued improvement, building on our earlier work and informing our strategy for managing losses as we move into RIIO-ED2.

SSEN remains fully committed to ensuring that losses on the network are managed as effectively as possible to reduce the impact on customers. The learning from our earlier work in tranches 1 and 2 has improved our understanding of losses, provided a firm foundation for us to implement processes into our business as usual (BAU) activities, and enabled wider stakeholder engagement. This learning is being incorporated into our RIIO-ED2 planning and will continue to support our original principles of knowing where to intervene, knowing how to intervene and ensuring that we intervene effectively.

Understanding **where to intervene**

- By the end of financial year 2020/21 SSEN is on track to have 3,650 feeders equipped with monitoring devices, allowing us to monitor power flows. Development of substation selection criteria during tranche 2 has enabled this rollout to be focussed on regions with high potential for increased losses along with other risk factors including loading and/or LCT uptake.

- Our extended trial of Mobile Asset Assessment Vehicle (MAAV) technology, has led to 51 investigations into our underground LV network. We are assessing the potential to deploy MAAV as part of our BAU toolkit to identify circuits which may be experiencing high losses.

Understanding **how to intervene**

- We are reaching out to a wider range of stakeholders than ever before, through our #NotWorthTheRisk campaign. This helps us understand stakeholder needs and responsiveness, and how we can best drive awareness of losses.

- Our Low Energy Automated Networks (LEAN) innovation project, supported by Ofgem's Tier 2 Low Carbon Networks Fund (LCNF) investigated the technical feasibility and economic viability of applying automated technology to reduce network losses.

- Project Local Energy Oxfordshire (LEO), led by SSEN, is actively considering the implications of losses in the (flexible/local) electricity system of the future. Work by the University of Oxford will examine losses in the context of energy sales within a localised network.

Intervening **effectively**

- Building on a project in tranche 2 which investigated the 'optimum' level of monitoring, in tranche 3 we undertook an in-house project to define the minimum level of monitoring required. This project found a need for a broad range of data and increased levels of LV monitoring to understand power flows.

- Nine internal dissemination events have brought visibility and access to the LV Monitoring data. This allows teams across the business to consider losses in operational decision-making. Our comprehensive LV Strategy considers losses holistically in line with network loading and LCT uptake, making losses reduction an integral part of our network planning.

- Our #NotWorthTheRisk campaign on electricity theft delivers a strong message to a wide audience via social media platforms, improving awareness with limited outlay of resource.

- Our in-house eLearning Module will be mandatory for all system planners, connection designers and operational staff, ensuring losses are integrated into all decision planning.

Our holistic approach – embedded in the business

Our work to date has clearly demonstrated that network losses are a complex issue and if considered in isolation can be difficult to address cost effectively.

Therefore, we have moved to adopt a strategy which is based on taking a more holistic and targeted approach, using the new sources of data available to us to determine areas of the network which may have issues with losses, headroom for Electric Vehicle (EV) connections or require maintenance. Addressing each of these issues in isolation is not cost effective, however, by taking a holistic approach and addressing all the issues simultaneously allows the benefits to be “stacked” improving the financial viability of all these issues.

Through tranches 1 and 2 we explored first the use of dedicated Losses Teams, and subsequently broader-remit Network Efficiency Teams, to undertake interventions on targeted locations. SSEN has now learned that in order to combat losses systematically, losses cannot be addressed in isolation but rather must become integral across all of our operations. SSEN has achieved this through various methods including:

- eLearning;

- Embedding losses in LV monitoring selection tool;

- Building the capabilities and systems to use new data sources for understanding losses and targeting interventions; and

- Policy changes to equipment specification.

Our work on Losses Investment Policy and Network Protection has led to a £12.48m saving for customers over the four years from 2015/16-2018/19. We will continue to grow this saving for customers, while delivering a flexible low-carbon network.

A. Understanding of Losses

Scottish & Southern Electricity Networks

Are DNO groups able to demonstrate how they are continuing to improve their understanding of the current level and sources of losses on their networks (including through the use of smart meter data)?

Throughout tranches 1 and 2 SSEN has continued to improve our understanding of losses by focussing on three key areas: LV (substation) monitoring, smart meter data and analytics and new datasets. Continued development of our capabilities and capacities in these areas is allowing SSEN to fully develop our understanding of losses and target interventions for network losses.

Modelling work in our Minimum Levels of Monitoring Data Analytics Project has enabled us to understand the minimum level of data we require to draw useful conclusions, and extensive internal dissemination and training has ensured our teams understand sources of losses, and how to consider the impact of losses within their work.

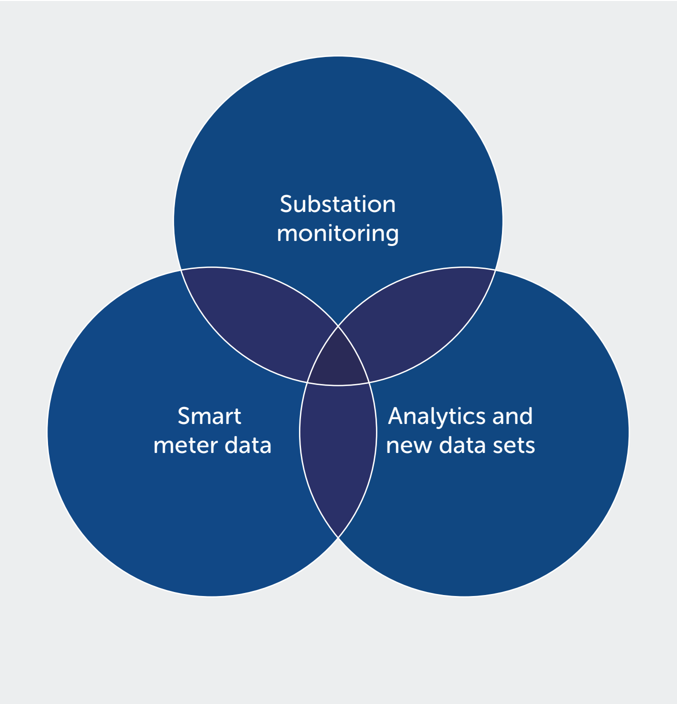


Figure 1: Tranche 1 Understanding Losses Areas of Focus

LV Monitoring

In tranche 1 of the LDR, SSEN highlighted the challenges in identifying network losses with limited availability of the relevant data. An emerging key data source for the industry was substation monitoring data. LV substation monitoring had been deployed during the New Thames Valley Vision (NTVV) project, and this enabled SSEN to embark on the Losses Teams project. Using the data gathered through NTVV allowed a detailed study into the losses characteristics of a section of the SSEN network. This concluded that the use of new data sources would be essential in targeting losses investigations and potential interventions.

SSEN's tranche 2 submission discussed our deployment of the learning from our initial trials of substation monitoring on the NTVV project. An NIA project "SSEPD 0027 Low Cost Substation Monitoring" was undertaken to make deployment of large volumes of LV monitoring economically viable through targeted engagement with the supply chain. The NIA project installed monitoring in approximately 250 substations.

Moving to tranche 3, SSEN has continued the rollout of LV substation monitoring as a BAU activity. Figure 2 demonstrates SSEN's current and forecast rollout of monitoring devices; by the end of financial year 2020/21 SSEN is on track to have 3,650 LV feeders equipped with monitoring devices. These monitoring devices have been located in substations which have been identified as being already heavily loaded and have a high potential for LCT uptake, based on our approach to asset risk mapping.

Deployment	No of feeders monitored
BAU NIA Redeployment	1,100
BAU 2019/20	650
BAU 2020/21	1,400
TRANSITION/LEO 2020/21	500
Total no by end financial year 2020/21	3,650

Figure 2: LV Substation Monitoring BAU Roll Out

Figure 3 illustrates the current distribution of monitoring devices across SHEPD and SEPD networks. The red dots symbolise current deployment.

All new monitoring devices, and the redeployment of devices from our NIA project, are based on the established substation selection criteria. The basis for this selection criteria is on forecast Electric Vehicle (EV) uptake and substation loading. This selection was based, in part, on work that was undertaken by the ENA Technical Losses Group and SSEN in tranche 2. The ENA Technical Group commissioned consultant WSP to undertake a study on the impact the low carbon transition could have on technical losses. As reported, the WSP study top three headlines are:

1. The uptake of low carbon technologies will significantly impact losses.
2. How networks accommodate low carbon technologies will impact losses.
3. Losses are complex, difficult to measure and vary based on regional topology.

SSEN commissioned a separate piece of work with TNEI to identify losses on the LV network with limited data available; the objective was to propose interventions in order to improve losses performance. One key finding in this project, as shown in Figure 4, was that loading was a key indicator of a network with higher losses. As the use of flexibility and smart solutions will generally increase the utilisation of existing network assets, they will also generate higher losses. Therefore, losses need to be fully considered when making these decisions.

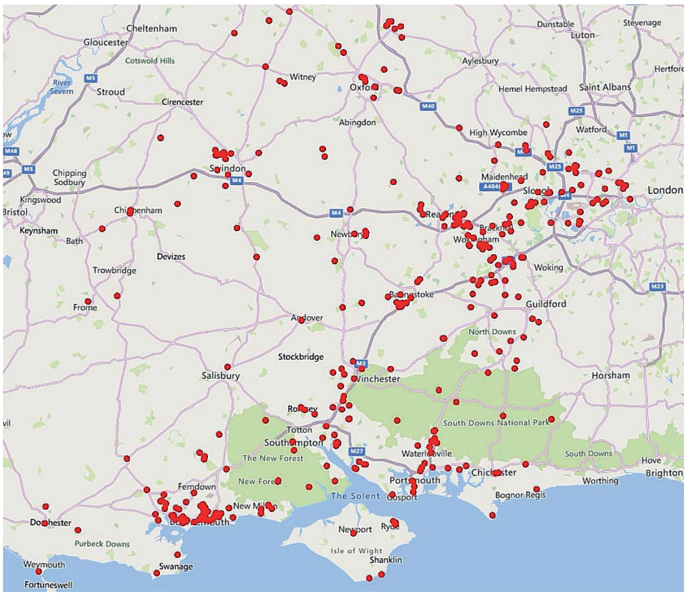


Figure 3: Distribution of LV Substation Monitoring Devices.

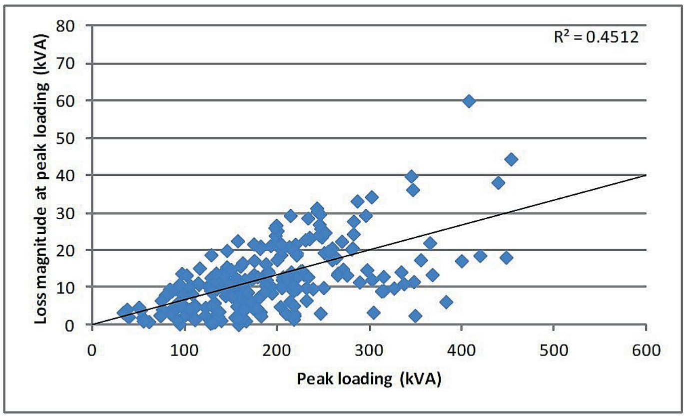


Figure 4: Correlation of Losses at Peak Loading with Peak Loading

SSEN has made considerable efforts to ensure the LV monitoring data is shared widely within the business to deliver as much value as possible. To date, we have run nine knowledge sharing sessions with various areas of the business to highlight the data available from the LV Monitoring rollout, and to allow staff to analyse it and understand where we are experiencing high losses on the network. See Appendix 1 Circuit Magazine for the internal publication to all networks staff detailing the data they can now access and how to access it.

Teams within SSEN are now starting to use LV Monitoring data as a result of our knowledge sharing sessions. From the feedback at these sessions, we have adapted the outputs from our monitoring portal to visualise this data specifically to help identify network losses. For example the Polar Plots shown in Figure 5 show the feeder current imbalance for the Old Slade Lane substation. A noticeable phase imbalance is evident on feeders 2 and 3, indicating likely avoidable losses. We also developed a view to show the Feeder Current Imbalance at a global state across a number of substations – this is shown in Appendix 2.

This was developed in conjunction with system planners, connections designers and operational staff. Requests to use this data are being received from our BAU teams and the data is being employed for operational decision making. This example demonstrates that we have begun building the process for employing our LV Monitoring data to understand losses and target interventions.

The learning from our earlier Losses work, BAU funded developments and learning from our portfolio of innovation projects has helped us to develop our approach to Asset Risk (Figure 6) which will be used to target deployment of LV monitoring to allow us to determine the most appropriate interventions.

Smart Meter Data

As of February 2020, there are approximately 280,000 SMETS2 smart meters installed across the SSEN network; this accounts for around 8% of our network. With the enrolment of SMETS1 in future, the pool of smart meter data will dramatically increase.

The first generation of smart meters, SMETS1, are now able to be enrolled into the smart metering communication system. As suppliers are required to enrol these meters the pool of smart meter data available to DNOs will dramatically increase.

