electricity north west
Bringing energy to your door

The future

Innovation Funding Incentive Annual Report

2014-2015

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Introduction

This report sets out the details of Electricity North West's IFI funded activities for 2014/15. It begins with a brief description of our innovation strategy for the RIIO-ED1 period then an overview of some highlights from 2014/15 followed by further details of the specific project work we have completed in the year. It also contains a description of the benefits gained from our IFI work, a résumé of completed projects and concludes with our report of project descriptions and year-end figures.

About Electricity North West

Electricity North West owns, operates and maintains the North West of England's electricity distribution network, connecting 2.4 million properties and more than 5 million people in the region to the National Grid. We own one of the 14 regulated electricity distribution networks in England, Wales and Scotland and are regulated by Ofgem, the Office of Gas and Electricity Markets. Our network covers a diverse range of terrain, from isolated farms in rural areas such as Cumbria to areas of heavy industry and urban populations including Manchester. We deliver more than 25 terawatt hours of electricity each year to our customers through our network of:

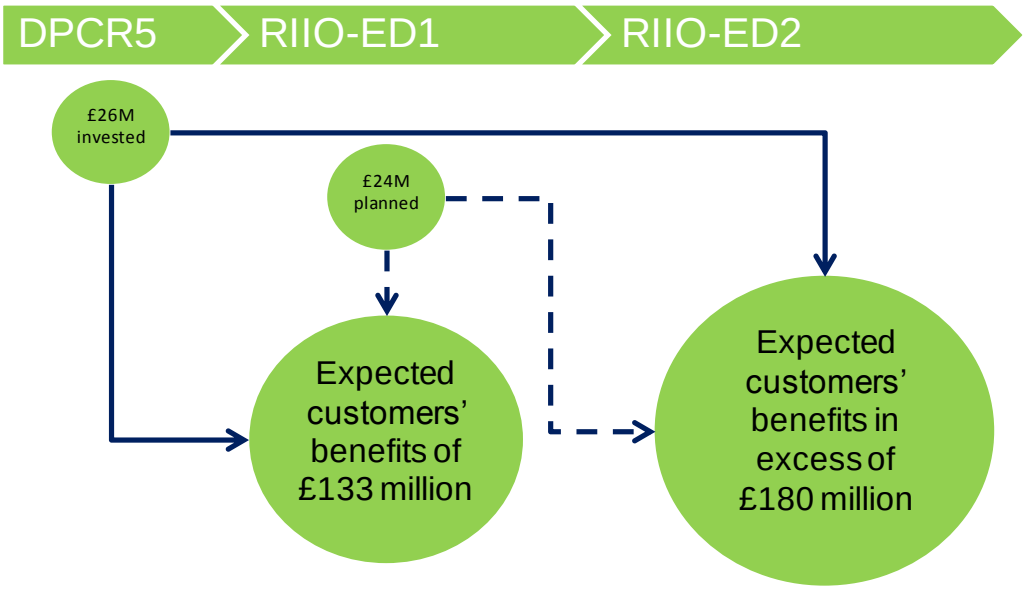
- around 13,000 km of overhead lines
- almost 44,000 km of underground cables
- almost 84,000 items of switchgear
- more than 34,000 transformers.

Electricity North West is focused on the efficient delivery of key outcomes to our customers within the regulatory period and on delivering an economic return to our shareholders. We are a significant contributor to the North West's economy, with a substantial R&D spend and a key role to play in enabling regional economic development. Between 2010 and 2015, Electricity North West is investing over £1bn in the region's infrastructure including £73 million for new connections, £129 million to reinforce the network and £395 million to replace assets at the end of their operational lives. Electricity North West is committed to a programme of regular stakeholder engagement to ensure future investment has minimal visual and environmental impact and contributes to a low carbon environment but at the same time is sufficiently robust to minimize lost service due to exceptional events. Electricity North West will continue to invest in the North West's electricity network to maintain the current excellent level of reliability and to meet the future energy needs of our customers through the development of low carbon, environmentally friendly solutions.

Innovation Strategy

In DPCR5 we invested over £26 million in innovation, this combined with our innovation plan for the RIIO-ED1 period will enable us to deliver about £132.5 million of benefits for customers in RIIO-ED1 and we aim to deliver in excess of £180 million benefits in RIIO-ED2. Figure 1 illustrates the customer savings that are directly enabled through our innovation plan.

Figure 1: Predicted customer savings from previous and future innovation spending compared against traditional techniques



Our work with stakeholders shows that their requirements centre around three consistent themes, namely reliability of supply, sustainability of operations and affordability of service. Figure 2 below shows these priorities centred on the key requirement of providing excellent customer service.

Figure 2: Our stakeholders' priorities

Our innovation plan is strongly influenced by these stakeholder priorities and our focus for RIIO-ED1 is split correspondingly into three broad areas which are illustrated below and described in more detail through a sample of case studies in the following sections.

Table 1: Key innovation themes

Affordable reliability	• Optimise the life of existing assets to keep costs down whilst maintaining reliability through refurbishment and monitoring.
	• Operate networks in new ways to deliver more capacity or value to customers though real time automation.
Customer Service	• Improve service reliability through better understanding of asset performance and investment timing.
	• Offer new services and more choice to new and existing customers.
	• Keeping our customers better informed and engaged and listening to their feedback.
Sustainability	• Enable customers to easily adopt low carbon technologies at an affordable cost without delay.
	• Allow DG customers to access the network without delay and for less.
	• Reduce the carbon cost of our networks, our operations and our investments.

We have been granted an innovation funding rate of 0.7% for RIIO-ED1 which equates to an annual investment of just under £3 million across our innovation portfolio. This is a slight reduction in the level of investment we made in DPCR5.

The reduced funding in the period will require us to work harder deliver the benefits that we set out in our well justified business plan. We remain committed to delivering these benefits and we plan to do a number of things to do so.

Firstly, we anticipate that more learning will be available from the wide range of projects being delivered by others or developed collaboratively with our partners. This allows us to identify and implement best practice solutions without the full cost burden being passed on to our customers. We intend to explore every opportunity to leverage this learning and the Innovation Rollout Mechanism (IRM) has been introduced by Ofgem to assist us in these areas where appropriate.

