



Western Power Distribution

Losses Discretionary Reward
Tranche 1

January 2016

Approach to losses

We are committed to improving our understanding of losses and translating this into effect measures that we can take to reduce losses in the future. Our approach is defined by four key areas; understanding of losses, best practice and stakeholder engagement, process management and innovative approaches and transition to business as usual. Please find a summary of work so far in these areas below:

UNDERSTANDING OF LOSSES

OUR **COLLABORATION**
WITH UK POWER NETWORKS TO DETERMINE
MOST IMPORTANT LOSSES
WAS COMPLETED BY **SOHN ASSOCIATES**



PUBLISHED IN
2013



REVISED IN
2014



DEVELOPED IN
2015

LOW VOLTAGE
NETWORK
IMBALANCE

FLAGGED
BY
SOHN
REPORT



SPARKED

**FURTHER
RESEARCH**



WE HAVE CREATED A
**HOLISTIC
APPROACH**

WHICH INCLUDES THE EFFECTS OF

3 **KEY TYPES OF
CUSTOMERS**



STAKEHOLDER ENGAGEMENT

STAKEHOLDER ENGAGEMENT IS
NUMBER 1

WE PRESENTED OUR DRAFT STRATEGY TO
STAKEHOLDERS
WITH A SPECIFIC INTEREST IN

LOSSES



EVENTS

JAN '14

JAN '15

JAN '16

EVENTS, DISCUSSIONS AND
REVIEWS WITH STAKEHOLDERS

REVIEWS AND DEVELOPMENT
OF LOSSES STRATEGY 2015

LOSSES
STRATEGY 2016

WORK WE HAVE CARRIED OUT AT
INDUSTRY LEVEL
CAN BE SEEN IN OUR



**INNOVATION
STRATEGY**



WE ARE FOCUSING ON A
**COLLABORATIVE
APPROACH**

PROCESS TO MANAGE LOSSES

26 **RECOMMENDATIONS**

06

✓ Adopted

08

✗ Rejected

09

? Under consideration

03

↔ Future consideration

OTHER PROCESSES INCLUDE



**NATIONAL &
INTERNATIONAL
BEST
PRACTICE**

+ **USING SMART METERS**

INNOVATION APPROACHES

INNOVATION PROJECTS WITH ADDED LOSSES BENEFITS

FALCON

FLEXDGRID

EQUILIBRIUM

LOSSES
INVESTIGATION

1. Forward

2. Introduction

2.1	Structure	5
2.2	Scope	5
2.3	Format	5
2.4	Approach to losses	5

3. Understanding of losses

3.1	Research to improve understanding	6
3.2	Further research	6
3.3	Industry-wide work	6
3.4	Holistic network approach	7

4. Best Practice and stakeholder engagement

4.1	Stakeholder engagement for losses	8
4.1.1	Timeline for stakeholder engagement	9
4.1.2	Topics covered	9
4.2	Industry-wide engagement	10
4.3	Sharing best practice	10
4.4	Losses in relation to wider stakeholder engagement	10

5. Process to manage losses

5.1	Management of losses	11
5.2	National and international best practice	13
5.3	Using smart meters	13

6. Innovative approaches and transition to business as usual

6.1	Innovation projects	14
6.2	Innovation outside of funded projects	14
6.3	Transition to business as usual	15

1. Forward

.....

At Western Power Distribution we always seek to find better ways of working and our track record of innovation and change has helped us continually improve the way we deliver our services to customers.

The challenge of operating an efficient and economic network includes work to address the level of losses seen in the network. We are committed to improving our understanding of losses and translating this into cost effective measures that we can take to reduce losses.

.....



Our Losses Strategy was a key element of our RIIO-ED1 submission and has been updated and reviewed since its initial publication. Work we have completed to improve the understanding of losses, and views expressed by our Stakeholders have all combined in revisions of the strategy. The most recent version includes a list of areas for investigation and consideration through the ED1 period.

It is clear that improvements can be made to losses by changing asset specifications, especially since the introduction of the new Ecodesign transformer specification. We have amended our specifications and minimum sizes for transformers and cables to reduce the level of losses produced. Our commitment to providing value for money to our customers is key and all of our interventions provide a positive return over their asset lifespan.

Stakeholder Engagement is key in developments to our Losses Strategy and revisions have been discussed at general engagement sessions and two more focussed losses engagement sessions. We were pleased to welcome all other Network Operators and a wide range of industry and academic stakeholders to these sessions, which will be continued through ED1 and beyond.