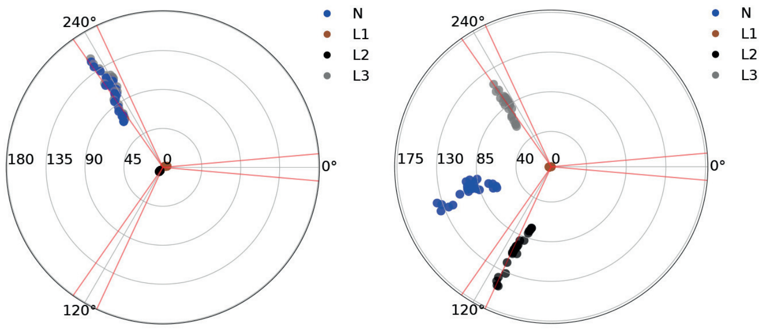


Figure 5: Eneida Feeder Current Imbalance Polar Plot for Old Slade Lane

Asset risk mapping

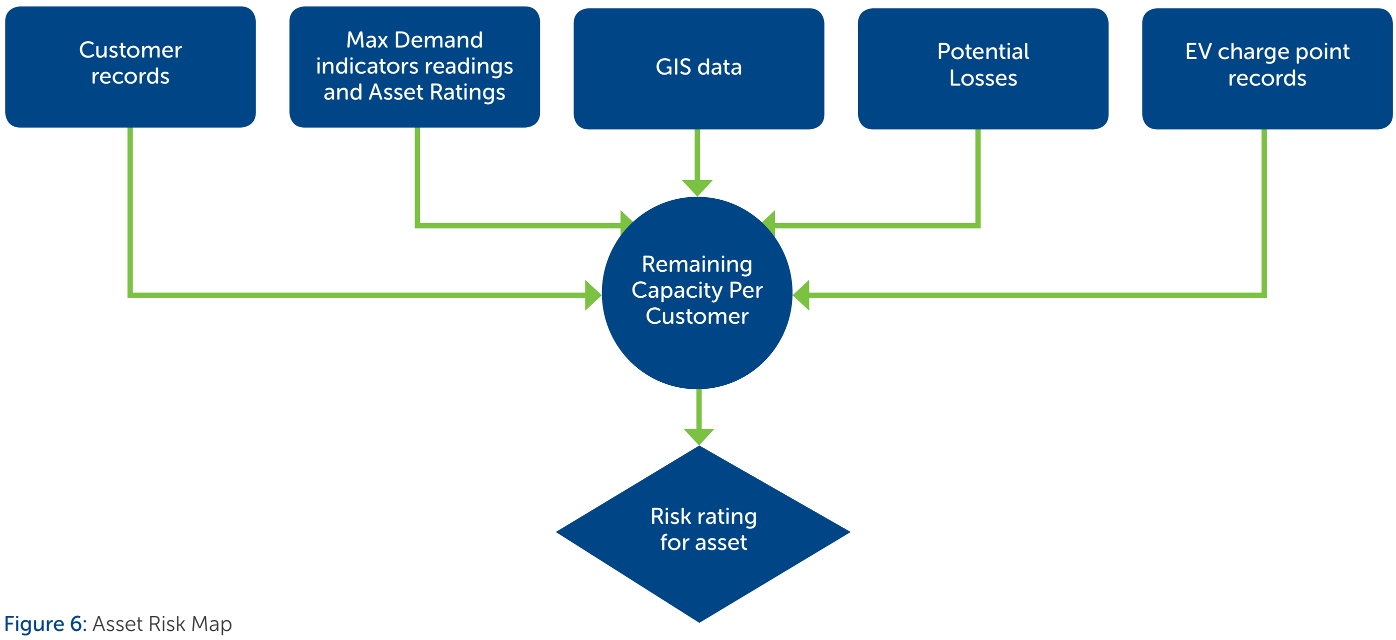


Figure 6: Asset Risk Map

The map below, shows the geographical position of the SMETS2 units deployed across our network. While the rollout of SMETS2 has greatly increased this year, it has not yet reached a level of clustering on the network to be able to be reliably used for understanding losses. We have previously explored the use of large volumes of smart meter type data from earlier innovation projects in studies undertaken by University of Strathclyde and TNEI, which has demonstrated the potential suitability of smart meter data to be used for losses management. However, the relatively low levels of smart meter penetration have prevented us from fully progressing in this area.

Additionally, we are not yet able to access the data from these devices, pending Ofgem's review and acceptance of our Smart Meter Data Privacy Plan (DPP).

However, as the penetration of SMETS2 meters increases and the DPP is approved, we are well prepared to utilise this information in the management of the LV network and losses. This will be complemented and supported by our ongoing LV monitoring roll out, improved forecasting of LCTs and enhanced asset information to allow the level of network losses to be better optimised.

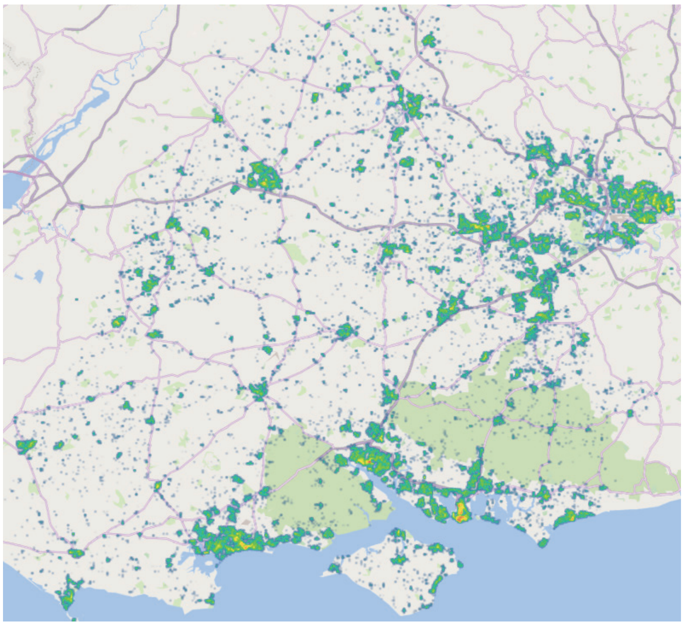


Figure 7: Geographic Position of SMETS2 units

Using analytics to derive value from data

In tranche 1, SSEN engaged Awesense to investigate the minimum level of monitoring required to identify the areas of our network experiencing the highest electrical losses. Awesense concluded that there is an optimum level of monitoring to gain useful, actionable data on losses.

In tranche 2, SSEN built on this work by commissioning the University of Strathclyde (UoS) to study the penetration of smart meters required to inform estimation of network losses. The project concluded that smart meter data could be utilised at relatively low levels of penetration, only when combined with substation monitoring.

Our conclusion in understanding losses in tranche 2 was that by optimising the use of monitoring, smart meter data and analytics, it would be possible to identify areas which are suffering from losses in a cost-effective fashion without full penetration of monitoring.

In tranche 3, SSEN undertook an in-house project "Minimum levels of monitoring Data Analytics Project" to embed this learning into the business. This work was undertaken by SSEN internal IT Data Analytics team and investigated how combining multiple sources of industry data could be used to assess network loading, to enable targeted deployment of LV monitoring equipment at locations where it would be most cost effective. The project outcomes challenged the conclusions of our earlier work by establishing the need to use a wider set of data sources. The project is described below.

The secondary aim of the project was to understand what datasets would be required to produce an improved Network Load Model that would allow SSEN to better simulate the widespread adoptions of Low Carbon Technologies (LCT). This will be informed by our Regional Scenario Modelling which describes detailed predictions for future load growth. **https://www.ssen.co.uk/SmarterElectricity/**.

During the discovery stage of the project a wider range of new data sources were considered. These consisted of existing industry data and newer sources, such as LV monitoring. See Figure 8.

The D0030 flows are designed to represent varying customer types to provide profiles that can be used for system planning, network design and informing the settlement process. By utilising the data available from previous innovation projects and newly available LV monitoring data, the team were able to mitigate the absence of smart meter by using data analytics techniques to predict of load shape. Whilst the overall profile shape remained similar, there were significant differences, especially around peak demand as can be seen in Figure 9. With uptake of LCTs and the increased use of flexible services we will see a greater degree of uncertainty associated with customers, demand making the delta between the D0030 profiles and the actuals increase. Thus, having access to appropriate volumes of smart meter data and LV substation monitoring data is going to become more important.

Figure 8: Data Sources Identified and Used

Source	Availability	Maturity
Industry		
D0030 Industry flows – Profile usage shapes (generated by Elexon) EAC	Yes	Mature data, proven data source
D0010 Industry flows – Meter readings	No	New data source gaining understanding
Smart Meter consumption	No	New data source gaining understanding
Smart Meter max demand	No	New data source gaining understanding
Estimated Annual Consumption	No	New data source gaining understanding
Internal		
SIMS – Service Interruption Management System (Asset info)	Yes	Mature data, proven data source
Low Voltage Monitoring (SAVE, Gridkey, Eneida)	Yes	New data source gaining understanding
North/South MDi list	Yes	Mature data, proven data source
NCM – Network Connectivity Model	Yes	Mature data, proven data source
High Voltage Monitoring (PI)	Yes	Mature data, proven data source
B2B Max Demand / Meter readings	Yes	Mature data, proven data source
Smart Meter Identification	Yes	New data source gaining understanding
Non-industry		
Energy Performance Certificates (external)	Yes	New data source gaining understanding
Electric Vehicle Uptake	Yes	New data source gaining understanding

Before completing this work, SSEN sought to minimise the rollout of LV substation monitoring to minimise cost; however, it is clear from the results to date that the assumptions made historically, and used in D0030 profiles, were too narrow. Through our other innovation projects TRANSITION and LEO, we we will look to improve our understanding of how the network may behave in the future and how this will impact on demand profiles, helping to further develop our understanding of future losses.

Our work on data has shown that even with access to extensive data sets, the inherent inaccuracies and tolerances may make the accurate prediction of losses problematic. However, through the use of smart meter data, LV Monitoring data and advanced analytic techniques, it is possible to make an informed assessment of network losses to allow these to be included in a cost benefit analysis (CBA), which appropriately considers a wide range of other network parameters for the best whole system outcome.

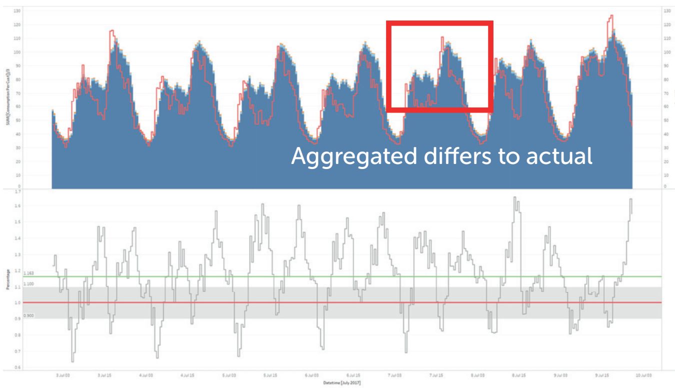


Figure 9: D0030 Aggregated Profile Shapes Vs LV Monitioring Data

1.2 Are DNO groups considering the network in a holistic manner and making efforts to understand how losses and their actions to manage losses on their network affect others e.g., those on the transmission and/or other distribution networks in an integrated way with their network capacity management and considering the needs of their stakeholders?

Considering the network in a holistic manner is critical to ensuring that we achieve the best Whole System Outcome for customers and stakeholders; as part of our transition to a Distribution System Operator (DSO) we are actively engaging with other DNOs, TOs, the ESO, the regulator, community energy groups, government bodies, and consumer groups. SSEN has established a Whole System Development Forum considering many aspects of the move to whole system planning and whole system operations. The remit of this group includes consideration of the impact of decisions on losses, as well as on other aspects of the whole system. This will continue throughout the coming years alongside the ENA Open Networks Project Workstream 4 team, to inform our thinking in the Whole System area. Additionally, we are already engaging with local authorities on their longer term energy plans and also contributed to the Scottish Governments, Local Energy Policy Statement[1]. From this work we have seen, there is a clear desire to have a more local and flexible energy system. This engagement has helped to inform the development of projects such as Project LEO and MERLIN desicribed in Appendix 3 and 5, which look to demonstrate local energy systems including the optimisation of losses in consideration of the whole system. Demonstrating a local energy system and the impact on several factors, including losses, will enable us to gather real feedback from stakeholders and customers to understand their needs.

As described earlier, we have already implemented measures to manage losses in several key areas within our overall LV Strategy, which provides the opportunity to combine benefits and reduce costs for customers. For example, in our EV Strategy we are assessing our LV networks to identify areas of potentially high EV uptake and those that are likely to have limited capacity remaining.

From this, we identified that there were strong synergies between those networks most at risk from overloading and those most likely to be suffering high levels of losses.

Following on from our project NIA – Whole System Growth Scenario Modelling, we have developed a follow-on project NIA – Regional Energy System Optimisation Planning (RESOP). This project will include partners SHE Transmission and Scottish Gas Networks, and will look to further develop and refine a framework for whole system planning for a local region. The project will include key contributions from both local authorities, Transport Scotland, and Scottish Government, to inform their development of Local Energy Plans and Local Heat and Energy Efficiency Strategies. This programme of work will consider both the distribution and transmission systems.

SSEN has also engaged in the Scottish EV Partnership with SPEN and Scottish Government; from this we have identified further projects which look to inform the rollout of EV charging infrastructure in Scotland. Our E-Tourism NIA project[2] will look at how large volumes of tourist driven EV traffic will impact on popular visitor routes and destinations. This is likely to result in significant network peaks during the tourist season in remote areas; the project will also consider how local solutions can be used to manage these peaks as an alternative to a traditional network reinforcement. This will include engagement with local renewable developers, attraction owners, accommodation providers as well as development agencies, local authorities and transport bodies. Again there is a strong desire to focus on local solutions, which will impact on losses.

These projects have been initiated based on strong engagement with key stakeholders on the need to consider a holistic approach to network development, in order produce the optimum whole system outcomes, including consideration of losses.

[1] https://consult.gov.scot/energy-and-climate-change-directorate/local-energy-policy-statement/

[2] https://www.smarternetworks.org/project/nia_ssen_0038/print

1.3 What progress have DNO groups made since tranche two and how has their understanding of losses developed? Can they identify areas (from tranche two) that have allowed them them to improve their understanding of losses?