Secondly, we have already funded a number of innovations from the efficiencies they yield in our expenditure plans, such as Connect and Manage and our work on promoting energy efficiency. We will continue to utilise this approach in RIIO-ED1.

For larger scale innovations we will apply for additional funding through the Network Innovation Competition (NIC, the RIIO-ED1 replacement to the Second Tier LCN Fund mechanism) with our partners. Plus, as already mentioned, we will seek funding from the Innovation Rollout Mechanism (IRM) that will also allow us to deliver RIIO - ED1 innovations with our partners for our stakeholders. We will also explore top-up funding opportunities both here in the UK and from abroad and work closely with our technology and academic partners to ensure that this aligns with our wider innovation pans.

We are committed to sharing our knowledge and experience with other DNOs and stakeholders through our continued chairmanship of and contribution to industry forums and working groups.

Our innovation strategy can be found here.

Overview of 2014/15

Electricity North West has been very active during the last year with a number of highlights;

- We recently published our RIIO-ED1 Innovation Strategy which outlines our approach to innovation for the forthcoming period.
- We made a significant contribution to the planning and delivery of the fourth Low Carbon Networks Conference in Aberdeen hosted by SSE.
- We continue to invested significant effort with the ENA R&D Working Group overseeing the RIIO-ED1 Network Innovation Allowance and steering the creation of the ENA Smarter Networks Portal.
- We have successfully delivered a number of IFI projects.
- We have successfully concluded our work across a number of IFI projects ahead of the closing of the IFI funding mechanism and the move to the new Network Innovation Allowance (NIA) arrangement for RIIO-ED1. The projects have the potential to deliver significant and measurable financial benefits and avoided costs to our business in addition to the new learning generated.
- We have continued to expanded our Future Network Team with additional technical and commercial experts to ensure that project we develop are aimed at specific business needs and can be delivered into our main business.

IFI Project Successes

Some highlights of our IFI project work in 2014/15 are presented below;

Fault Assistance Centre

The most common strategy in use by DNOs for management of low voltage (LV) transient faults is to utilize investments in fault detection and diagnostic devices to achieve speedy location and subsequent repair of faults before they become permanent. The existing approach is typically the eventual deployment of fault finding devices on to troublesome circuit. These devices often provide auto-reclosing functionality alongside local fault diagnostics of the fault. However, it is the correct configuration and subsequent analysis of the captured waveform data which is key to ensuring that transient faults are proactively managed and that where possible further permanent fault outages are prevented.

This project aimed to develop a system which allowed this specialist fault diagnostic activity to be scaled up and applied right across the company on an industrial scale.

This advanced approach for the proactive management of LV transients will:

- Ensure that the DNO achieves a consistent response strategy
- Minimize the cost and service effects of transient faults
- Maximize the financial benefits from existing and future investments
- Minimize the disruption on planned operations owing to out of hours call outs and subsequent staff unavailability.

To assist with the management of LV transient faults the faults assistance centre has been developed alongside our technology partner Kelvatek Ltd. The centre enables the use of the fault location features on an industrial scale as the analysis is performed centrally, off-site by specialists who then provide location information and specific fault management advice directly to Electricity North West via a help line function.

The centre is an off-site specialist support function provided by Kelvatek. Kelvatek are the manufactures of the Rezap, Bidoyng and Weezap fault management devices which have been developed in conjunction with Electricity North West. The devices and support function are not only used extensively within ENW and but have now been successful transferred into several other UK DNOs.

- The centre provides remote diagnostics of all active faults together with a 24/7 technical support service for field staff.
- Technical support includes real-time expert advice and guidance to ENW staff on the correct configuration and operation of supported devices thus ensuring reliable findings.
- The specialists at the centre make recommendations to the DNO on management of active faults, the deployment and redeployment of associated kit and support all our available fault finding technologies.
- The centre will evolve into a largely an automated process but allows specialist expertise to analyse problematic traces thus enhancing the capability of the existing hardware and ultimately improving the chances of finding the fault early.
- Performance reporting and other management information is also available.

The faults assistance centre enables the 'time shifting' of fault repairs from out of hours into normal hours thus reducing sleep time, freeing up repair teams and improving service to customers.

Demand Forecasts and Real Options Model

Electricity North West prepares annual forecasts of peak demand for each Primary, BSP and GSP, as a regulatory requirement and as part of planning investment to ensure sufficient capacity on the network. The October 2014 forecast benefited from significant review of the forecast method in this IFI project, and during 2014/15 further developments were implemented which resulted in significant improvements to the accuracy and credibility of the 2015 forecasts. The project has also improved the ability to update 'Future Capacity Headroom' model; which gives indicative future load scenarios for secondary network assets.

The key changes at Grid & Primary level have been to move from a single best-view forecast of observed peak demand, to a set of scenarios which better capture the range of demand uncertainty. For the past five years, the baseline data is also corrected to a 'gross' level of peak demand, based on the metered export of generators on the network, and the peak demand of winter-peaking assets is adjusted by National Grid's 'Average Cold Spell' correction factor for the year.

Updated analysis by Cambridge Economic Policy Associates feeds the underlying assumptions around future trends in domestic and non-domestic energy and peak demand per local authority, and how this varies based on different scenarios for economic activity, energy efficiency, price and customer behaviour. The DECC scenarios for electric vehicle and heat pumps are applied appropriately per Primary to indicate the localised affects of these low carbon technologies. Streamlined Excel tools have been developed to translate these various input assumptions into peak demand scenarios by asset. The background and low carbon technology scenarios are combined in a logically consistent way to produce four to five consistent scenarios. The overall methodology and outputs have been reviewed against National Grid's Future Energy Scenarios.

The demand scenarios feed into our plans for applying Real Options (RO) analysis. Real Options is an approach to making decisions, in circumstances where there is material uncertainty and flexibility in the decision, supplement traditional NPV analysis. In 2013/14, Electricity North West worked with the University of Manchester on how a real options approach could be applied for DNO capacity decisions, given uncertainty in demand. The output was a comprehensive overview of the state of the art of RO analysis and risk assessment, with a focus on the issues and opportunities from demand side response (DSR) altering the amount and timing of capacity delivered.