Robert Symons
C.E.O. Western Power Distribution

2. Introduction



2.1 Structure

This Losses Discretionary Award submission is made by Western Power Distribution at a company level. The submission covers our four DNO licence areas of South West, South Wales, East Midlands and West Midlands.

2.2 Scope

The first tranche of the Losses Discretionary Award looks at the future. In our report we have focused on the processes and methods we have employed to understand and ultimately manage network losses in a better way. We have shown how these have helped us to go beyond the actions required by the general licence obligations, reducing our losses even further.

2.3 Format

We have followed the Ofgem recommended format and structured this report to address each of the assessment criteria listed in the guidance document.

- ▶ Understanding losses
- ▶ Engagement and sharing best practice
- ▶ Processes to manage losses
- ▶ Innovative approaches to losses management and actions taken to incorporate these approaches into business as usual activities

2.4 Approach to losses

We have developed our work on losses reduction based on knowledge gained from research completed for us and others in our industry. The most significant piece of recent research has been the 'Understanding and Management of Electricity Distribution Network Losses' project. This provided us with a strong action plan of recommendations.

Now, we are building up an important knowledge base around the source of losses. This will help us understand the impact of losses and how we can address them. We are proud to work collaboratively with others in our industry: as well as completing our losses project with UK Power Networks (UKPN), we have worked with DNOs and many others via our stakeholder events.

3. Understanding of losses



3.1 Research to improve understanding

In 2012 we collaborated with UK Power Networks to carry out an Innovation Funding Initiative (IFI) project. We wanted to understand the Management of Electricity Distribution Network Losses and this project helped us with our learning.

The project was completed for us by SOHN Associates and Imperial College. It built on the losses research carried out by Central Networks before our acquisition and set out to identify where losses are generated throughout our network areas and components. The study aimed not just to propose intervention measures to reduce losses but also to help us establish which were the most important. The project reported after our first Losses Strategy was published in 2013. This meant we were able to incorporate it in our revised strategy, published in 2014 and build on it in our 2015 strategy.

Collaboration across our industry is important, so we shared the report with other DNOs at our Losses Stakeholder Engagement workshop in 2014. Now we are pleased to see that other DNOs are referencing the project in their own Losses Strategies.

3.2 Further research

In our South Wales area we established a highly monitored network to support the LCNF Tier 2 project 'LV Templates'. We are now using the results of this project to decide our next steps to reduce losses. The project suggested there was potential to reduce the low voltage nominal supply voltage to provide more capacity for distributed generation and to reduce overall losses. Having made changes to the operational target voltages in South Wales, we are now recording the impact.

We are also carrying out trials on low voltage network imbalance. This is an area that was flagged by the SOHN report for more investigation. Our trials on improving network balance are also taking place in South Wales as we use our monitored network in South Wales developed for LV Templates for feeder level analysis. We are also working with Manx Utilities to use individual customer level data and plan to use this to model the effect of potential improvements.

3.3 Industry-wide work

The research above is all being used to inform the ENA's industry-wide Statutory Voltage Limits Task Group. This Group – chaired by us and developed following the LV Templates project – is looking at the effect of changing voltage limits across the country.

3. Understanding of losses

3.4 Holistic network approach

The transitions set out in the Carbon Plan have a big impact, not only on our network but also on generation and demand customers. If we want to manage losses in a holistic way, we need to include the effects of these areas and take these types of customers into account in our plans.

Demand customers

Research and Carbon Plan forecasts tell us that demand customers will probably use more electricity in the future as their heating and transport requirements move from carbon rich sources to electricity generated from low carbon sources. In turn, this will inevitably lead to increased losses on our networks as they become more heavily utilised. We want to mitigate this so we have identified a number of areas as 'hotspots for change' and are using a programme of selective uprating of assets in those areas.

Generation customers

Generation customers increase the use of our network and any losses, although this is partly offset because the generation is closer to the user and there is a reduction in transmission losses. Intermittent generation sources can produce peaks on our network when generation exceeds local demand. We are working with generation customers on a range of projects to help manage their production and use it to balance our network and reduce losses.

Major energy users

We are also working with major energy users to schedule their usage, where possible, to times of the day when generation is at its peak. This type of scheduling has the benefit of creating more local use for that energy, reducing losses across the network. Water companies in the South West are working with us on Project Sync to plan their non-essential water pumping at times of the day when generation can be balanced. Meanwhile, a number of domestic customers in Cornwall are part of the Sunshine Tariff project and are incentivised to use electricity during the day when solar generation is most active.



4. Best practice and stakeholder engagement

4.1 Stakeholder engagement for losses

Stakeholder engagement is hugely important to every part of our business. So, in developing our third Losses Strategy, we carried out a specific programme of stakeholder engagement.