Since tranche two, SSEN has continued to develop our understanding of losses, focussing on the three key areas described in Section 1.1 – LV monitoring, smart meter data and analytics using a broader number of datasets. Work undertaken in-house following tranche 2 has highlighted the difficulties of quantifying losses, where accuracy of measurements is combined with layering of data. Project LEO, described below, is actively considering the implications of losses in the local energy system of the future.

Our Minimum Levels of Monitoring Data Analytics Project in tranche 3 is informing our understanding of the monitoring assets we require to identify how best to intervene effectively on losses in a given area, which is currently helping inform our approach to network management. Operationally, we have sought tools which help us to better identify losses in the field, such as the Mobile Asset Assessment Vehicle (MAAV) described below. Finally, our external **#NotWorthTheRisk** campaign, which began in tranche 2, has led to a significant increase in our engagement with the general public who can potentially aid detection and resolution of non-technical losses on our network, while also increasing customer safety.

MAAV

The Mobile Asset Assessment Vehicle (MAAV) is a sophisticated truck-mounted electric field sensor system. It provides visibility into inaccessible areas of the underground distribution system. SSEN was introduced to the MAAV through discussion with our industry colleagues at UKPN during the Low Carbon Networks Innovation (LCNI) Conference. UKPN has had success in employing the MAAV to detect contact voltages on their network and has been able to calculate the losses caused by these defects; UKPN has called these losses Contact Voltage Losses (CVL). Through discussions with UKPN we were able to trial their MAAV vehicle for two nights in the High Wycombe and Slough area of our network. UKPN has been employing the MAAV based on a safety and network losses cost benefit analysis. SSEN believed that the MAAV could also be employed to possibly identify areas of the network which give rise to cable faults in the future, thus adding to the stacked benefit approach.

Figure 10: Trial of UKPN MAAV

The trial was successful, and 26 voltage events were found during the 2-night trial. The detection rate was 31.1 events per 100 miles, which was similar to UKPN's Central London detection rate of 36.2 per 100 miles. During the 2-night trial a potential rogue circuit was detected from a MAAV find; by employing further pinpointing using thermal cameras, a failing pot-end joint was identified and repaired. The findings from the trial gave SSEN confidence that a further extended trial would be of value to understand the full potential of the MAAV. During November 2019, a further one-month trial was then carried out in our Wessex and South East regions, which includes Portsmouth and Southampton city centres.

No of Events	No of Investigations	No of further monitoring assets installed
157	51	3

Figure 11: MAAV Trial in Numbers

As shown in Figure 11, 157 events were detected during the one-month trial. As SSEN adopted the UKPN response matrix for responding to events, this involved the further investigation by SSEN staff of 57 events found by the MAAV. This has also resulted in the deployment of sophisticated monitoring devices in specific network locations in an attempt to identify and resolve issues which could potentially lead to a future outage but are also likely to be causing losses. The trial has given SSEN a robust source of data on the use of the MAAV technology, and further investigation is being carried out to assess the viability of a BAU deployment of the MAAV into our stacked approach to dealing with network losses.

B. Effective engagement and sharing of best practice with stakeholders on losses

Project LEO – Local Energy Oxfordshire

Project Local Energy Oxfordshire (LEO) is one of the most ambitious, wide-ranging, innovative and holistic smart grid trials ever conducted in the UK.

Project LEO seeks to create the conditions that predict the local electricity system of the future to develop an evidence base that can be used to inform the transition to a smarter electricity system (more information on Project LEO can be found in Appendix 3).

Understanding of how this will impact on network losses is an important element of the project, as the project's core objective is to develop the best whole system outcomes. Work Package 4 of the project entitled Future System is being led by Professor Malcolm McCulloch, Group Leader of the Energy and Power Group at the University of Oxford. While LEO is looking at the transition to a lower carbon economy and smart grid ecosystem, losses remain a core part of the project's development. The outputs of Project LEO will be widely disseminated, and SSEN will ensure that this includes to both Ofgem and the ENA Technical Working Group.

2.1 How are DNO groups planning to utilise stakeholder engagement to inform their losses management actions and allow them to understand their impact? How have DNO groups already engaged with stakeholders in this regard?

SSEN actively engages with a wide range of stakeholders on both technical and non-technical losses. Throughout tranches 1 and 2 SSEN engaged with other network operators in the form of representatives from the water and gas industry in understanding their approach to leakage and shrinkage, as well as engagement with international network operators and organisations working to understand and reduce losses. In tranche 2 SSEN worked with Canadian organisation Awesense to transfer learning from the work that they had carried out reducing losses with BC Hydro.

SSEN has continued to leverage learning from Canadian network operators and organisations through Project MERLIN which has allowed the transfer of learning from Hydro Ottawa as well as a number of GB and Canadian SMEs, supported by the University of Cambridge. Project MERLIN is described in more detail in Appendix 5.

SSEN plays an active role in all losses activities taking place across the industry, an important example being the ENA Technical Losses Task Group. SSEN also joined WPD's losses strategy consultation event and we have widely disseminated the results from our LEAN. Figure 12 shows the extent of the dissemination activities carried out on our LEAN project (as described in Section 3.1), and the positive outcome that the LEAN outputs have been picked up in the losses strategies of other GB DNOs.

ENW Losses Strategy, April 2015	"5.6.1 Review the Low Carbon Networks Fund strategy Another relevant LCN Fund project includes the 'Low Energy Automated Networks'."... "We will continue to explore how the learnings from this project might inform the development of the loss-reduction policies in our business."
NPG Strategy for Losses, v2.1, February 2018	"Switching out under-utilised plant"... "SSEPD are investigating this as an (LCNF) Tier 2 project called 'LEAN'. We will wait on the findings of this project before proceeding."
UKPN Distribution Losses Strategy, July 2019	"Our DNO peers at SSEN is undertaking a project in this area using Transformer Auto Stop Start technology through their Innovation funded project LEAN. We are actively engaged with SSEN on this project and are keen to understand the potential losses benefits and if we can apply the same or similar solution to our network."
WPD Losses Strategy, February 2018	"WPD is continuing to monitor Low Energy Automated Networks (LEAN), the LCNF Tier 2 project being undertaken by Scottish and Southern Electricity Networks (SSEN)."

Figure 12: LEAN Dissemination and uptake in DNO's Losses Strategies

SSEN engages with external stakeholders through our Scottish EV Partnership and EV Energy Taskforce. The EV Energy Taskforce was announced as part of the 'Road to Zero' strategy in July 2018, when the Government created the EV Energy Taskforce. This was established to form a cross-sector group able to identify and suggest ways to tackle the key obstacles to widespread uptake of EVs, creating multiple working groups across key topics with EV drivers at the heart of the thinking. The group contains membership from across the sector including OLEV, Dept of Transport as well as automotive original equipment manufacturers (OEMs) and customer groups such as Citizens Advice and the AA.

The Taskforce aims to find ways to ensure that costs and emissions are as low as possible, and opportunities for vehicles to provide grid services are capitalised upon for the benefit of the system, energy bill payers and electric vehicle owners. Influencing the market for electric vehicles, charge points and a smart energy system is a key deliverable, as well as assisting in the development of a consultation to inform the development of secondary legislation following the introduction of the Automated and Electric Vehicles Act 2018.

As discussed in Section 1.2 SSEN is engaged in the Scottish EV Partnership with SPEN and Scottish Government. The key desire from participating in both groups is to drive a holistic whole system approach to EVs considering the views of multiple stakeholders, industry bodies, community groups, technology providers and original equipment manufacturers (OEMs). This will help us focus on local solutions, which will help optimise losses performance.

Non-Technical Losses – building awareness and engaging new stakeholders

In 2018, SSEN exhibited at the Emergency Services Show 2018 with the objective of informing a new but important group of stakeholders about the dangers of electricity theft and network interference.

The Emergency Services Show is the UK's largest event of its kind for all emergency services, with attendance in excess of 8,000, and offers a prime opportunity to engage with a group of stakeholders who may be directly involved and potentially placed in danger as a result of network interference and power theft.

Attendance at the Emergency Services Show also allowed SSEN to share best practice with other exhibitors as well as deliver bespoke seminars on the dangers of electricity theft, what to look out for and how it should be reported.

As well as the traditional emergency services we were able to engage with first response providers and community safety providers and we plan to maintain this engagement going forward.

SSEN involvement at the show was well received and we were subsequently approached by the Emergency Services Show organisers to publish an article in The Emergency Services Times, April 2018, on the dangers of electricity theft in. Emergency Services Times is a bi-monthly magazine sent free to 6,000 buyers and specifiers of equipment and services within the UK emergency services sector.

THE EMERGENCY SERVICES SHOW
HALL 5 | NEC | BIRMINGHAM | 19-20 SEPTEMBER 2018

Figure 13: Emergency Service Show Stand

The dangers of electricity theft

Scottish and Southern Electricity Networks (SSEN) is responsible for maintaining the electricity networks, which supply over 3.7 million homes and businesses across central southern England and north of the Central Belt of Scotland. It owns one electricity transmission network and two electricity distribution networks, comprising 106,000 substations and 130,000km of overhead lines and underground cables across one third of the UK.

SSEN's first priority is to provide a safe and reliable supply of electricity to the communities it serves. As part of this, SSEN's Revenue Protection department has teams working day and night to ensure that the network is safe and secure, not only to keep the lights on for the company's 3.7m customers, but also to make sure that all of its substations, cables and overhead wires are free from any tampering or interference.

Electricity theft is often carried out as part of the illegal drugs trade, and has also been identified as a contributory factor in a number of house fires. Shane Scarsbrook heads up SSEN's Revenue Protection Department, and explains why it is important to raise awareness of electricity theft. He said, "At SSEN everyone works under the principle 'If it's not safe, we don't do it'. Not only is stealing electricity highly dangerous, in the worst cases it can result in a fatality. It's not just the act of stealing electricity that is dangerous in its own right, the fallout from this criminal activity can also impact negatively on innocent bystanders and neighbouring buildings.

"In the course of our team's day-to-day work, we've come across substations where the locks have been sawn off, doors smashed in and fences cut open, with the end result looking very tempting for young children to explore or meaning it's too easy to retrieve a stray

Electricity theft has been identified as a contributory factor in a number of house fires.

football or Frisbee. We've also come across street lighting columns, which have been 'tapped into' to abstract electricity for illegal activities."

Extra vigilence

If the thought of potentially killing themselves, frie and neighbours is not enough of a deterrent, for th who are caught, charged and prosecuted for steali electricity there is also the prospect of a fine of up t £2000 and up to five years behind bars.

SSEN is encouraging everyone to be extra vigila report any suspicious activity near its equipment a substations. They would also like to hear from you i see extra cables, clips or wires attached to commu electricity meters, as this is a clue to possible theft incoming electricity.

There are many ways in which you can report suspicious activity on SSEN's network, all of which treat your call in the strictest confidence.

www.ssen.co.uk/ElectricityTheft/

To contact SSEN's Revenue Protection team, you can either call 0800 048 1618 or e-mail: rpnetworks@sse.com followed by any details that you can provide

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Figure 14: Electricity Theft in Emergency Services Times

#NotWorthTheRisk

Network Protection (Non-Technical Losses)

SSEN's **#NotWorthTheRisk 2018** campaign was run on multiple media platforms with one aim: to reach as many stakeholders as possible to inform around the dangers of electricity theft, a non-technical loss.

In 2020, SSEN relaunched the **#NotWorthTheRisk** campaign to continue the spotlight on the dangers of electricity theft, which can cause major safety concerns ranging from outages, power quality issues as well as damage to property and the risk of fire.

The **#NotWorthTheRisk** campaign 2020 focused on utilising social media for the week-long campaign. Covering both our SEPD and SHEPD areas with the addition of Local Press in our SHEPD area. Across the 2018 and 2020 campaigns SSEN has engaged over 1.6million stakeholders. The **#NotWorthTheRisk** campaign will continue to form a key part of SSENs engagement activities.

#NotWorthTheRisk Campaigns

	2018	2020	Total Engagement
SSEN Internal app	575	770	1,345
Internal Email	1798	0	1,798
Facebook	26,020	51,689	77,709
SSEN Webpage	207	0	207
TV (estimated hit)	1,000,000	0	1,000,000
Radio (estimated hit)	348,000	0	348,000
Instagram		478	478
Local press reach		152,018	152,018
Twitter impressions		18,455	18,455
Unique open stories		2,563	2,563
Linkedin impressions		2,249	2,249
Intranet		202	202
	Overall Engagament 2018 - 2020		**1,605,024**

Figure 15: #NotWorthTheRisk 2020 Campaign Stats

2.2 How are DNO groups engaging with stakeholders (e.g. suppliers, distributed generators, the TSO, TOs etc.) to develop relevant partnerships which may help to manage losses (e.g. opportunities to use Demand Side Response)? This could include initiating a joint project where a reduction in losses is the primary driver or identifying opportunities within existing projects to help manage losses.

It is clear from our work to date that network losses are a complex issue, driven by a wide range of influencing factors, and that losses are often driven by demand on the network. SSEN believes that local energy systems will have a crucial role in ensuring that the country meets its decarbonisation targets and this forms a key principle of our strategy for SSEN to transition to a DSO[3]. Our aim is to remove any barriers and empower local solutions in a way that benefits the whole system to reduce losses, improve network utilisation, decarbonise and provide economic stimulus. We are working with other actors in flexibility markets to allow this aspiration to become a reality. Therefore, SSEN has engaged in a number of initiatives to support local energy systems and hence our understanding of losses. These include:

- Project LEO – includes a wide range of partners and stakeholders from across the energy supply chain including local communities, local authorities, energy suppliers, flexibility providers and academics – see Appendix 3 for further details. LEO will explore how the growth of decentralised renewables, battery storage, electric vehicles and demand-side response can be supported by a smarter and more flexible power grid to support a local energy system across Oxfordshire. Losses will be a key consideration in the development of this local energy system.