The work proposed a novel methodology and worksheet architecture in Excel for RO assessment of network investment, defining the alternative investment strategies as a series of interventions with defined trigger points, with demand uncertainty defined by long-term

demand scenarios and Monte Carlo simulations reflecting annual demand volatility around those long-term scenarios.

In 2014/15, early prototypes were developed of the model to compare costs and network risks over time for traditional reinforcement versus the Capacity to Customers DSR technique (trialled in a separate Second Tier LCN Fund project). Development of the Monte Carlo cost analysis in Excel was more challenging than originally envisaged, but the initial demonstrations of the outputs to Commercial and Strategic Planning colleagues showed the promise of the technique in assessing whether to deploy Capacity to Customers in business as usual applications.

The Grid & Primary scenario methodology and the Real Options DSR analysis techniques are now being taken forward together in part of a wider new NIA project 'Demand Scenarios with Electric Heat and Commercial Capacity Options'.

Statutory Voltage Limits

Distribution network operators (DNOs) are required to supply electricity to customers within two mandatory operating standards relating to voltage and total harmonic distortion (THD). These standards have existed for many years and their origins are based on the requirements of appliance technologies from the 1960s. Modern appliances are designed to operate in many countries and therefore, across a much wider voltage and THD range. Low voltage (LV) networks presently compliant with existing standards are likely to breech these limits, as greater penetrations of low carbon technologies (LCTs) such as heat pumps, electric vehicles and micro generation are adopted. If these standards could be relaxed, even by a relatively small amount, significant savings could be made in reinforcement expenditure on the network infrastructure required to maintain compliance.

There is little evidence that short duration or lower level excursions outside existing standards cause any noticeable effects for customers or any adverse impact on appliances or customer satisfaction and empirical evidence shows no correlation to complaints. Whilst protracted extreme voltage or THD excursions are noticeable, these are comparatively rare.

Given the cost challenges posed by the introduction of LCTs, there is a need to examine whether parameters can be extended by either absolute limit or by excursion duration. It is not technically possible to definitively determine whether any given potential revised value is 'correct' and therefore customer research is necessary to establish the measured power quality values at which customers raise concerns about their supply.

The aim of this research project was to collate the largest possible sample of actual LV power quality measurements and compare corresponding customer data, obtained from a detailed survey, to gauge sensitivity to minor changes in voltage and THD standards, exceeding current statutory limits.

The research was tasked with asserting that either;

- Customers do notice and are sensitive to excursions exceeding the existing standards. The current power quality limits are therefore correct and should remain unaltered;
- Or, the analysis supports the argument that customers exhibit little sensitivity to minor excursions in power quality limits beyond the current standards. If established:
- Empirically determine revised power quality limits that are likely to be acceptable to customers and define the new voltage and THD limits that should be adopted by the UK.

The research was undertaken in two phases relating to summer 2014 and winter 2014, during which time over 1,700 customers were consulted and over 4000 LV networks data sets interrogated. This research provides the first comprehensive assessment of the voltage profile across a representative range of LV feeders on Electricity North West's distribution network.

The analysis of customer data indicates that in both seasons, only 7% of respondents reported an adverse effect in power quality. This increased when specific questions were asked about lighting, which resulted in approximately 20% of participants in summer and 26% in winter claiming to have noticed an effect.

Notably, customer satisfaction was very high amongst the targeted sample of customers surveyed, despite this survey population being skewed to areas of actual and suspected incidences of voltage excursions. Approximately 90% of these customers reported satisfaction ratings between 8 and 10 (10 representing complete satisfaction and 1 completely dissatisfied). Interestingly, customers fed from non-excursion networks exhibited significantly less satisfaction with service than those exposed to excursions.

Such a high level of satisfaction within the target 'excursion' population and the contradicting results from customers on 'non-excursion' networks implies a very weak correlation between voltage excursions and customer satisfaction.

The analysis identified that customers who observe an adverse effect in overall power quality are no more likely to have had a recent or significant excursion, indicating a weak relationship between detection and actual voltage excursions

Notably, the result of this research mirror the findings from customer research conducted by Electricity North West's as part of its Second Tier LCN Fund project Customer Load Active System Services (CLASS), by confirming the impact of power cuts and a resultant contact with the DNO seems to be a much stronger indicator of dissatisfaction than voltage excursions.

Technical data provided little evidence to suggest that LV networks in Electricity North West's distribution region are currently at risk of breaching the permissible 5% planning tolerance for background harmonics.

A peer review of the research methodology found it to be robust and rigorous. Whilst the research was unable to definitively determine the limits at which sensitivity is observed, and therefore cannot identify the most appropriate revised upper and lower limits, it has proven that customers exhibit little sensitivity to minor excursions in power quality limits beyond the present standards.

These findings support an extension of the existing UK voltage limits in parity with the European standard of 230 +/-10% and the potential to expand these limits further.

Outlook for 2015/16

As we look forward to 2015/16 we recognise the changes to the way in which innovation is to be funded. The new Network Innovation Allowance (NIA) will be active replacing the IFI funding. Given this we have put considerable effort into ensuring the all of our IFI projects are completed ahead of this transitional phase. We have been successful in this and we are now looking forward to establishing an appropriate mix of newly formed NIA projects. We have already registered a number of NIA projects and further details on these can be found on the ENA's Smarter Networks Portal.

Summary

The factors described earlier in this document have led to significant technical and commercial challenges for electricity distribution networks against a background of downward pressures on cost and increasing customer expectation. Innovation is now embedded as business as usual within Electricity North West and will help us to meet the combined challenges arising from the migration to a low carbon economy. Innovation will ultimately provide opportunities for Electricity North West to develop new business and commercial services to deliver increased value to our customers and stakeholders.

Our customers and stakeholders are currently receiving the measurable benefits of previous IFI projects that have delivered successful innovations into our business and we are looking forward to building upon this success in the future. We also note that a number of our innovations such as those associated with LV transient fault management have been successfully adopted by other network operators.

Collaborations

We have an extensive list of collaborators for our IFI project portfolio to ensure that the majority of our available IFI funding goes to companies and institutions predominantly based within the North West of England.