In November 2014 we presented our draft third Losses Strategy to invited stakeholders with a specific interest in Losses. Our invitation list – carefully selected from our general stakeholder engagement database – included stakeholders with a technical awareness and interest in losses. We targeted people from manufacturers, other network operators, electricity suppliers, customer groups, academics, consultants and regulatory bodies.



The events



On **6th November 2014** we held a stakeholder event at the IET in Birmingham. We welcomed over 30 representatives who had the opportunity to learn more about the work that formed our strategy. We provided a draft strategy and launched our consultation period, which closed in December 2014 when the strategy was finalised.

On **12th November 2015** we held our most recent stakeholder event where we gave an update on our work and all the changes it had prompted to our strategy. We were pleased to welcome stakeholders who had not previously attended so took the opportunity to summarise once more the whole content of our strategy. The feedback we received on the day really supported our high level objectives and actions.

At the 2015 event we also discussed the future timing and format of stakeholder integration through the RIIO-ED1 period. The stakeholders agreed with the idea of reviewing and re-issuing the Losses Strategy each year. They suggested that specific dissemination events would be useful every second year or whenever a significant development had occurred.

The strategy



In **January 2016** we published our most recent version of the Losses Strategy, pulling together everything we had learnt in 2015. This revision includes updates on all the work carried out since the last review and shows how we are progressing on items on our list of SOHN recommendations.

4. Best practice and stakeholder engagement

4.1.1 Timeline for stakeholder engagement



4.1.2 Topics covered

January 2014

- ✓ The concept of losses
- ✓ Ways losses can be reduced
- ✓ Early versions of our strategy
- ✓ High level objectives and results

November 2014

- ✓ SOHN losses report
- ✓ Losses strategy items including process of selection
- ✓ Cost benefit analysis,
- ✓ Early transformer replacement for pre-1958 units
- ✓ Discontinuation of small sizes of transformers and cables for new works
- ✓ Design changes for networks to remove tapering
- ✓ Network phase balancing
- ✓ Revenue protection

November 2015

- ✓ SOHN Losses Report
- ✓ Losses Strategy update
- ✓ Innovation projects and losses
- ✓ Low voltage cable length modelling
- ✓ Heat recovery from large transformers

4. Best practice and stakeholder engagement



4.2 Industry-wide engagement

Much of the work we have carried out at an industry level can be seen in our Innovation Strategy. The Innovation Strategy included plenty of projects and initiatives, many of which show a reduction in losses as part of their targets to increase utilisation of the network. Higher levels of utilisation will always increase losses, but a smoother demand profile can contribute to the overall reduction of network losses.

We can use demand side response to reduce the peaks of load and associated losses on our network. As a result of our FALCON project, we found that customers are often not able to help us with DSR due to contracts in place with National Grid. We are working with National Grid to change their standard terms and conditions to allow customers to operate in both markets. We have set up the DSR Forum, where DNOs, Ofgem and National Grid are represented, to discuss this in more detail.

4.3 Sharing best practice

It's important for us to engage with other network operators to develop best practice – a desire that can be traced back to our IFI project on Losses that we completed with UKPN. This took place before the specific work on our Losses Strategies and really helped us shape our own strategy. We have shared the project's findings with many other network operators and are pleased that elements of it and references to it appear in other DNO strategies. Scottish and Southern Energy Power Distribution (SSEPD) not only shares our intervention on pre-1960 transformers, but has cited our IFI project as the research source.

We are also always keen to learn from others and use their research to develop our plans. Our third Losses Strategy included topics highlighted in other DNO strategies and this collaborative approach continues. One of the items for further research in our current strategy is the de-energisation of a plant when not required. We are watching with interest SSEPD's Low Energy Automated Networks LCNF project as it develops.

We were pleased to see that other DNO losses strategies now include some of the elements of our plan. All DNOs face similar issues so this kind of peer review and inclusion is a fantastic development.

4.4 Losses in relation to wider stakeholder engagement

Our specific stakeholder engagement for losses is detailed in 4.1 above, but the story doesn't end there. Losses have also formed part of our more general stakeholder engagement work. In January 2015, we proposed the topic of Losses with our stakeholders at six general sessions to find out if there was an appetite. We soon realised that losses were of real interest to our stakeholders although many were content to leave the more technical debate to a specific stakeholder event. Smaller subsets of stakeholders were keen to engage in more depth and attended our November events.