- MERLIN – involves Hydro Ottawa as well as a number of GB and Canadian SMEs, supported by the University of Cambridge. The project will consider losses as part of the economic assessment and decision-making process[4]. Please see Appendix 5.

SSEN is also continuing to support the development of local energy systems via our BAU activities, by continuing to implement flexible connection options to maximise the use of existing infrastructure and by implementing new flexibility services to encourage greater participation by local resources. These include:

- SWANs – South West Active Network Scheme: when fully commissioned this scheme will see over 800MW of new renewable generation connect to the SSEN network. This scheme, being delivered in conjunction with National Grid ESO, will see this new generation being offered flexible connections to the distribution system to avoid upstream transmission constraints. The successful delivery of this project has required extensive engagement with both the Transmission Operator and the System Operator as well as a wide range of generation developers.

  SWANS will allow significantly more generation to connect to the existing network rather than wait for an upgrade; whilst this is the best whole system outcome it may result in an increase in network losses, so we will continue to monitor this as the scheme moves to full operation later in the year.

- Islay Constraint Managed Zone (CMZ), which has seen SSEN place its first economically viable flexibility contract, for a total of 6MW worth of services with a local renewable generator on the Isle of Islay. These services have been secured for network outage support, which will be supplied by an existing local hydro power plant, reducing reliance upon fossil fuel-based energy generation on the island during adverse network conditions[5]. These services were secured via an online procurement portal, followed by a compliant procurement process which included engagement with potential providers, local developers and communities. This engagement has stimulated significant interest amongst these providers and should allow SSEN to adopt similar schemes on other island groups such as Skye and the Western Isles. Whilst this use of local renewables will increase local network utilisation (and hence losses), it avoids the use of imported energy, therefore producing an overall system benefit.

In working with a diverse and wide-ranging stakeholder group across our portfolio of projects, SSEN is beginning to deepen our understanding on the technical,

[3] https://ssen-transition.com/dso/ssen-dso-strategy/

[4] http://news.ssen.co.uk/news/all-articles/2019/june/ssens-project-merlin-charms-the-uk-government-and-receives-funding/

[5] http://news.ssen.co.uk/news/all-articles/2019/october/ssen-places-first-cmz-contracts-for-the-isle-of-islay-to-deliver-a-flexible-low-carbon-future/

commercial and societal benefits from the use of local energy systems. This includes the impact that improved network utilisation has on losses and ensuring that losses are properly assessed and considered in the design and operation of these schemes.

More recently, SSEN and SPEN have entered into a Strategic Partnership with Scottish Government and Transport Scotland to develop a joined-up approach to electric vehicle charging infrastructure in Scotland[6].

The partnership also includes input from SHE Transmission and SP Transmission. In tranche 1 SSEN undertook a losses competition in collaboration with the UK Energy Innovation Awards to stimulate third party and SME involvement in tackling losses. This lead a pilot project with a Canadian SME. SSEN also investigated the feasibility of a Hackathon on network losses. It was found that the deliverables would be limited due to the current smart meter penetration and SSEN's smart meter Data Privacy Plan submission status.

2.3 Are DNO groups able to demonstrate that they have processes in place to share their own best practice with relevant stakeholders by identifying any outcomes of tranches one and two that they intend to do/carry on doing.

This could include engaging with one another, the Transmission System Operator (TSO) and the Transmission Owner (TO) to facilitate a holistic and coordinated approach to losses management as they transition to DSO roles.

SSEN will continue to engage with industry through participation in ENA Technical Losses Task Group to share our best practice on losses and learn from other DNOs. In particular, as an active member of the ENA Open Networks project we continue to keep customers and best whole system outcome at the forefront of our planning and ambition for the move to DSO.

A number of outcomes from tranche 1 and 2 will continue to be used and developed by SSEN, including:

- our #NotWorthTheRisk campaign, which has reached an estimated audience of over 1 million users since 2018, to educate on non-technical losses;

Figure 16: Islay CMZ Inver Hydro Dam

- our Minimum Levels of Monitoring Data Analytics Project will inform our deployment of LV monitoring to enable best use of the data to inform our losses strategy;
- the transformer auto stop start (TASS) system developed through project LEAN, which is being considered by SSEN and several DNOs in their forward planning as shown in Section 2.1;
- our analysis on non-metered usage at Tealing, described below, which has been included in SHE Transmission's Sustainability Action Plan and SHE Transmission's RIIO-T2 Transmission Losses Strategy, resulting in a in a estimated 106,542,549 kWh in avoided losses and £7,588,638 in total cost savings from avoided losses and carbon emissions. For more details please refer to Appendix 7.[7]

Figure 17: Strategic EV Partnership with Scottish Government

[6] http://news.ssen.co.uk/news/all-articles/2019/august/charging-ahead-with-evs/

[7] https://www.ssen-transmission.co.uk/media/3811/climate-change-and-sustainability-justification-paper.pdf

C. Processes to manage losses and proposals for RIIO-ED2

3.1 Do DNO groups continue to look at best practice, both nationally and internationally, when considering processes and methods to manage losses on their networks?

SSEN has continued to search for best practice both nationally and internationally when considering processes and methods to manage losses on our networks. Such best practice has been drawn from across a variety of industry sources.

Several the projects or activities presented in Figure 18 are described in further detail below, emphasising the extent of coordinated activity and industry alignment in aid of effective losses management.

Innovation Projects

- LEAN
- Project LEO Oxfordshire Programme
- Power Forward Challange T.E.F. Programme

Bussiness as Usual Activities

- MAAV
- DNO Boundary Investigation
- Network Protection Team
- Data and Anlytics
- ANM
- CMZ – Islay

Industry Working Groups

- Technical Losses Task Group
- ENA Open Networks Project

Figure 18: Best Practice Projects to Manage Losses

Innovation Projects

Flexibility Demonstrators
As discussed earlier, SSEN sees local energy being a critical part of the future systems therefore we are in a number of demonstrators, the objective being to secure the best whole system outcomes including losses.

Low Energy Automated Networks (LEAN)
Our Low Energy Automated Networks (LEAN) innovation project was supported by Ofgem's Tier 2 Low Carbon Networks Fund (LCNF). This project sought to establish the technical feasibility and economic viability of applying automated technology to reduce network losses. The project achieved losses savings of over >100 MWh from two primary substations over the course of the trial, equating to carbon savings of over 38 tCO_2e.

The project concluded in 2019 having successfully met its objective to develop and apply Transformer Auto Stop Start (TASS) technology to reduce losses at 33/11kV primary substations. The key principle of TASS is to switch off one of a number of transformers in a substation at times of low demand to avoid the fixed iron losses associated with that transformer – akin to turning off a car engine when the vehicle isn't driving anywhere. SSEN have decided to retain the equipment at the two deployment sites and are currently evaluating the application of the TASS methodology to any future Primary substation construction or suitable retrofit.

Over the course of the project the TASS Evaluation Tool has been requested by and shared with four other DNO Groups – ENW, NPG, UKPN and WPD.

Figure 19: Two 33/11kV primary substation transformers during a visit to a LEAN project trial site

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Project LEO Oxfordshire

As described previously in the document and in detail in Appendix 3. LEO will improve our understanding of how opportunities can be maximised and unlocked from the transition to a smarter, flexible electricity system and how households, businesses and communities can realise its benefits. The wide range of partners involved including suppliers such as EDF, local authorities, community groups and emerging flexibility providers such as Piclo and Nuvve, will bring a diverse range of inputs and perspectives to ensure that the project considers the optimisation of the Whole System including losses. Likewise the academic rigour of the system modelling work packages led by University of Oxford and Oxford Brookes University will bring best practice in modelling and data handling from outwith the traditional network sector.

T.E.F. – TRANSITION, EFFS and FUSION

SSEN have an ongoing NIC project TRANSITION which is looking at the future DNO to DSO transition. SSEN have engaged extensively with WPD and SPEN on their EFFS and FUSION projects which are also looking the DSO transition issue. Collectively, this programme known as T.E.F. is sharing best practice and outputs to accelerate the learning in this area. This experience of "learning by doing" is feeding into wider industry initiatives such as Open Networks. Again, losses is one of the parameters which will be considered in the development of the outputs from the T.E.F. programme.

Power Forward Challenge

MERLIN is part of the Power Forward Challenge, a joint UK/Canada government funded project. The aim of the challenge is to share technological innovations between the two countries in order to accelerate the development and implementations of smart technologies within the energy industry.

SSEN has been looking at best practice internationally through the MERLIN project. The purpose of the MERLIN project is to assist our understanding of how economics will impact future energy networks. Future world forecasts suggest distributed energy resources (DER) will be fundamental in reducing costs associated with increasing energy demand from electric vehicles (EVs) and variable power flows from renewable generation. With hundreds, possibly thousands of DER services operating on our electricity network it will be essential that we are able to effectively manage these services not only from a physics perspective, but also from an economic perspective. MERLIN will make use of Canadian based Opus One's GridOS tools to assist with economic modelling of future networks.

This will help us understand the cost impact of DER services, allow us to make more informed investment decisions and assist in managing a wide-ranging portfolio of DER services. Again the impact of losses will be considered in the design of the framework.

Business as Usual Activities

MAAV

As discussed in Section 1.3 of this submission, this collaboration and knowledge transfer between SSEN and UKPN led to a one-month trial of the MAAV, learning from UKPN's best practice and gathering data that will allow SSEN to consider the viability of a BAU roll out of the MAAV.

DNO Boundary Investigation

During tranche 1 we investigated a pair of major connections which were geographically situated close to the border between our networks and those of UKPN. In each case, the customers had asked for connection quotations from both DNOs. Given that the cost of losses between the two options was markedly different, we indicated that we were planning to investigate further during tranche 2. Changes to the connection charges to incorporate connection losses would depart from current practice of quoting for the least cost of installation only. It would depart from accepted current practice requiring a change to the existing connection charging arrangements. We will continue to consider how best to approach this issue.

Network Protection Team

In gathering best practice for non-technical losses, the SSEN Network Protection team explored the losses management processes and methods with peers at UKPN in an attempt to share best practice. The discussions that took place focused on the following:

- Working together we have identified instances where illegal connections have been made to the network, with equipment belonging to another DNO. These are now being followed up and investigated to avoid recurrence.
- SSEN are looking to develop and improve our processes and procedures for installations which involve Building Network Operators (BNO), based on knowledge sharing we have done with the DNO.

Business as Usual Activities continued

Data and Analytics

As discussed in section 1.1 SSEN embarked on a Minimum Levels of Monitoring Data Analytics. Project Figure 8 demonstrated the extent to which a wide range of data sources were considered. SSEN is committed to continue to explore new data sources such as social economic data to understand and target losses interventions.

Flexible Connections

The use of flexible and ANM based connections has the potential to offer significant benefits for customers wishing to connect in constrained areas; this has been particularly successful in connecting large volumes of renewable generations. Invariably, this results in a increased utilisation of the existing network, which despite producing the best whole system outcome may have a detrimental impact on losses. However, they also play a key role in managing local energy systems if they can be linked to local demand, as demonstrated in our earlier ACCESS NIA project. Therefore, in assessing these schemes we would look to consider losses as part of the assessment, via the financial assessment of the project.

CMZ

As described earlier we have taken best practice and learning from a number of our earlier NIA projects as well as those of other DNOs, to develop our Islay CMZ, which is using a local renewable generator to support the network during outages. This use of a flexibility service utilising local assets reduces the need to support the network using temporary diesel generation, or increasing the amount of imported energy both of which could potentially increase losses.

Industry Working Groups

Technical Losses Task Group

SSEN has and continues to be a core member of the Technical Losses Task Group (TLTG), sharing best practice, collaborating with peers and driving forward the latest incentive mechanism work undertaken by WSP on the group's behalf. See Section 3.6 for further details.

ENA Open Networks Project

The ENA Open Networks Project (ON-P) is designed to aid the smart grid transition with all network licensees actively supporting and leading defined elements. SSEN has and continues to be active across all workstreams including Workstream 1B – Whole Electricity System Planning and Workstream 4 – Whole Energy Systems under which losses is most relevant. SSEN have continued to raise the topic of losses within the workstreams to ensure they form part of enduring planning processes and best practice. Throughout the next couple of years planning solutions shall be developed, being considered collaboratively alongside Ofgem and BEIS ahead of long-term implementation. The T.E.F. projects have aligned with the ON-P where practicable to test out concepts including those involving losses, feeding learning back into the working group for consideration by the industry collective.

3.2 What have DNO groups learned from tranches one and two, which they have used or will intend to use going forward?

The various initiatives undertaken to support our tranche 1 and 2 submissions has informed SSEN's understanding of losses, how they will be impacted by the widespread adoption of LCTs, and the need to consider losses more fully within our decision-making processes. Going forward, SSEN will continue to build on much of the work already undertaken, especially around the collection and analysis of network data, raising the awareness of losses issues, and ensuring losses are appropriately considered in our decision-making. Specific examples include:

eLearning Module

SSEN has implemented a bespoke eLearning course which will be mandatory for all system planners, connection designers and operational staff. This course will raise awareness of losses as well as reinforcing and strengthening compliance with SSEN's published Losses Strategy. Examples from the eLearning module can be found in Appendix 4.

Data

We are building our capabilities and systems to utilise the ever-increasing sources and volumes of data. We have already invested in our systems for utilising smart meter data, and as volumes increase, we will be able to start to better utilise this data. Similarly, we are expanding our LV monitoring capability, as well as developing local level future scenarios which will further expand our sources of data[8]. We have also invested in updating our Connectivity models and GIS systems. As these data sources expand and mature, they will allow us to further optimise our approach to losses management.
In addition, we will continue to grow and develop our data analytics capability.