Table 2: List of collaborators

Project	Collaborator
Strategic Technology Programme modules	EA Technology Ltd
Pole Mounted Fault/Load monitor	Nortech
EA Technology Ltd Forums	EA Technology Ltd
OLTC Monitoring	Liverpool University
Dynamic Line Rating	ADAS/Nortech
Oil Regeneration - Phase 2	Manchester University
Distribution Transformer Real Time Thermal Ratings	Manchester/Liverpool University, Nortech, Schneider Transformers
LV Automation	Kelvatek/EPS
ENA Recharges	ENA
Demand Control	Manchester University/PB Power
Duckbill Anchors	Anchor Systems Europe
PV Array Monitoring	Streamline/Bellrock

Project	Collaborator
Network Modelling	CGI
Transformer Investigation	ABB
Cable Temperature Sensor	Technology Partnership plc (TTP)
Birds and Power Lines	WWT, Lancaster University
Fluid Filled Cables Repair System	Gynosis
Statutory Voltage Limits	Impact Research Ltd
Fault Assistance	Kelvatek

Electricity North West considers it vital that we use our available funding to encourage companies both small and large to engage with us and we have a number of stakeholder events and publications to reach out to the wider community of innovators.

Table 3: Completed Projects

Project Title	Collaborative Partner	Outcome	Financial Benefits	Operational Benefits	Industry Benefits
OHL Dynamic Ratings	Internal	This project has resulted in successful implementation of a dynamic line ratings system on both 132 and 33kV OHLs at key locations on our network.	Upon implementation as BAU the introduction of dynamic line ratings on OHLs has the potential to reduce the need for network reinforcement thus reducing costs for customers.	The success of the project has laid the foundations for moving the use of dynamic ratings into BAU.	The project has tackled a number of practical issues associated with the deployment of remote sensors into harsh environments.
Distribution Transformer Thermal Behaviour	University of Manchester	The adoption of new low carbon technologies by customers is expected to place increased loads on already highly loaded networks. This project developed an improved level of understanding of the thermal characteristics of distribution transformers.	This project aimed to develop understanding of the thermal behaviours of transformers on the basis that new load profiles associated with high concentrations of low carbon loads could increase the failure rate of transformers. Its difficult to quantify the precise benefits financially but clearly improved network reliability and associated customer service can be expected.	The success of the project has laid the foundations for a NIC project to allow the trial of the concepts at scale and eventually moving the use of dynamic ratings into BAU.	All DNOs will have an installed transformer base of similar characteristics to those in use by ENWL and can expect to see the same types of low carbon loads moving forward. As such the learning from this project will benefit all DNOs.
Next Generation LV Board and Link Box	Kelvatek / EPS	A number of new products have now been released to the market following the successful conclusion of the project.	These new products allow DNOs to realise a number of benefits right across their operational portfolio including customer service.	The addition of automated switches at the low voltage layer has a number of operational benefits including customer service and operator safety.	The project has tackled a number of practical issues associated with the deployment of LV automation.

Project Title	Collaborative Partner	Outcome	Financial Benefits	Operational Benefits	Industry Benefits
Conservation Voltage Reduction	ABB and University of Manchester	This project demonstrated the potential for use of reactive compensation to improve voltage control on OHL HV networks.	There are real reductions in technical energy losses and savings in energy consumption associated with improved voltage regulation on HV OHLs through use of reactive devices such as capacitors.	Much of the learning from this project is now being trialled as part of much larger Second Tier LCN Fund project (Smart street).	The wider benefits from this project will depend to an extent upon the unique challenges within each DNOs network. The learning from the Smart street project is expected to be particularly relevant to UK DNOs.
Oil cable leaks	Energy Innovation Centre (UK DNOs) / Gynosis	Gnosys have identified a number of chemistries that have the potential to create the desired blocking effect when a fluid leak is present. These chemistries will be advanced through further stages and experimentation.	Indicative data from one DNO shows that the current cost of this problem is of the order of several £M per annum across the UK as whole. Implementation of cable with self-heal properties would help resilience to these issues. The financial savings are from reduced need for cable repair as a result of leakage.	This project requires further development in order to get to a position where the product is available to DNOs for purchase and for implementation on its live network.	None as yet given that further development work is ongoing.
Cable Core Temperature Sensor	Energy Innovation Centre (UK DNOs) / The Technology Partnership PLC	A successful proof of concept at using easily retro-fitted externally fitted sensors to accurately deduce the core temperature of three phase power cables.	This project was proof of concept only. Further work would be required to develop this into a commercially available product which could be used on live networks.	Low cost easily fitted sensors have the potential to increase the real-time visibility of networks which provides the DNO with increased capability to manage these network effectively and more actively.	None as yet given that further development work is ongoing.

Project Title	Collaborative Partner	Outcome	Financial Benefits	Operational Benefits	Industry Benefits
Cable Dynamic Thermal Ratings	University of Manchester	A new thermal modelling tool has been developed and several thermal models built which provide greater insights into the thermal properties of low voltage underground cables.	Further work is required to develop the models and to reduce the complexity of the tool for use within DNOs.	The thermal capability of LV cables is expected to be an increasingly common problem in toward the end of ED1 and into ED2. The improved understanding of the thermal performance of cables is crucial if DNOs are to avoid the need for costly network reinforcements.	None as yet given that further development work is ongoing.
Demand Forecasting and Real Options	University of Manchester	Revised methodology for peak demand scenarios, and early prototype tool to assess when to use DSR	Enabling efficient decisions on how and when to provide network capacity	Implementation of learning in 2015, facilitating transition of DSR to business-as-usual	Dissemination through new NIA project
Mobile LV Distribution Board	Kelvatek	A prototype mobile LV distribution board (that meets all operational and safety requirements) has been developed and tested.	The mobile LV board can be used to reduce the cost of faults within DNOs by offering temporary solutions to restoration of supplies.	ENWL are using the mobile LV board to help address the issues associated with faults on its low voltage networks thus reducing fault costs and increasing customer satisfaction outcomes.	All DNOs have requirements to ensure that supplies are restored as fast as possible in the event of a fault on the network.
Ferranti PV System	University of Manchester	A live test system has been installed and commissioned at the UoM campus which is being used to provide ENWL with increased awareness of the issues associated with the use of PV systems on LV networks.	The expected increase in the use of PV generation by customers at low voltage will increase the demands placed on networks. This information provided from this system will enable DNOs to make more informed decisions on the investment requirements.	Not expected to be significant operational benefits from this system.	All DNOs will face similar challenges in understand how low voltage networks will cope with increased penetration of PV systems.