5. Process to manage losses



5.1 Management of losses

The work we completed with SOHN Associates has become a core part of our Losses Strategy as it provided an impressive 26 recommendations (see below) for further work and action. These recommendations now form the basis of the work we are carrying out throughout the RIIO-ED1 period. We have started to work through them and have already addressed some as interventions in our Losses Strategy. We review our progress against them every year as part of our Losses Strategy update.

The 26 recommendations

The key recommendations listed below have allowed us to shape our Losses Strategy. They ensure that our work stays focused and relevant to the management of the electricity network. Some of our innovation projects are now focusing on specific elements of the report to help our industry gain a better understanding of losses.

		Adopted Rejected Under consideration Future consideration
Recommendation	Status	
1. The network modelling and analysis tools used in the study are based on calibrated representative network models data. Given the increasing importance of losses, it would be appropriate that DNOs establish the capability of modelling and evaluating loss performance of their present and future networks, under different future development scenarios.		
2. DNOs to consider carrying out more systematic data gathering associated with power factor to assess the materiality of the issue and to enhance the understanding of the costs and benefits of power factor correction at consumers' premises. The business case for power factor correction may then be developed.		
3. Further work is required to assess the extent of the imbalance problem and to test various solutions, which will not only reduce losses but deliver many other benefits of a well-balanced network. It may be appropriate to develop policies and working practices for avoiding excessive imbalance in future.		
4. The inaccuracy of loss calculation using half-hourly data at the edges of the LV network should be recognised when conducting network studies.		
5. As the benefits of peak demand reduction may be material an assessment of the opportunities enabled by alternative smartgrid techniques to achieve this should be carried out.		
6. As the benefits of active voltage control in LV distribution network may be significant, comprehensive assessment of the opportunities to further reduce network losses should be carried out.		
7. When considering active network management solutions and technologies to facilitate low-carbon connections, the impact on losses should be given full consideration.		
8. There is a clear case for fundamentally reviewing cable and overhead line ratings to ensure that future loss costing has been included in the economic rating calculation. This could be based on Ofgem's loss investment guidelines or on loss-inclusive network design standards.		

5. Process to manage losses

✓ Adopted ✗ Rejected ? Under consideration ⇄ Future consideration

Recommendation	Status
9. The transformer loss calculations indicate that the benefits of investing in low-loss transformers may be significant and this should be considered further to establish, or otherwise, the low-loss transformer business case in line with UK energy and carbon policy.	?
10. In future, losses may drive early asset replacement when economically efficient. If early replacement programmes are economically justified and capable of being funded, appropriate resources would need to be made available to facilitate delivery of such programmes.	✓
11. Network designers may consider the option of installing additional distribution transformers to minimise LV network reinforcement cost and reduce losses.	✗
12. In the light of future developments, particularly in relation to the integration of low carbon demand and generation technologies, it may be appropriate to reconsider long-term distribution network design. This may take a strategic view of future voltage levels and include consideration of losses in the decision-making.	?
13. In order to reduce losses and provide future flexibility within LV networks, LV tapering policy may be re-examined.	✓
14. A review of DNOs' network modelling and analysis tools and capabilities may be required to support design engineers in applying new policies and processes relating to loss-inclusive network design.	⇄
15. There is opportunity for considerable further learning in Europe and also from National Grid. It would be beneficial to share experiences of waste heat recovery installations among DNOs.	✗
16. An Innovation Project, based upon learning from this initial Study, may be initiated in order to gather further insight into the technical and practical solutions which can be tested at more sites. The Project could be scoped to also tackle the regulatory and commercial market structural issues which will also need to be overcome to bring heat recovery and use into mainstream application.	⇄
17. DNOs may maintain an awareness of the potential for heat recovery when planning the installation of EHV transformers and seek to install more systems where the recovered heat may be of commercial use.	✗
18. Further work on heat storage may be integrated with future trials work on recovery of heat from the distribution network, as it may improve the economics of more basic heat recovery systems.	⇄
19. DNOs should develop loss-inclusive network design strategies, based on their specific data, in order to ensure that the overall economic network operation and design criteria are met. This should include network modelling capability for answering 'what-if' questions in order to predict the impact of proposed network policies, projects and network demand forecasts on the overall reported network losses.	?
20. DNOs, with support from DECC and Ofgem, may determine the common basis in relation to loss mitigation and loss-inclusive network design and investment.	⇄
21. There is a need to establish the basis for assumptions on future electricity costs and carbon prices that would be used in loss-inclusive network investment that is consistent with the overall UK low carbon policy.	⇄