Stacked Approach

Our work to date has clearly demonstrated that network losses are a complex issue, driven by a wide range of influencing factors, many of which are outwith our control, and if considered in isolation can be difficult to address cost effectively. Therefore, we have moved to adopt a strategy which is based on taking a more holistic and targeted approach, using the new sources of data available to us to determine areas of the network which may have issues with losses, headroom for Electric Vehicle (EV) connections or require maintenance. Addressing each of these issues in isolation is not cost effective; however, by taking a holistic approach and addressing all the issues simultaneously allows the benefits to be "stacked" improving the financial viability of all these issues.

The heat maps shown in Figure 3 demonstrate where we have used EV uptake and network loading to prioritise areas of the network for intervention. Any intervention will also consider losses as part of the decision-making process.

SSEN Network Protection (Non-Technical Losses)

Non-technical losses have been a key area of focus for SSEN during the previous tranches; key to this has been raising awareness of the dangers and safety risks associated with power theft. This aligns with SSENs core safety value and our culture of "if it's not safe, we don't do it".

Previously the team responsible for these activities in SSEN were known as Revenue Protection, however, reflecting the change in focus to safety it was decided to rename the team as Network Protection.

This change has helped with our external engagement activities as:

- Removes any potential confusion with Supplier activities such as debt recovery and disconnection etc;
- Is clearly focused on the safety considerations and risks of power theft etc.

This allowed SSEN and specifically the Network Protection team to engage more positively with a much more constructive message, without any of the more negative connotations associated with Revenue Protection. This has made it much easier to engage with a wider stakeholder groups, some of which had previously been reluctant to engage on this topic.

[8] http://news.ssen.co.uk/news/all-articles/2019/november/rapid-growth-of-evs-and-new-technology-in-north-of-scotland/

Losses team

In tranche 1 SSEN believed that a dedicated Losses Team needed to be established in order combat losses in systematic manner. **"Our vision therefore, is to establish dedicated "Losses Teams" responsible for systematically applying the right solution, in the right place, at the right time to bring about a sustained reduction in losses. By intervening in such a systematic manner, we anticipate being able to provide other benefits to the network and customers."** A feasibility study on the creation of a dedicated Losses Team was funded by SSEN (and not through any innovation mechanisms). SSEN has now learned that in order to combat losses systematically losses cannot be made the job of one sole team and must be made the mandate of all teams working on the network. SSEN has achieved this through various methods:

- eLearning
- Embed losses in LV monitoring selection tool.
- Building the capabilities and systems to use new data sources for understanding losses and targeting interventions.
- Policy changes

3.3 How are companies preparing to effectively use smart meter data to develop specific actions to manage losses? What processes do the DNOs have in place now, following tranche one and two submissions?

As stated previously, SSEN is continuing to build our range of data sources and modelling capabilities. Smart meter data is obviously a critical element of this approach; however, this requires access to data from SMETS2 meters which are still only installed across a relatively small number of customers in our region. A critical mass of smart meters will be required to identify LV network loading. Whilst we have started to prepare our systems to accept this data there are insufficient volumes currently installed to let us fully utilise it. However, the work we undertook with TNEI and University of Strathclyde during tranche 1 and 2 has given us a clear indication of the route forward. SSEN has also developed a smart meter Data Privacy Assessment which is currently with Ofgem for approval, and this will further allow SSEN to access and utilise this data.

The Minimum Levels of Monitoring Data Analytics Project also considered the future availability of smart meter data. As the data becomes more widely available, we will continue to develop our approach to understanding how best to utilise it.

We are also planning to consider the use of smart meter data in our MERLIN and LEO projects to better inform our decision making and investment planning. These projects are discussed in more detail in Appendix 3 and 5.

3.4 What processes do the DNOs have in place now, following tranche one and two submissions?

The work we have done to date has been used to inform the development of several policy areas across SSEN activities including:

LV Monitoring Deployment

SSEN has already established an initial process to determine the most appropriate location for deployment of LV network monitoring equipment. The process not only considers existing network loading but also losses, future demand forecast and potential for "clustering" of LCTs.

eLearning Module

SSEN has implemented a mandatory Losses eLearning module for all network designers and system planners.

Smart Meter Preparation

SSEN has undertaken extensive preparatory works to ensure that we are able to access and utilise smart meter data as it becomes available. This will support and complement our monitoring deployment.

Investment Planning

Losses continue to be embedded within the SSEN Investment process.

Non-Technical Losses

SSEN has introduced robust new processes around investigating and reporting electricity theft. As detailed in Appendix 6, SSEN now scrutinise multiple data sources for electricity theft and unregistered MPANS, as well as our #NotWorthTheRisk campaign being run by our business as usual Network Protection team.

3.5 Have the DNO groups considered whether any of the actions they have taken from tranches one, two and three will help feed into RIIO-ED2 on losses?

Actions from tranche one, two and three have helped SSEN refine its approach to losses for the remainder of ED1 and helped to inform our thinking about how losses can be optimised in RIIO-ED2. The table below describes some specific activities; we will continue to develop and assess these options as we develop our RIIO ED2 business plan.

No of Events	Initiatives undertaken Losses tranche 1, 2 and 3	Potential Role going forward
Developing our Understanding		
LV Monitoring	Roll out of monitoring to 350 plus substations, an understanding of how this data can be used by BAU teams. Developed specific view and uses for data in targeting losses – see Figure 5 phase imbalance. SSEN has also sought to develop and understanding of the level of monitoring required.	Progress with rollout of monitoring devices to 750 by 2021. Further uptake by BAU teams, using the data to target losses interventions in our stacked approach.
Smart Meter Data	Developed an understanding of how smart meter data can be used to identify losses and target interventions.	Understanding of Smart Meter data in place with plans for employing to target losses interventions in ED2.
Analytics	Identified a wide range of industry and internal data sources that can be used to understand losses as well as new social economic sources that can be used in the future.	
Training our People		
eLearning module	Developed eLearning module to train our staff on losses interventions.	Deployed to upskill our staff in losses interventions.
Network Protection	Trialled and tested new approaches.	Ownership for new approached within the business.
Technology		
Islay CMZ	First economically viable flexibility contract, considering losses impact.	Adopt similar schemes on other island groups such as Skye and the Western Isles, while considering losses impact.
LEAN	Retained equipment beyond end of LCNF Funding period.	Possibly expand to other sites – this will be considered in development of the ED2 Business Plan.
Policy decisions		
Cable Sizing	Increasing the minimum cable size to next size up.	Implemented into the business and delivering anticipated benefits.
Transformer Sizing	Increasing the minimum size of new distribution transformers.	Implemented into the business and delivering anticipated benefits.
Transformer replacement	Early replacement of pre-1960 secondary transformers.	Implemented into the business and delivering anticipated benefits.

Figure 20: Actions taken from Tranche 1 and 2 and potential for ED2

3.6 What have the DNO groups considered for RIIO-ED2 when understanding and managing losses? We expect DNOs to have taken learning from the LDR in RIIO-ED1 to create proposals for how losses incentives should be managed in RIIO-ED2.

In 2016, the ENA launched the Technical Losses Task Group (TLTG). This expert technical group has reviewed approaches and commissioned independent reports for managing network losses in the context of the low carbon transition and helped develop proposals for losses incentives in RIIO-ED2. SSEN has actively contributed to TLTG by sharing best practice and identifying opportunities for collaborative working.

The Group commissioned a report by WSP to look at a wide range of possible options for a potential Losses Incentive for ED2. This work looked at the wide range of factors which influence losses and also at a number of potential options for a future losses incentive mechanism. This work involved a review of a wide number of approaches which are currently in operation across the world in a range of energy markets and geographies. Following the initial assessment SSEN, alongside all other licensees, were interviewed independently to ensure all were given the opportunity to input with WSP acting as the neutral party analysing the findings and making the appropriate recommendations. The report was published on the ENA Website[9].

The key findings from the report CEP023 Technical Losses Mechanism Study Final Report were presented at the Ofgem organised ED2 Decarbonisation and Environmental Working Group (DEWG) at a meeting in Glasgow early in 2020 following earlier engagement with the regulator during 2019 to ensure transparency was maintained. There will be continued dialogue and discussion at the DEWG during a series of meetings and workshops planned for the next few months. The TLTG will continue to input and support this process to identify a suitable mechanism for RIIO-ED2.

Key findings from the TLTG, include:

- Losses are complex, difficult to measure and vary based on regional topology
- Losses are largely outwith the control of DNOs and will be exacerbated by high level of EV and DER uptake
- Deployment of smart measures such as ANM or flexibility are likely to cause an increase in losses, which could be justifiable if part of a holistic approach
- There is no clear evidence internationally to support a measured output-based incentive
- It is suggested that all network operators should adhere to a consistent losses approach
- A CBA-based incentive mechanism testing methodology has been prepared which aims to further evaluate the effectiveness of this incentive mechanism.
- A combined Reputational & CBA based losses incentive mechanism is advantageous.

This was submitted to Ofgem by the ENA group on 10th January 2020 – please see Appendix 8.

The Technical Losses Task Group will continue to work with the Decarbonisation and Environmental Working Group to develop an appropriate losses incentive mechanism for RIIO-ED2.

[9] https://www.energynetworks.org/electricity/engineering/technical-losses/.

D. Innovative approaches to losses management and actions taken to incorporate these approaches into business as usual activities

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4.1 How are DNO groups planning to use innovative approaches to manage losses (including through the use of smart meter data) outside of projects funded through the RIIO-ED1 price control and the innovation stimulus mechanisms? What innovative approaches have DNO groups identified from tranches one and two?

Throughout RIIO-ED1 SSEN has demonstrated a commitment to developing innovative approaches to technical and non-technical losses management and incorporating them into business as usual.

For example, losses consideration is now incorporated into our Asset Risk Model for deployment of monitoring equipment, to help us prepare for the anticipated rollout EVs as shown in Figure 21. This model visualises how LV monitoring data, smart meter data and analytics can be used to understand losses and help target interventions.

This will be used to support our new approach to identify how and when to intervene on the network to optimise losses. (see Figure 20).

During earlier tranches, SSEN used innovative approaches such as a Losses Competition to stimulate industry and focus on interventions for network losses. We will continue to assess and explore new innovative approaches, particularly towards data analysis. We will review this approach as more data, in particular from smart meters, becomes available.

We have also continued with our innovative approach to raising awareness of Non-Technical Losses through our #NotWorthTheRisk campaign developed during tranche 1 and 2. The messaging of this campaign focuses on the dangers and safety considerations associated with illegal abstraction, meter interference and power theft. We will continue this initiative going forward.

Local energy systems have emerged as a key priority for both UK and Regional Government through innovation programmes such as Prospering from the Energy Revolution and the Power Forward Challenge. SSEN and partners have helped secure circa £54m of additional private sector, NIC and BEIS funding leveraged to support local energy system development and demonstration in Oxfordshire through Project LEO, TRANSITION and MERLIN. These funds leverage our NIA and NIC funding to allow a wider, more comprehensive local energy system to be developed and demonstrated, and the impact on losses in a local energy system will be a key learning from these flagship innovation projects.

Asset Risk Model

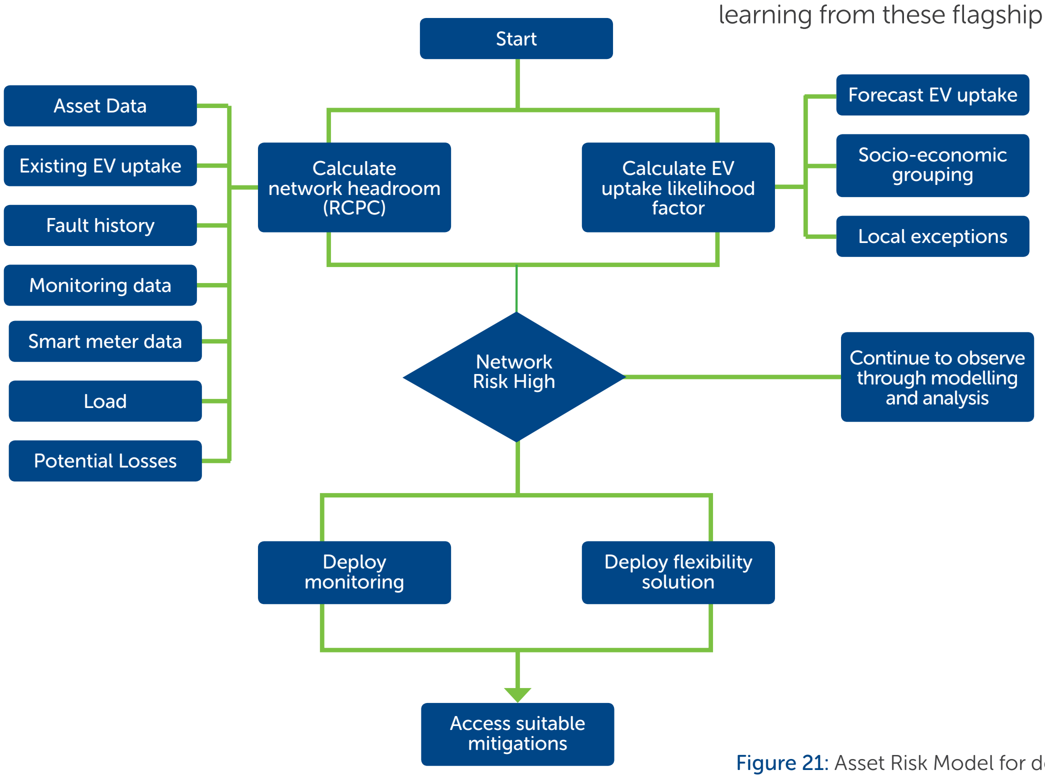


Figure 21: Asset Risk Model for deployment of monitoring equipment

4.2 How will DNO groups incorporate these approaches into "business as usual" activities? Have the DNO groups incorporated any innovative approaches set out in tranches one and two to BAU?