Project Title	Collaborative Partner	Outcome	Financial Benefits	Operational Benefits	Industry Benefits
Statutory Voltage Limits	Impact Research Ltd	The final report will be published in August 2015. A number of additional research activity around ESQCR technical compliance and obtain clarity of the current ESQCR regulations and guidance notes in respect of voltage limits, which are presently considered too restrictive. The viability of extending the present UK +10/-6% limits up to or beyond the current EU +/-10% limits and examine the advantages and risks of doing so.	Further work is required to understand the full implications of any changes to the statutory voltage limits applied to networks. However, this research is useful in understanding how customers perceive changes in voltage which can be used to inform changes to limits.	In the short term there aren't expected to be any significant operational benefits from this research.	The industry is faced with a number of challenges on the issue of appropriate voltage limits. This research will make a crucial contribution to this ongoing work.
Metal Theft and Substation Security	Greater Manchester Police	Development a number of innovative techniques to complement more traditional security strategies.	These techniques have been used to better secure our network and reduce the number of customers suffering supply interruptions due to criminal activity.	These initiatives have been successful in both stopping further increase in metal theft and in helping deliver a 46% reduction in theft instances.	
Fault Assistance Centre	Kelvatek	An off-site expert fault support service has been successfully demonstrated and is now in the process of being implemented as BAU within ENWL.	The ability of DNOs to effectively manage transient faults on low voltage network has the potential to reduce both fault costs and the costs associated with loss of supply to customers.	The expert support offered by Kelvatek via the fault assistance centre has the potential to significantly improve the effectiveness of fault response within DNOs.	Further work is required to develop the fault assistance centre before an assessment of the industry benefits can be fully established.

Project Title	Collaborative Partner	Outcome	Financial Benefits	Operational Benefits	Industry Benefits
Grid iView	SSEPD	Development of an innovative approach to the collection of information from customers using mobile applications	Further work is required to develop the application before any real assessment of the financial benefits can be established.	Further work is required to develop the application before a quantified assessment of the operational benefits can be established. The capture of accurate information on faults is of crucial importance to DNOS especially during abnormal periods such as storms.	Further work is required to develop the application before an assessment of the industry benefits can be established.
Fault Location	University of Manchester	A considered review of current best practice on the determination of distance to fault on high voltage networks.	The financial benefits of this work will be realised upon successful completion of a follow up NIA project – Sentinel.	The operational benefits of this work will be realised upon successful completion of a follow up NIA project – Sentinel.	The industry benefits of this work will be realised upon successful completion of a follow up NIA project – Sentinel.

Financial Report

Table 4: 14/15 summary report on IFI activities

Distribution Network Revenue	£ 528,554,000
IFI Allowance	£ 2,643,000
Unused IFI Carry Forward 14/15	n/a
Number of Active IFI Projects	34
Summary of benefits anticipated from IFI projects - Sum of Projected NPV	£ 8,726,892
External expenditure on IFI projects in 14/15	£ 2,516,960
Internal expenditure on IFI projects in 14/15	£ 251,914
Total expenditure 14/15 on IFI projects	£ 2,768,874
Estimated benefits actually achieved from IFI projects to date	£ 5,062,588

Project Title	Strategic Technology Programme Overhead Line Networks			
Description of project	A DNO research and development collaboration hosted by EA Technology			
Expenditure for 14/15 financial year	Internal £266 External £43,339 Total £43,605		Expenditure in previous (IFI) financial years	Internal £22,853 External £338,809 Total £361,662
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	The Module 2 programme for budget year 2014/15 aimed to optimise overhead network design, improve operational performance, maximise potential benefits, improve financial performance, and minimise risk associated with overhead networks.			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		16	9	25
Expected Benefits of Project	If successful project in this Module may increase the performance and reliability of OHL networks.			
Expected Timescale to adoption	Range 1-5 years - dependent on project		Duration of benefit once achieved	Range 3-5 years - dependent on project
Probability of Success	Range 49-95% - dependent on project		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£42,652
Potential for achieving expected benefits	The 14/15 work programme demonstrates the development of innovative products, processes and techniques that improve the management of Overhead Networks.			
Project Progress to March 15	Work in 14/15 concentrated solely on delivery oh phase 1 of the Development of a probabilistic overhead line rating methodology applicable to distribution networks.			
Collaborative Partners	Other DNOs			
R&D Providers	EA Technology			

Project Title	Strategic Technology Programme Cable Networks			
Description of project	A DNO research and development collaboration hosted by EA Technology			
Expenditure for 14/15 financial year	Internal £258 External £42,101 Total £42,359		Expenditure in previous (IFI) financial years	Internal £14,689 External £387,324 Total £401,923
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	The Module 3 programme for budget year 2014/15 aimed to improve operational performance, maximise potential benefits, improve financial performance, and minimise risk associated with cable networks.			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		14	8	22
Expected Benefits of Project	If successful projects in this Module may increase the performance and reliability of cable networks			
Expected Timescale to adoption	Range 1-2 years - dependent on project		Duration of benefit once achieved	Range 3-5 years - dependent on project
Probability of Success	Range 45-100% - dependent on project		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£42,013
Potential for achieving expected benefits	The 14/15 work programme demonstrates the development of innovative products, processes and techniques that improve the management of cable Networks.			
Project Progress to March 15	During this year the programme consisted of just the two projects; Delivering improvements to the performance and management of service termination equipment (cut-out assemblies) and CRATER lite.			
Collaborative Partners	Other DNOs			
R&D Providers	EA Technology			