5. Process to manage losses

✓ Adopted ✗ Rejected ? Under consideration ⇄ Future consideration

Recommendation	Status
22. Early in the RIIO-ED1 period, DNOs may develop more accurate means of measuring and reporting on distribution network losses.	?
23. The DECC/Ofgem comparison of reported losses shows a discrepancy which may cause a distorted view of GB DNO losses, within industry, government and internationally.	⇄
24. DNOs may grasp opportunities as they may arise to influence loss reporting in other countries and as it is presented in international studies. This is in order to ensure that GB DNOs' loss management performance is presented accurately.	⇄
25. Industry, government and regulators should consider developing appropriate regulatory and commercial frameworks that would facilitate development of loss-generated heat schemes where economically justified.	⇄
26. DNOs' loss strategies may be 'stress tested' to demonstrate that they can deliver an objective of achieving an economic level of losses based upon avoided loss valuation, engineering costs and future network demands.	✓



5.2 National and international best practice

Our stakeholder engagement sessions inspired us to boost the scope and aspiration of our Losses Strategy. We made the following changes:

- ▶ Discontinuing small size cables for new works
- ▶ Discontinuing small size transformers for new works
- ▶ Using a 'next size up' design policy
- ▶ Targeting the early retirement of older transformer designs.

These topics are now included in many UK DNO Losses Strategies and demonstrate a good level of national best practice.

While our research into the optimum length of low voltage feeders did not produce any evidence to change our proposals, the research we conducted with SOHN Associates is now being proposed as a paper for the next Cired conference in Helsinki in June 2016.

5.3 Using smart meters

We have developed a strategy for the use of Smart Meter data within our current Losses Strategy. Previously this information was held in our Smart Grid Strategy. We can manage losses by reducing the peaks in demand and smoothing the load profile of a network. We have limited visibility and monitoring on the low voltage network so will use smart meter data to give us an initial assessment of network loadings.

The functionality of smart meters will allow us to collect limited data on our network without the cost and work of installing substation monitoring. Where Smart Meter Data shows a potential highly loaded area on our network, we will follow up with our own monitoring.

6. Innovative approaches and transition to business as usual

6.1 Innovation projects

Losses have been a focus of our project work for many years through the Innovation Funding Initiative (IFI), Low Carbon Networks Fund (LCNF) and Network Innovation funds. We have completed research work under IFI and have carried out demonstration projects through LCNF and NIA/NIC.

Our main piece of research was the Management of Electricity Distribution Network Losses project. We completed this in partnership with UKPN.

6.2 Innovation outside of funded projects

All our projects registered under the Low Carbon Networks Fund have been funded to help the transition to The Carbon Plan and establish a smarter way of using electricity. While none of them have focused specifically on losses reduction, some have provided us with information and savings as an indirect benefit which was not specifically funded.

Innovation projects with added losses benefits

FALCON

This project investigated Dynamic Asset Ratings, Network meshing, Automatic Load Transfer between feeders and Energy Storage as methods which could be used to increase the use of a distribution network and accept more Low Carbon Technologies and Distributed Generation.

Losses benefit: We used the modelling, scenarios and trials to improve our knowledge of losses for each of the scenarios. We have included details of those that can be used to reduce losses in our Losses Strategy.

FLEXDGRID

This project is looking at methods of reducing Fault Level on the urban network in Birmingham. Again, the focus is on increasing the utilisation of a distribution network and accepting more Low Carbon Technologies and Distributed Generation.

Losses benefit: The project has also shown how operating the network in a mesh configuration will reduce losses.

EQUILIBRIUM

This project aims to provide additional generation capacity by altering power flows and balancing the network.

Losses benefit: We expect that this work will show how a network can be balanced to reduce losses.

LOSSES INVESTIGATION

Our work with SOHN Associates showed that we could benefit from a greater understanding of customer losses and low voltage system balance. Building on the work completed in the LV Templates project, this new project will take the focus down to individual customer level using Smart Meters and Distribution Network monitors installed on the Isle of Man by Manx Utilities. Working with Manx will allow us to complete a lot of our research by modelling and save the cost and physical impact of making network changes.

6. Innovative approaches and transition to business as usual



6.3 Transition to business as usual

Whenever we introduce initiatives into BAU, we issue policy documents. Each policy document contains an Implementation Plan which explains exactly how the policy should be applied. At its simplest, this is achieved by a local team manager explaining the changes to the team while more complex changes are shared using presentations or training sessions.

Example: Equipment Specification



One of the losses innovations that has already been transferred into BAU is the removal of small size cables and transformers from our standard equipment pick lists. We achieved this by updating the specification documents for these items and by updating the G81 information we provide to Independent Connection Providers so that their network designs meet our new specifications.