We have successfully incorporated a number of innovations into BAU following their initial trials during tranches 1 and 2 including:

LV Monitoring

As part of the BAU rollout of LV monitoring SSEN has established a process to determine the most appropriate location for deployment of LV network monitoring equipment. The process not only considers existing network loading, but also losses, future demand forecast and potential for "clustering" of LCTs. The data collected via this process will help deepen our understanding of losses.

eLearning Module

SSEN has implemented a mandatory Losses eLearning module for all network designers and system planners.

Investment Strategy

Our approach to investment will continue to consider losses holistically as part of the process, informed by our data and analytics work.

Non-Technical Losses

SSEN has built on the original **#NotWorthTheRisk** campaign driven by our BAU Network Protection Team. This has become a regular activity for the team to maintain awareness of the dangers of electricity theft and the cost to the end-consumer.

4.4 DNO groups must verify that the innovative activities are not funded under any other RIIO-ED1 financial initiatives. This is to ensure DNOs are not rewarded multiple times for the same activity.

The aim of the LDR is to encourage DNO groups to undertake additional losses reduction actions over and above those set out in their business plans. For example, these might include identifying more cost-effective and innovative ways of utilising the allowed revenue to enhance the reduction of losses.

The LEAN project was directly funded under the Low Carbon Networks Fund. We are retaining the TASS systems within our BAU operations at our own cost beyond the end of the project to continue to realise the benefits of the LEAN project and we are considering other deployments going forward.

As has been discussed in this submission, projects such as LEO and MERLIN have greatly helped our understanding and approach to network losses. These projects have received significant funding from BEIS and Innovate UK which leverages SSEN NIA and NIC contribution to the projects. These additional funds have allowed for more complex, wide ranging trials to be undertaken than the NIC or NIA funding could fund, thus deepening our understanding of network losses and improving the value driven from the Ofgem funds.

The development and BAU implementation of activities such as LV Monitoring, e-Learning, Minimum Levels of Monitoring Data Analytics Project, and **#NotWorthTheRisk** described in this submission have been funded directly by SSEN, with no funding from any of the RIIO-ED1 financial incentives.

Appendix 1
LV Montoring Internal Engagement

The Circuit 24

Leading the charge on EV monitoring

As we commit to support the roll out of 10 million Electric Vehicles (EVs) in the UK by 2030, we've been working hard to find a low-cost solution to monitor our network which doesn't compromise data quality.

Help accommodate 10m electric vehicles

Build electricity network flexibility and infrastructure that helps accommodate 10 million electric vehicles in GB by 2030.

This is key to supporting our transition to a Distribution System Operator (DSO), enabling us to better manage our assets and crucially provide customers with a network which can facilitate smart EV charging, home storage, micro generation and peer-to-peer trading.

As part of the initiative, we installed and tested 250 low cost substation monitors across the north of Scotland and analysed their performance.

These data trials are already helping us make improvements, from delivering new connections to supporting our colleagues in the Customer Contact Centre.

During the 24-month test period the equipment met all requirements for data accuracy and performance with a 70% reduction in cost when compared to equipment used in earlier innovation projects.

With this performance and cost reduction, it was time to move from it being an innovation project to a business-as-usual initiative, and so a further 100 monitors were procured earlier this year. The Regions have been busy rolling them out across both licence areas to gain a greater visibility of the low voltage network.

Our EV Readiness Manager, Richard Hartshorn, said: "By using these low cost, low voltage substation monitors, we have been able to gain visibility of these networks and examine the information in the back-office data and analytics platforms of the two current providers - Eneida and Lucy Electric Gridkey.

Richard Hartshorn , EV Readiness Manager

"This allows teams from across the business to easily view the electricity demand on a given secondary substation - as well as each individual phase of its feeders - with near real-time visibility and historical data available to view and analyse.

Read More

Appendix 2
Global State of Feeder Imbalance

Feeder Current Imbalance Global State 6

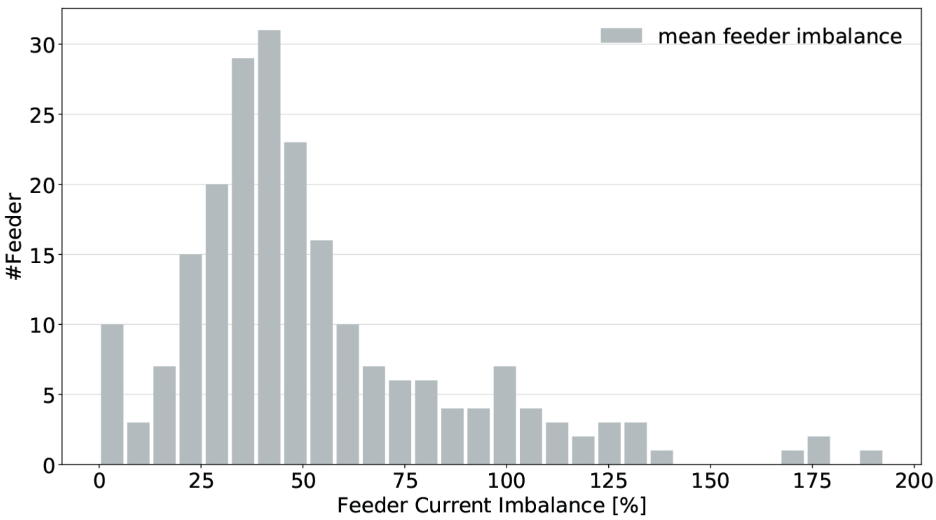


Figure 2: Distribution of Current Imbalance (x-axis) across the population of Feeders (y-axis). For each Feeder, the value of current imbalance is the aggregated mean value of current imbalance calculations over the period of reference (from 2019-04-02 23:59:00 to 2019-04-30 23:59:00). Current imbalance is being calculated as the ratio between the max deviation of the 3 phase currents from their mean value, and their mean value.

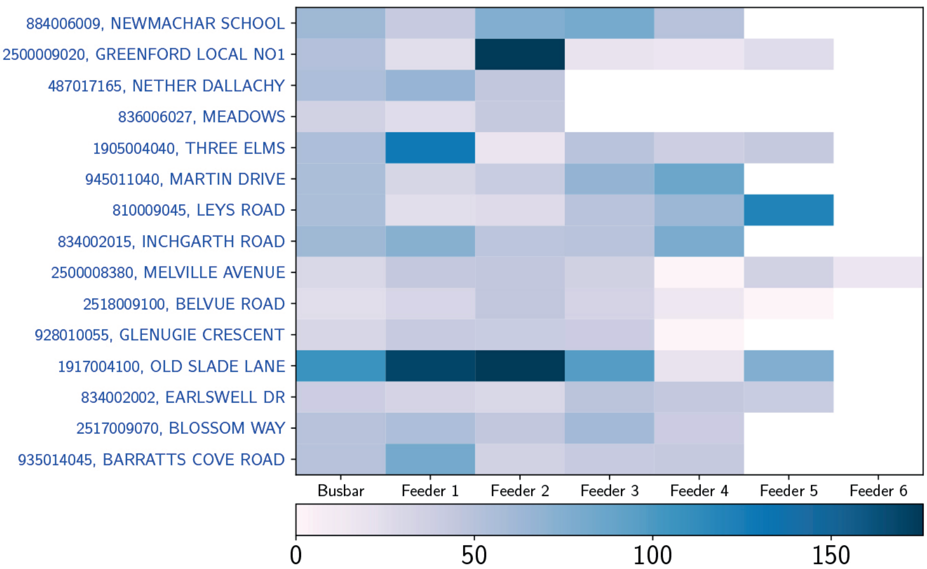


Figure 3: Color map where the color intensity corresponds to the imbalance value for each sds/feeder.

Feeder Current Imbalance Global State 7

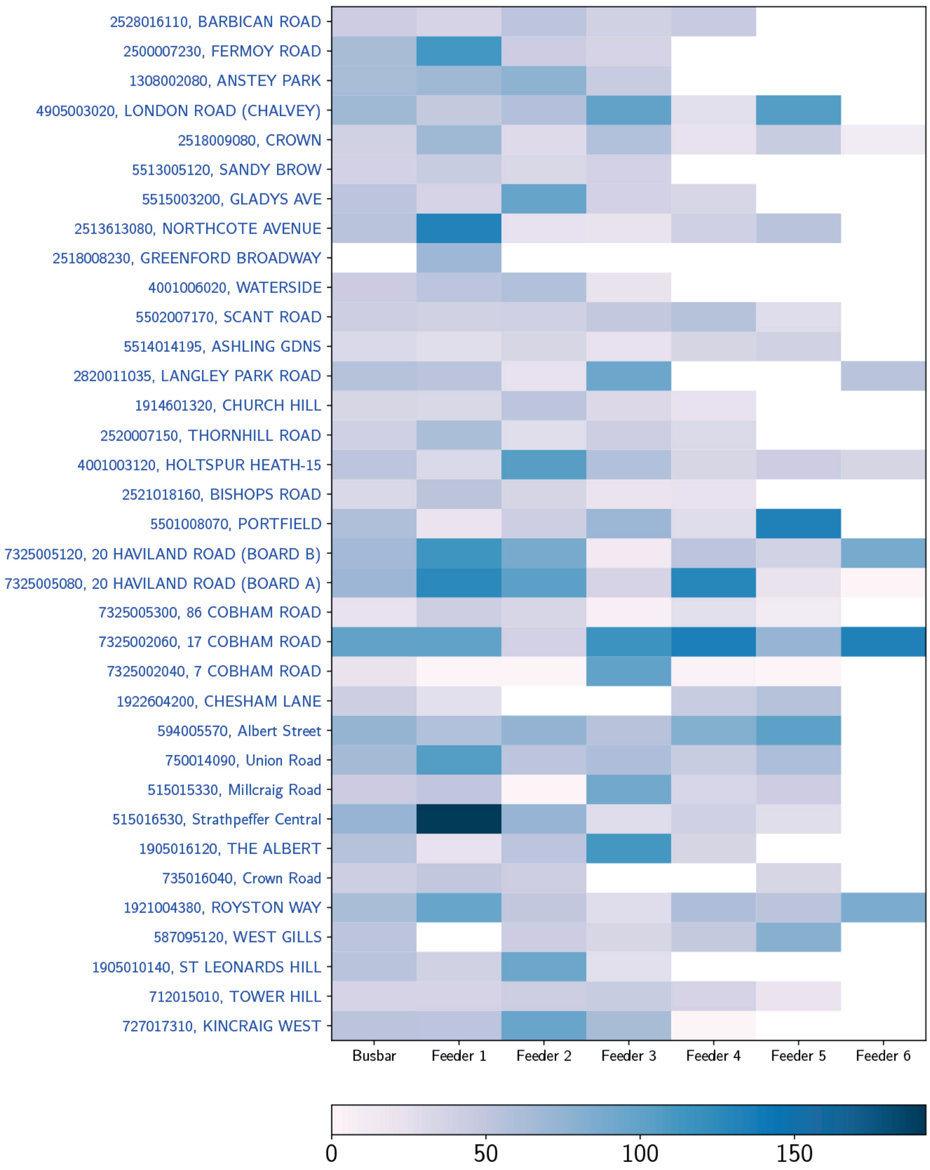


Figure 4: Color map where the color intensity corresponds to the imbalance value for each sds/feeder.

Appendix 3
Project LEO — Local Energy Oxfordshire

Scottish and Southern Electricity Networks (SSEN), has joined together with key local and industry partners to launch Project LEO (Local Energy Oxfordshire), one of the most wide-ranging and holistic smart grid trials ever conducted in the UK.

The launch follows confirmation that the £40 million project, which will test electricity network flexibility models and markets across Oxfordshire, has received an award of £13.8m from the UK Government Industrial Strategy Challenge Fund.

An industry first, Project LEO will explore how the growth in local renewables, electric vehicles (EVs), battery storage, vehicle-to-grid (V2G) technology and demand side response can be supported by a local, flexible, and responsive electricity grid to ensure value for consumers and opportunities for communities and market providers.

The project aims to replicate and trial aspects of the Distribution System Operator (DSO) models being explored by industry, government and the energy regulator via the Energy Networks Association's Open Networks Project. It will balance local demand with local supply in a real-world environment, helping to test markets, inform investment models and, ultimately, assess the benefits of flexibility to the energy system. Understanding of losses will form part of the project's assessment of solutions.