Project Title	Strategic Technology Programme Substations			
Description of project	A DNO research and development collaboration hosted by EA Technology			
Expenditure for 14/15 financial year	Internal £0 External £76,411 Total £76,411		Expenditure in previous (IFI) financial years	Internal £32,079 External £304,956 Total £337,035
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	The Module 4 programme for budget year 2014/15 aimed to improve operational performance, maximise potential benefits, improve financial performance, and minimise risk associated with substations.			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		16.5	9.5	26.0
Expected Benefits of Project	If successful projects in this Module may increase the performance and reliability of substations.			
Expected Timescale to adoption	Range 1-4 years - dependent on project		Duration of benefit once achieved	Range 1-6 years - dependent on project
Probability of Success	Range 30-95% - dependent on project		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£32,721
Potential for achieving expected benefits	The 14/15 work programme demonstrates the development of innovative products, processes and techniques that improve the management of substations.			
Project Progress to March 15	During this year the programme consisted of just the one project; Transformer Post Mortems.			
Collaborative Partners	Other DNOs			
R&D Providers	EA Technology			

Project Title	Strategic Technology Programme Networks for Distributed Energy Resources			
Description of project	A DNO research and development collaboration hosted by EA Technology			
Expenditure for 14/15 financial year	Internal £236 External £47,128 Total £47,364		Expenditure in previous (IFI) financial years	Internal £35,710 External £289,343 Total £325,053
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	The Module 5 programme aimed to improve operational performance, maximise potential benefits, improve financial performance, and minimise risk associated with the integration of distributed energy resources into electricity distribution networks.			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		13.5	8.5	22
Expected Benefits of Project	If successful projects in this Module may increase the performance and reliability of distribution networks			
Expected Timescale to adoption	Range 1-3 years - dependent on project		Duration of benefit once achieved	Range 2-5 years - dependent on project
Probability of Success	Range 51-100% - dependent on project		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£28,841
Potential for achieving expected benefits	Collectively, the work programme demonstrates the development of innovative products, processes and techniques that improve the management of electricity distribution networks.			
Project Progress to March 14 (Continued)	Very minimal activity in this programme during 14/15. No new projects created.			
Collaborative Partners	Other DNOs			
R&D Providers	EA Technology			

Project Title	Pole Mounted Fault/ Load Monitor			
Description of project	The aim of this project was to develop and trial a reliable non-contact Fault/load remote monitor up to 33kV			
Expenditure for financial year	Internal £1,735 External £3,025 Total £4,760		Expenditure in previous (IFI) financial years	Internal £824 External £69,226 Total £70,046
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	Fault Passage Indicators have been used for many years and have evolved from simple blinking light indications to the latest devices that include an array of communications and sensor technology, the Polestar was selected for a trial with the aim of gathering data and developing communications protocols to allow the FPI to communicate with the control room management system. The Polestar Device is non-contact and is installed 3 metres below 11kV conductors on the wooden pole. It detects the presence and magnitude of the magnetic and electrical field in the vicinity of the conductor and uses a GSM/GPRS modem to report alarms, routine events and field capture trends to a central iHost Platform Objectives • Trial the device • Develop load monitoring algorithms • Evaluate the potential replacement for power outage devices (PODs) on OHL networks • Feed real-time fault/load data into CRMS • Historical load data for planning network reinforcement or development.			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		10	11	21
Expected Benefits of Project	Financial - From a reduction in CML and CI's Quality of supply - On-line load monitoring to assist in network management gathering fault data and outage data, can be used with automation schemes in helping to determine which NOP to close and what load would be picked up, gathering of historical load data for planning or network development and faster restoration			
Expected Timescale to adoption	3 years		Duration of benefit once achieved	10 years
Probability of Success	75%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£198,887
Potential for	This project stems from a strategy of developing our infrastructure			

achieving expected benefits	to allow greater visibility of the network loads in the control room at any instant in time. The Polestars can be installed without any outage making them an attractive device. Once the results are calibrated they will provide another means to better manage issues such as DG connections
Project Progress to March 15	During 2013/14 we removed the installed Polestar devices and installed the Bowden Alpha 360 OHL FPI unit in their place, we are currently monitoring their performance. The development and trial of the new Nortech ground mounted communicating FPI was completed. Following a positive review of their performance the decision was taken to adopt the device as business as usual and install a significant number on our network. This project is now completed and the FPIs are being used every day to inform post fault switching on our network This project is now completed and closed.
Collaborative Partners	WPD
R&D Providers	Nortech

Project Title	**EA Technology Ltd Forums**			
Description of project	In addition to the Strategic Technology Programme (STP), Electricity North West currently attended seven forums and information exchange groups hosted by EA Technology. They are; • Protection Engineers Forum • Cable Engineers Forum • Effective Protective Coatings for Plant and Overhead Line Towers • Plant Engineers Forum • Overhead Line Forum • Partial Discharge User Group • Energy Storage Operators Forum			
Expenditure for financial year 14/15	Internal £779 External £26,977 Total £27,756		Expenditure in previous (IFI) financial years	Internal £50,530 External £148,736 Total £199,266
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £12,273 Internal £2,166 Total £14,439
Technological area and / or issue addressed by project	The EA Technology Ltd Forums address a range of different issues and have been used to develop a common industry view on a range of issues of a technical, engineering or safety nature.			
Type(s) of innovation involved	Demonstration (System prototypes or trials)	Project Benefits Rating	Project Residual Risk	Overall Project Score
		14	11	25
Expected Benefits	Financial - No specific financial reductions will result from			

of Project	participating in the Forums however, they have for many years provided an ideal opportunity for information exchange and both formal and informal industry collaboration. Other - No specific benefits are defined in the areas of Supply Quality, Environmental, Safety or Operation but all of these issues are addressed.		
Expected Timescale to adoption	1 year	Duration of benefit once achieved	10 years
Probability of Success	100%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£39,301
Potential for achieving expected benefits	The EA Technology Ltd Forums have provided a range of benefits across many areas of our business.		
Project Progress to March 15	Projects are funded on an annual 'rolling' basis and have concluded for the financial year. Electricity North West intend to continue to support the EA Technology Ltd forums albeit on a reduced basis as they offer a low-cost and effective means of accessing the latest technical developments across the industry.		
Collaborative Partners	Other DNOs		
R&D Providers	EA Technology Ltd		

Project Title	**Dynamic Line Rating**			
Description of project	This project is installing a distributed weather and conductor temperature monitoring system on a 132kV and 33kV Overhead Line in Cumbria and developing a Dynamic Line Rating Calculation Engine within our Control Room Management System based on the Cigré Algorithm			
Expenditure for financial year	External £6,631 Internal £26,526 Total £33,157		Expenditure in previous (IFI) financial years	External £159,223 Internal £227,866 Total £387,089
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	The increasing pressure to connect distributed energy systems without (or with minimal) constraints and in a sustainable way is leading to a great deal of interest in the subject of Dynamic Line Ratings, we are aiming to explore the physical loading limits of our assets rather than limit the potential connection of DES to national planning standards			
Type(s) of innovation involved	Development	Project Benefits	Project Residual Risk	Overall Project Score

		Rating		
		19	4	23
Expected Benefits of Project	This project will deliver a number of benefits as listed below: • Derive 'general principles' for Dynamic Line Ratings that can be transferred and applied to other similar circuits • Provide an economic and commercial assessment of the costs and resource required when installing and operating dynamic line ratings • Provide an assessment of remaining capacity (if any) on the two selected 33kV circuits • Provide an economic assessment of the costs and potential of Dynamic Line Ratings against traditional reinforcement • Although this project may require substantial investment, it would require significantly less financial expenditure than a major reinforcement project. Even if a major reinforcement could simply be deferred for a number of years it should still present an opportunity to deliver substantial benefits			
Expected Timescale to adoption	3 years	Duration of benefit once achieved	10 years	
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£451,878	
Potential for achieving expected benefits				
Project Progress to March 15	All equipment now installed and monitoring of the readings is continuing. This project is complete.			
Collaborative Partners	None			
R&D Providers	Nortech, Gridsense			

Project Title	**Oil Regeneration – Stage 2**
Description of project	This project is to use the recently commissioned Electricity North West portable oil regeneration unit, based at our Central Oil Reprocessing Depot (CORD) in Blackburn, Lancashire to undertake oil regeneration on a sample primary transformer within the Electricity North West estate with the aim of deferring replacement of the identified unit beyond at least financial year 2017/18. The oil regeneration process consists of connecting the regeneration unit into the oil circuit of the transformer and then pumping the oil through various sieves, filters and heaters to remove impurities and dry the oil. In order to ensure this is economically viable it is essential to properly understand the effect of the regeneration on the transformer oil condition and the subsequent rates of deterioration following the proposed intervention which is made more difficult due to the loss of historical oil data held in the

	untreated oil			
Expenditure for financial year	External £39,978 Internal £0 Total £0		Expenditure in previous (IFI) financial years	External £119,935 Internal £194 Total £120,129
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Following the DPCR5 settlement it is now necessary to investigate alternative transformer management options that have previously not been considered and the technique that would appear to offer the greatest opportunity to improve the transformer HI and thereby extend the operational life is Transformer Oil Regeneration. The aim is to test the efficacy of oil-regeneration as a reliable asset management technique and Manchester University have been recruited onto the project team to analyse the performance of the oil regeneration.			
Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score
		21	25	4
Expected Benefits of Project	Financial - The financial benefits from this project are derived from the potential transformer life extension and deferment of asset replacement costs. It has been calculated that a potential financial saving of £200,000 (including the cost of each regeneration) per transformer could result if the HI could be improved to permit a five year replacement deferment. Quality of Supply - The quality of supply benefits are limited to a better understanding of the risk of failure of older transformers and a better insight into the oil ageing process. Environmental - The Environmental benefits result from extending the life of transformer and its oil therefore reducing the requirements for disposal and recycling of used oil and scrap transformers			
Expected Timescale to adoption	3 years		Duration of benefit once achieved	10 years
Probability of Success	75%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£887,486
Potential for achieving expected benefits	A number of commercial organisations offer oil regeneration and it is considered a financially beneficial technique however it has not been widely tested on primary transformers on distribution networks, this project will define the benefits. These commercial providers do not always have the optium specification of their regeneration plant raising the possibility of the introduction of Corrosive Sulphur into our plant. As a result of this and the knowlwdge gained we are specifying a second mobile regeneration unit for use in the RIIO ED 1 period.			

Project Progress to March 15	The following milestones were delivered as part of this project: • A policy document for oil re-generation procedure and associated asset refurbishment was issued to the Company. • A technical report on the assessment of oil re-generation including the financial benefits, and trend analysis of post oil regen data analysis and etc. was distributed to other ESI Companies and an event held to brief other ESI Company representatives at our training academy. • A report on the model that can be used to determine the number of oil re-generation transformers and the improvement to the transformer health index has been adopted by the business. The result of this project has allowed Electricity North West to defer replacement of over 12 Grid and 77 Primary transformers in RIIO-ED1 which will save customers an estimated £33 million in RIIO ED1 period. We anticipate similar savings may be possible in the RIIO ED2 period. The project is now closed
Collaborative Partners	None
R&D Providers	Manchester University

Project Title	**Storage**			
Description of project	This project aimed at initial research on the technical and economic factors and specification development for installing an Energy Storage System (ESS) on Electricity North West Ltd's Network.			
Expenditure for financial year	External £0 Internal £51,538 Total £0		Expenditure in previous (IFI) financial years	External £170,614 Internal £13,005 Total £183,619
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	The project involves an academic investigation of the technical and commercial benefits and costs (and risks) of energy storage and a key deliverable is the development of a specification of an energy storage system.			
Type(s) of innovation involved	Development (Small scale trials / prototypes)	Project Benefits Rating	Project Residual Risk	Overall Project Score
		22	4	26
Expected Benefits of Project	The benefits from this work will be through developing a greater understanding of the potential merits of ESS as a viable network solution. The limited work so far has identified a number of specific areas where distribution network scale energy storage system can deliver benefits including; • Voltage control			