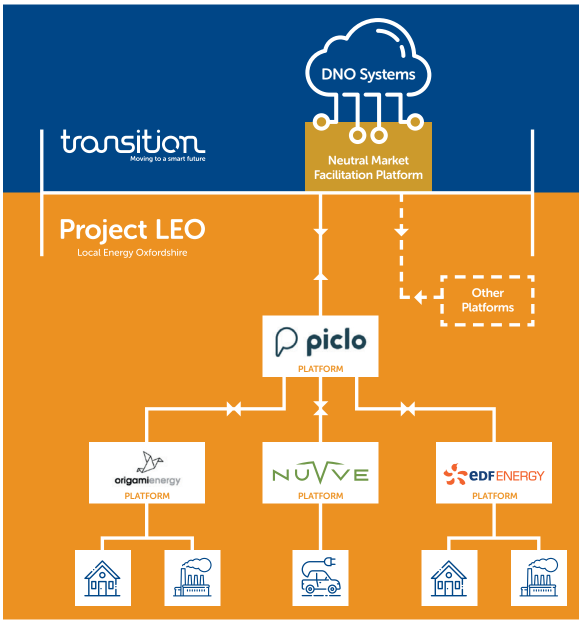
The £13.8m of funding from the Industrial Strategy Challenge fund, managed by Innovate UK, is supported by £26m of private funding from the project partners. This includes SSEN's Project TRANSITION, which received funding from Ofgem's Network Innovation Competition (NIC) Fund, the objectives of which are closely aligned to Project LEO. Project LEO will bring together significant local, academic and industry experience and expertise, with partners including:

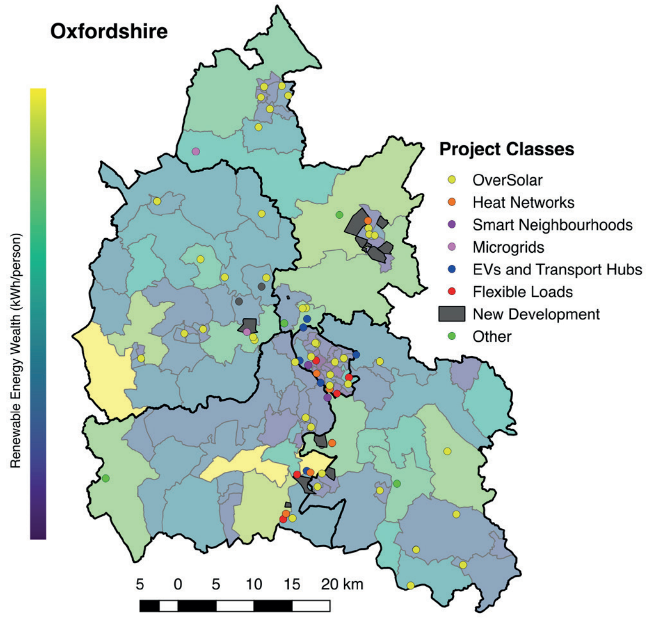
- Leading social enterprise, the Low Carbon Hub, to manage and develop a portfolio of local energy generation and demand projects, informing investment models;
- Leading academics from the University of Oxford and Oxford Brookes University, who will collect and analyse data sources to deliver a model for future local energy 'whole system' mapping and planning;
- Oxford City Council and Oxfordshire County Council will provide key infrastructure and local investment projects, including intelligent street lighting, EV infrastructure and responsive heat networks.
- Marketplace Operators Origami and Piclo, piloting new business models, via innovative market platforms, to deliver local energy trading, flexibility and aggregation;
- Nuvve Corporation, a global green energy technology company, will provide V2G technology, smart charging and bidirectional EV charging stations; and
- Energy supplier, EDF Energy bringing customer focused innovations and energy services to residential, industrial and public customers.

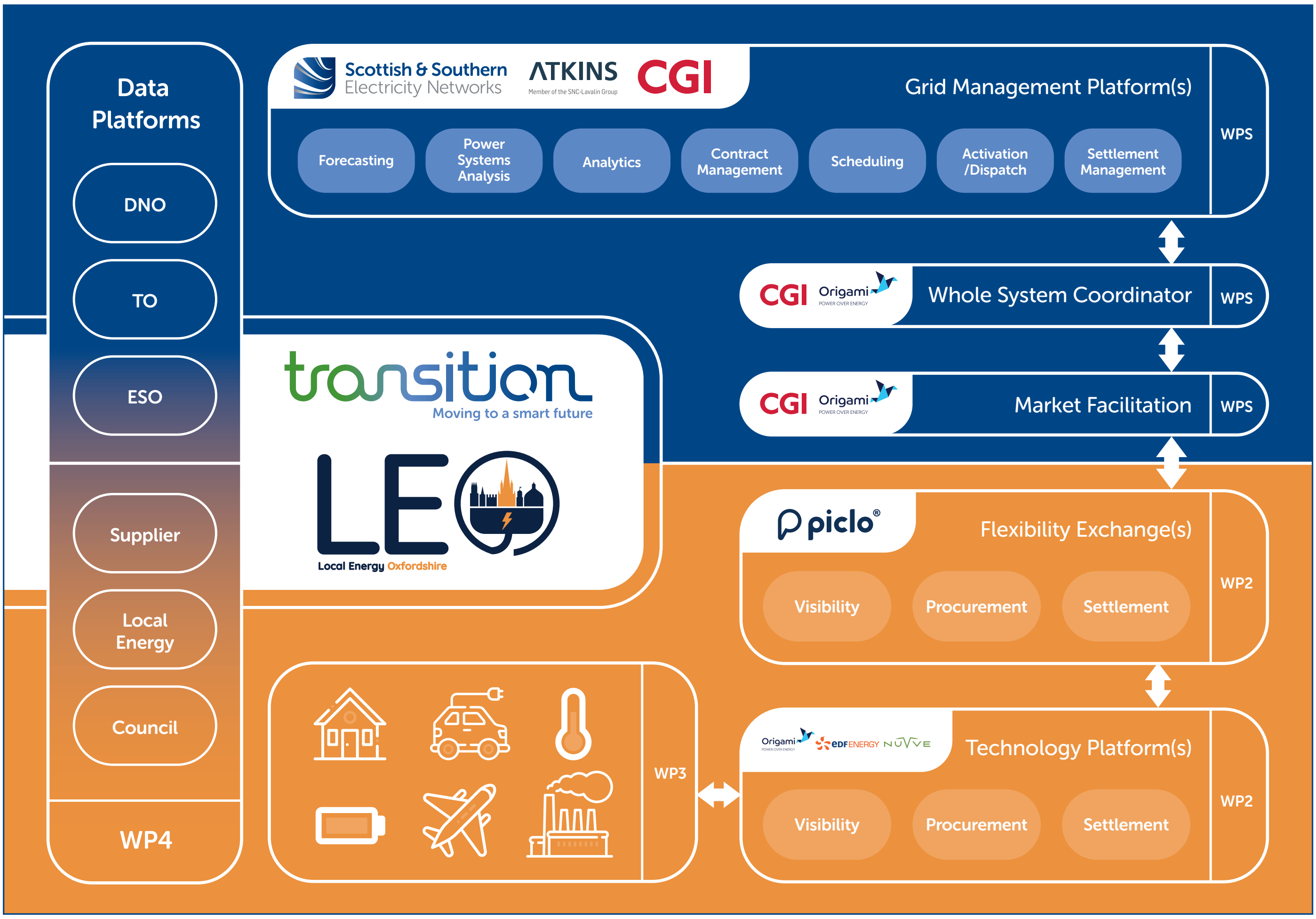
The Oxfordshire area was chosen for the project location due to the levels of constraint on the electricity network in the area, the active and developed community energy partners and the progressive approach of both local authorities.

The project is expected to run for three years and is seen by SSEN, our partners and wider industry as one of the most critical developments to date in the transition to Distribution System Operators. Its findings will be shared collaboratively across industry, academia and with policy makers and regulators, helping inform and influence the energy system of the future.

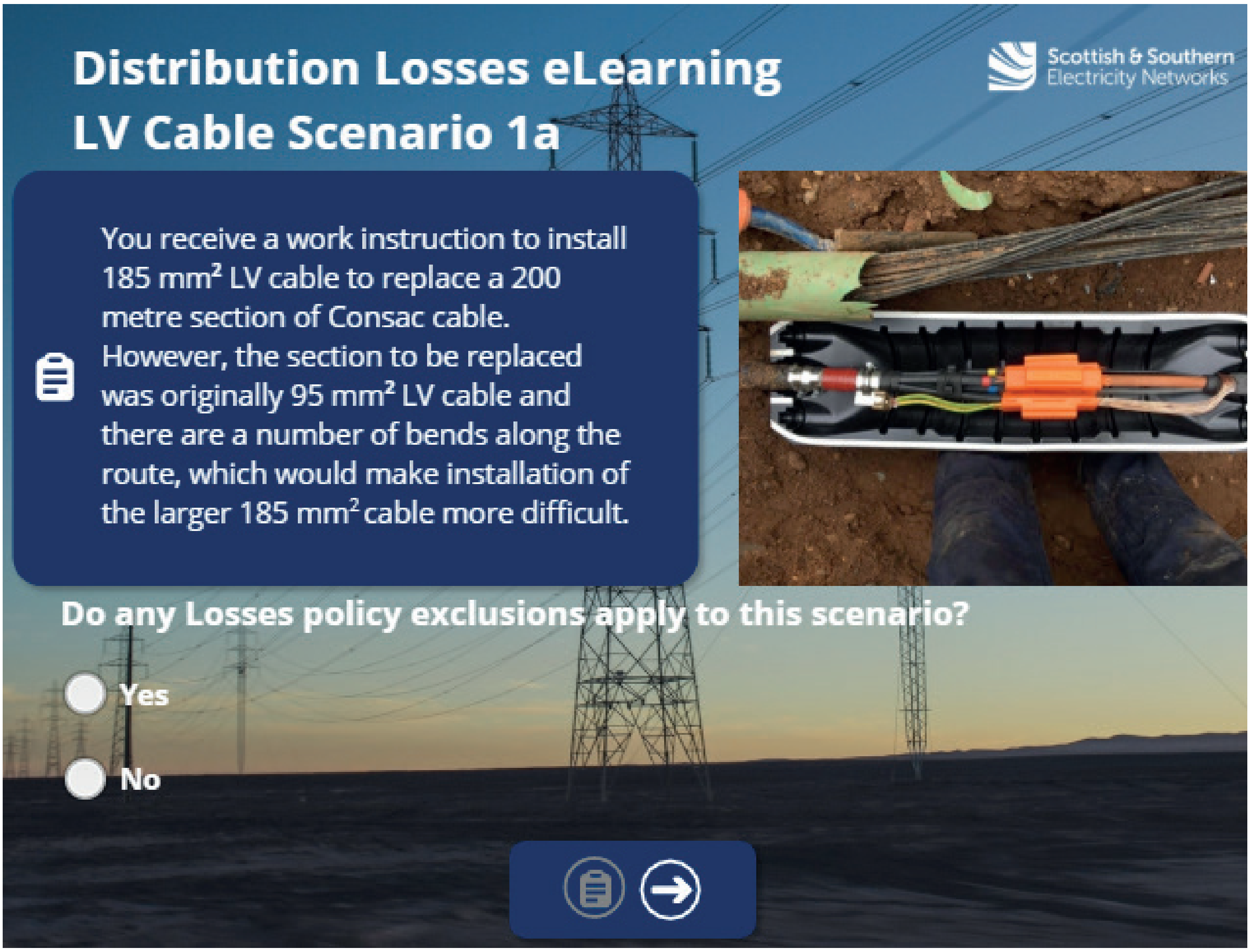
Oxfordshire Programme Overview

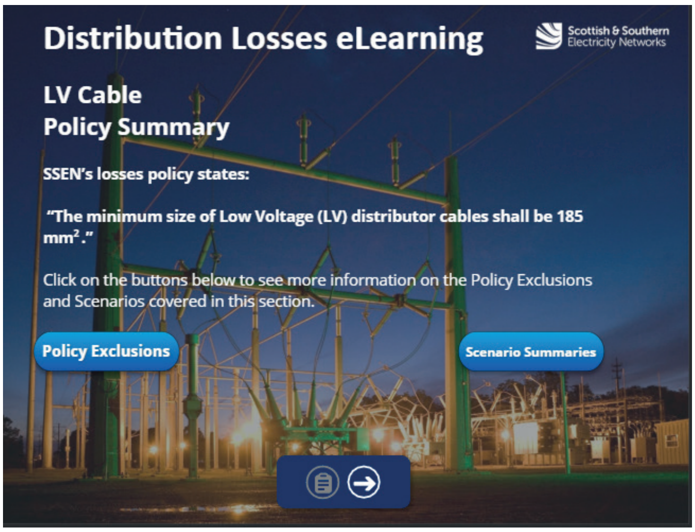


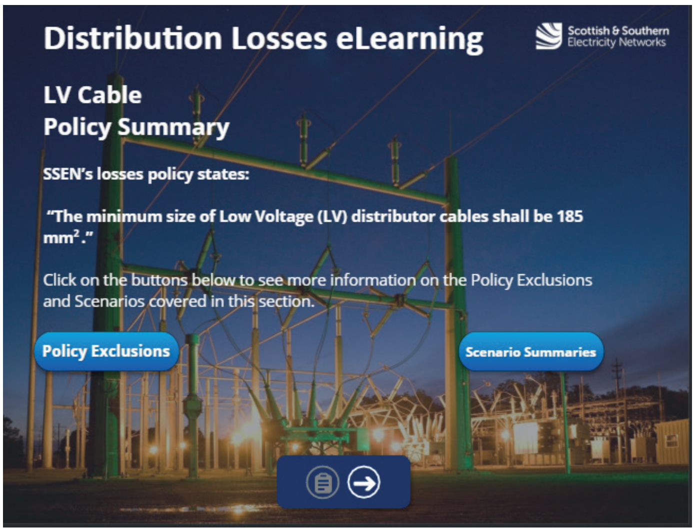




Appendix 4
Losses eLearning Module







Appendix 5
MERLIN

Project MERLIN (Modelling the Economic Reactions Linking Individual Networks) delivers a first-of-a-kind transactive energy management system in the UK to optimise economic network investment, maximise the business case of industry investors and deliver cost efficient energy to the wider consumer, from 2021 and beyond.

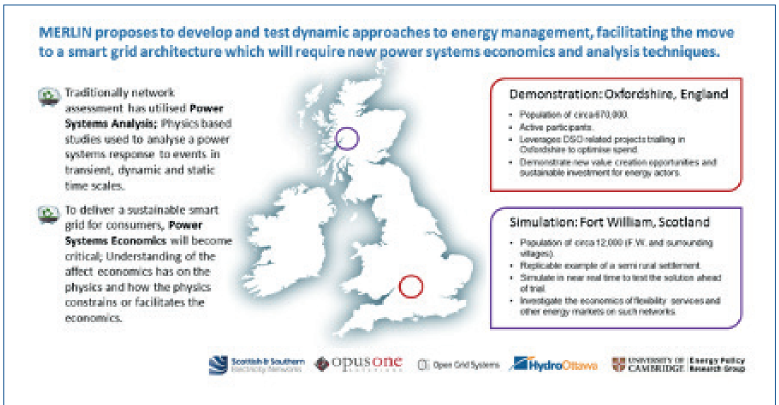
Traditionally, Distribution Network Operators (DNOs) have used the physics-based Power Systems Analysis to assess a power system's response to events in transient, dynamic and static time scales. However, to deliver a sustainable smart grid for consumers, understanding the effect economics has on the physics, and how the physics constrains or facilitates the economics, will become critical- this is known as Power System Economics. DNOs are transitioning to Distribution System Operators (DSOs) to enable local energy marketplaces to function effectively. Yet the current portfolio of industry projects does not solve the problem of managing the ever-variable value of services and associated conflicts which will become an increasing factor as Distributed Energy Resources (DER) increase.

MERLIN will develop and test full-stack optimisation across the electric power system value chain, including losses, bringing together a wealth of expertise through a strong partnership between: Canadian SME Opus One Solutions; UK SME Open Grid Systems; world-renowned academic institution EPRG Cambridge and two DNOs: Scottish and Southern Electricity Networks (SSEN) in the UK and Hydro Ottawa in Canada. This represents a consortium with the depth, strength and expertise required to deliver a strategic solution for the UK electricity grid, with 2030 firmly in mind.

MERLIN is deploying Open Grid Systems' Cimphony Concert platform and Opus One Solutions' GridOS platforms on an SSEN owned distribution network in Oxfordshire with knowledge sharing links with an unfunded sister project in Canada delivered by Hydro Ottawa, underpinned and guided by the academic rigor of EPRG Cambridge. Focused software development and configuration will be undertaken on both applications to enable integration with existing IT systems and processes within SSEN supporting their advancement to TRL 8 in readiness for large-scale commercialisation. Meanwhile up to ninety DER providers in Oxfordshire have been identified for potential participation.

MERLIN is building on previous work undertaken in the UK and Europe to standardised network data. This project will extend this to cover operational data for distribution systems, including: real-time data; market data; asset information and consumer data. This will require enhancing the IEC standards to support transactive energy and DER planning, then implementing these extensions within Opus One Solution's GridOS and Open Grid Systems' Cimphony platforms. This work will feed into both the UK and international standardisation process.

This is a full spectrum "integrated solution" that efficiently and optimally connects Investment Planning with the various other DSO functions as defined by the GB based ENA Open Networks Project. The solution is both novel and highly replicable across the UK energy system, bringing together UK and Canadian innovators to deliver a cutting edge, future-proofed end-to-end solution that manages distributed energy resources effectively integrated with the distribution system. MERLIN is disruptive, scalable and interoperable.



Appendix 6
Utilising Data – Network Protection (Non-Technical Losses)

In addition to the change of name SSEN Network Protection have introduced a more robust processes around the investigation and reporting of electricity theft. Streamlining and combining processes has created a more efficient working platform to progress the investigation of illegal abstraction.

Additionally, we have improved the detail and granularity of our internal reporting, these reports now contain information on specific types of cases, to more easily initiate any follow up actions:

- Illegal connections
- Direct mains connection
- Illegal damage by interference
- Illegal service alterations where customers have moved their service from inside to outside their property illegally

We have also broadened the range of data sources we now utilise to help identify potential issues, we have combined our internal records with new data sources including:

- ECOES (Electricity Central Online Enquiry Service) a national database for registrations of MPAN properties. A good indication of a property's history regarding legitimacy of supply.
- Inhouse SSEN's updated our GIS mapping system Electric Office. This upgrade displays historical network data giving a good indication on of a property's history regarding any works SSEN may have carried out, for example to disconnect or reconnect a supply.
- Online Street View looks at the property itself from 2009 allowing us to understand the property's history and current usage. Was it a commercial property that has since been turned into flats for domestic or has it always been a domestic dwelling?
- Online searches on the property's history including planning applications
- Online Property searches focus on providing users with access to information such as sold house and rented property information
- Council tax records informing if a property is occupied and if there is tax being paid. A registered property is a strong indicator which can be cross referenced with supply details
- Royal Mail website search informing if a property is registered on the Royal Mail address database, again a strong indicator of a property being energised

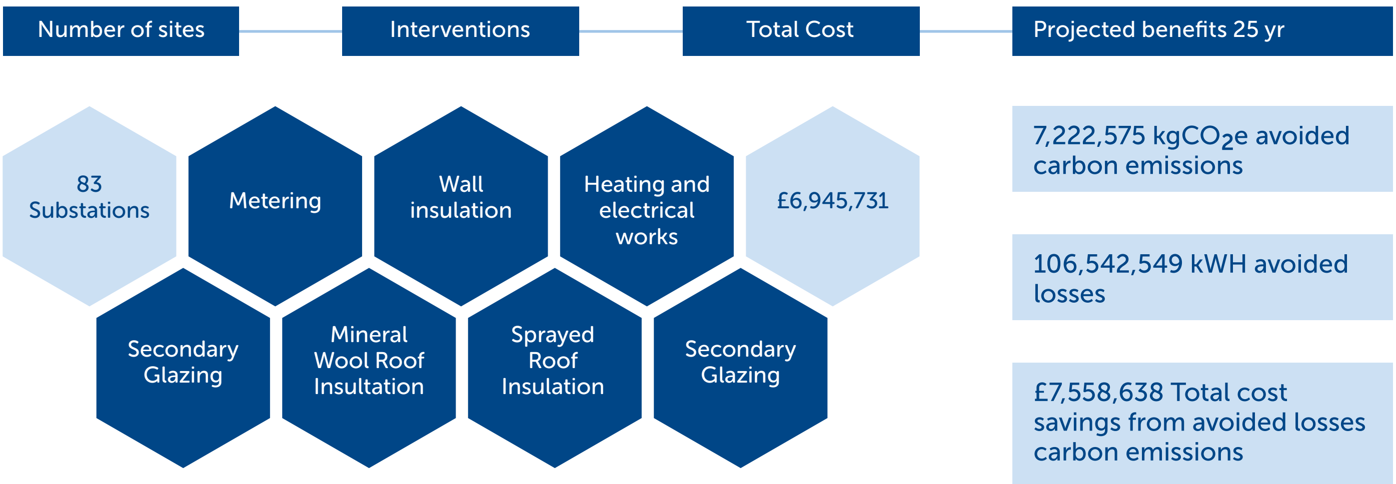
By broadening our use of a wider variety of date sources we are more effectively and efficient able to identify potential areas for further investigation.

Appendix 7
Tealing

In tranche 2, SSEN deployed monitoring equipment at Tealing Substation near Dundee in order to understand the non-metered usage at site for heating, lighting and building utilisation. A study on the data from the monitoring was also undertaken by Edinburgh Napier University, Scottish Energy Centre, entitled “Reducing energy losses and greenhouse gas emissions from substations”. The aim was to identify a range of different intervention measures suitable for the building archetypes. By applying some of these readily accessible intervention measures identified by Edinburgh Napier University, like lighting control and roof insulation, a saving of 161kWh/m^2 could be achieved along with a carbon reduction of 56tCO_2/m^2. Based on these results a desktop study was undertaken to extend the results across a similar range of substations. Extrapolated across 47 buildings in the study it was found that savings in the order of 1.24GWh could be achieved based on the applying the readily accessible interventions.

In tranche 2 SSEN committed to undertaking further assessments to determine the practicalities of retrofitting these measures into existing substation buildings. This was achieved through engagement with SHE Transmission sustainability team. The engagement led to direct meetings between SHE Transmission and the Scottish Energy Centre at Edinburgh Napier University. The output from this was the inclusion of these interventions for substations being included in SHE Transmission’s Sustainability Action Plan, SHE Transmission’s RIIO-T2 Transmission Losses Strategy and a fully costed proposal for implementation of these interventions in the SSEN RIIO-T2 plan. The diagram below is taken from the cost proposal for these interventions it shows the total cost for rollout across 83 substations and the projected benefits 25 years beyond the end of RIIO-T2 to reflect an estimate of the remaining asset life of these substations.

Energy Usage Reduction Costs



Appendix 8
Letter from the ENA Technical Losses Task Group

James Veaney
Ofgem
10 South Colonnade
Canary Wharf
London
E14 4PU

10th January 2020

Dear James

ENA Recommendations for a RIIO-ED2 Network Losses Mechanism

In 2016, the ENA launched the Technical Losses Working Group (TLWG) to facilitate sharing of best practice for managing network losses between UK DNOs, to assess the technical losses impact of low carbon technology (LCT) uptake and to review options for potential future regulatory mechanisms.

This expert technical group have reviewed approaches and commissioned independent reports for managing network losses in the context of the low carbon transition and recommend a RIIO-ED2 mechanism which combines CBA justified Losses Strategy's with a reputational incentive.

This letter provides the basis for the recommended approach.

1. Background to Distribution Network Losses

1.1. Electrical losses are a component of customers' bills and contribute to customer and DNO carbon footprints. They are grouped into two categories;

1.1.1. **Technical losses,** these cannot be eliminated and are an inherent result of power flowing through electrical equipment where a small proportion of energy is lost as heat.

1.1.2. **Non-technical losses,** units of energy transferred but not correctly accounted for due to errors in unmetered supplies, inaccurate billing estimations and illegal abstraction.

1.2. Prior to RIIO-ED1, Ofgem indefinitely suspended the DPCR5 measured incentive mechanism (Losses Rolling Retention Mechanism) due to data volatility and an inability to link changes in losses to DNO actions. The mechanism was influenced by settlement profile errors and metering inaccuracies, this resulted in unfair windfall penalties/gains for DNOs.

1.3. During RIIO-ED1, Standard Licence Condition (SLC) 49 ensures DNOs maintain losses as low as reasonably practicable, and ensures they comply with their DNO Losses Strategy.

1.4. In RIIO-ED2, distribution networks will be a key enabler to Net Zero with greater levels of utilisation and flexibility to accommodate the electrification of heat, transport and decentralisation of generation. Network losses will increase materially with utilisation.

2. Network losses cannot be accurately measured under present metering arrangements.

2.1. Measured Losses are the difference between energy metered entering the distribution system and energy metered exiting the distribution system.

2.2. The measurement of losses still suffers from volatility due to errors in conveyance (billing), meter reading estimations/inaccuracies and conversion of non-half hourly metering to approximate half hourly consumption profiles. Losses measurement is not an accurate or reliable measure of actual losses on the distribution system.

2.3. Actual losses are a small proportion of total energy transferred, as such errors in energy transferred measurement has a large effect on measured losses. A measured incentive may reward or penalise these 'errors' rather than actual losses.

3. Targets should not be set to reduce distribution network losses.

3.1. Network technical losses increase with utilisation as they are proportionally square to the power flowing through network assets; if power flows double, losses quadruple.

3.2. The leading factor influencing losses is customer demand. If peak demand and duration increases or reduces, technical losses will vary significantly. This is outside of DNO control though it has a direct consequence on customer bills.

3.3. Losses are most significant on the low voltage (LV) network and will be impacted most by low carbon technologies. The TLWG commissioned WSP to assess the impact of the low carbon transition, this determined that losses will increase under nearly all LCT scenarios.[1]

3.4. A requirement for an absolute losses reduction is counter to Net Zero and may discourage flexible/smart solutions and efficient connections. Flexibility solutions have the potential to facilitate the low carbon transition at pace with reduced upfront cost but will increase network utilisation and losses materially.

3.5. The carbon intensity of network losses is proportional to the carbon intensity of the energy generation mix (decreasing year-on-year with renewable energy trends). The effect of losses on DNO and customer carbon footprint is reducing relative to previous levels.

4. Recommendation for a RIIO-ED2 Network Losses Mechanism

A combined reputational incentive and CBA justified Losses Strategy within RIIO-ED2 business plans ensures that activities which offer customer benefit are efficiently managed and incentivised.

4.1. In RIIO-ED1, under SLC 49, DNOs maintain losses as low as reasonably practicable and comply with a cost-benefit analysis justified Losses Strategy. This licence requirement should be retained for RIIO-ED2 and incorporate lifecycle CBAs justified activities, detailed within each DNO RIIO-ED2 Losses Strategy and RIIO-ED2 plans.

4.2. A Losses Strategy enables DNOs to justify and undertake specific actions to manage losses to their optimum level. As these activities form part of the DNO RIIO-ED2 business plans they would be assessed and efficiently funded under price control allowances, supported by annually reported outputs.

4.3. Losses will be appropriately considered within wider investment decisions. For example, the incremental strategic costs of larger diameter cables may be offset by lifetime losses savings. Where future demand is uncertain, the risk of stranding assets is low compared to the risk of increased utilisation causing excessive losses over an assets lifetime.

4.4. RIIO-ED2 should also adopt a similar approach to the RIIO-ET2 Sector Specific Methodology Decision for a reputational losses incentive. Reputational performance should be assessed against delivery of activities outlined in the DNOs RIIO-ED2 Losses Strategy.

4.5. A reputational approach transparently allows stakeholders to review DNO actions for managing losses and to track progress against strategy commitments.

4.6. This approach builds on the developments of RIIO-ED1, ensures volatility and factors outside of DNO control do not influence DNO allowances and incentivises the economic and efficient management of distribution network losses to their optimum level.

Please contact the ENA if you wish to discuss any of the points raised above in greater detail.

The ENA, on behalf of the Distribution Network Companies

[1] http://www.energynetworks.org/electricity/engineering/technical-losses/

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Scottish & Southern Electricity Networks