	• Power flow management • Network management • Restoration • Commercial/regulatory • Energy market participation (arbitrage, balancing market) • Reduce DG variability • Increase DG yield from non-firm connections • Replace spinning reserve		
Expected Timescale to adoption	3 years	Duration of benefit once achieved	20 years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	-£312,614
Potential for achieving expected benefits	Although the technical performance of storage can be straightforward to model and can be demonstrated to deliver practical benefits to the operation of the network, the commercial and economic benefits of storage are not defined and have not been tested to any great extent. Furthermore the regulatory environment, in spite of the very public call for DNOs to adopt more flexible approaches to for example, accommodating more DG, would appear to actually discourage storage as a solution and one of the primary aims of the project would be to gather firm evidence to support arguing the case for either derogations from the regulatory rules or indeed a change to the licence conditions		
Project Progress to March 15	The project has continued to deliver a number of reports and academic papers describing technical and economic benefits of ESS, including one on '*Voltage rise as result of PV in 9,000 LV networks and a cost comparison between reconductoring and energy storage to prevent overvoltage'* leading to a paper at CIRED, and another on '*Coordination of Multiple Energy Storage Units in a Low Voltage Distribution Network*' in IEEE Transactions on Smart Grid. The research has supported three PhDs to completion. Due to the cost of installing an ESS (negative NPV) and other ESS projects being undertaken across GB, Electricity North West's innovation strategy is to observe storage projects rather than replicate those trials.		
Collaborative Partners	SP Power Systems		
R&D Providers	Durham University		

Project Title	**CBRM**
Description of project	The Condition Based Risk Management tool is used by the Company to inform investment decisions associated with the asset replacement or refurbishment of 18 asset groups. Whilst the modelling technologies have been available since around 2003, it was identified that there was the need to improve the manner in which data was retrieved from our company databases and loaded into the developed models. This is an area where we had little

	knowledge of the techniques available and we identified the need to develop these technologies and embed them into our business as usual processes/			
Expenditure for financial year	External £29,201 Internal £0 Total £29,201		Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Interrogation of company asset data sets, formation of the data into standard formats by data manipulation and loading to the CBRM models. This area of data manipulation and formatting was unknown to the Company due to its complexity			
Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
Expected Benefits of Project	The following Benefits were anticipated as a result of this work: • Consistent production of data reports for the creation of CBRM Models • Productionisation of report building • Consistency in providing data for Regulatory and Stakeholder reporting • Repeatable results which can be audited against DPCR5 Standards			
Expected Timescale to adoption	The Product was adopted in 2012		Duration of benefit once achieved	8 – 10 years
Probability of Success	80 – 90%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£
Potential for achieving expected benefits	Similar products have been provided by the R&D Providers and successfully implemented across different IT platforms. We have every reason to believe that the expected benefits will be achieved based on the delivery track record of the suppliers.			
Project Progress to March 15	This project was re-opened in 2014 due to the submission of late costs by the main contractor associated with the production of the Data loader. The software had been successfully implemented in 2012 and reported appropriately at that time. This Project is now Closed.			
Collaborative Partners	None			
R&D Providers	E A Technology Ltd, Capenhurst, Chester.			

<table>
<tr><th>Project Title</th><th colspan="5">Distribution Transformer Real Time Thermal Ratings</th></tr>
<tr><td>Description of project</td><td colspan="5">It has been recognised that due to the forecasted changing loads at lower voltages LV network peak loading and particularly distribution transformers may become a limiting factor in developing smart networks. Primary transformers and those at higher voltage have received a great deal of attention in recent years due to their high capital value and relatively small population and their performance and aging is fairly well understood, however distribution transformers have undergone little if any recognised research into better understanding their technical and economic performance. Electricity North West has approximately 33,000 distribution transformers both ground and pole mounted and many different designs exist with a large spread of ages and condition, this project is aimed at developing our ability to understand and define the effects of higher loading on distribution transformers and the benefits of available intervention strategies by installing 10 distribution transformers with internal and external sensors</td></tr>
<tr><td>Expenditure for financial year</td><td colspan="2">External £384,437
Internal £2,961
Total £387,398</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>External £303,645
Internal £40,012
Total £343,657</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td colspan="2"></td><td colspan="2">Projected 15/16 costs for Electricity North West</td><td>External £0
Internal £0
Total £0</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="5">The project will aid our ability to;
• Understand loading of existing distribution transformers
• Understand and assess condition of distribution transformers
• Enhance loading of distribution transformers</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Development (Small scale trials / prototypes)</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td colspan="2">Overall Project Score</td></tr>
<tr><td>20</td><td>6</td><td colspan="2">26</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="5">The project benefits are derived from being able to better understand the potential for releasing inherent capacity within our distribution transformers. By 2030 it is expected that domestic heat pumps will add an additional 2.75 GW (8kW for 6 hours) and domestic EV charging will add an additional 4 GW (3kW for 8+ hours) of demand at LV, even if optimally scheduled this is a doubling of demand from today. More accurate understanding of the performance of our distribution transformers will significantly add to our ability to meet this demand whilst managing the network within statutory limits</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">3 years</td><td>Duration of benefit once achieved</td><td colspan="2">20 years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">75%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td colspan="2">£791,193</td></tr>
</table>

Potential for achieving expected benefits	The project is expected to deliver the required results
Project Progress to March 15	The University of Manchester have developed initial thermal models based on the temperature readings from the fibre optics installed in the distribution transformers. The next step is to define a failure model to be applied to our asset base to help prioritise future investment plans. The IFI project has now closed and a NIA project has been registered to define the failure model.
Collaborative Partners	None
R&D Providers	Schneider Transformers/Manchester University/Liverpool University/Nortech

Project Title	**Next Generation LV Board / Link Box**		
Description of project	This project aims to facilitate development of an automated LV network that is capable of being switched into alternative mesh configurations in real time to provide greater flexibility to connect small-scale embedded generation and other 'smart grid' loads and demands. The project is specifically about the development of the necessary LV controls and switches. There are a number of significant advantages to operating LV mesh networks, these include: • Lower network losses • Optimum power and energy transfer across the load cycle enabling more load/generation connections at lower cost • Improved power quality • Improved voltage control This will require the development of a revised LV board design and an automated link box switch device that should be both for new installations and for retrofit to existing designs and the devices will require full communications functionality. The ultimate aim is to combine the solutions being developed under other IFI/LCN projects including LV storage and SVCs at the LV distribution board and use control algorithms to manage the LV board, link box and feeder voltage profiles.		
Expenditure for financial year	External £91,578 Internal £650 Total £92,228	Expenditure in previous (IFI) financial years	External £13,900 Internal £1,092,567 Total £1,106,467
Project Cost (Collaborative + external + [DNO])		Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Network Performance		

Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score
		18	3	21
Expected Benefits of Project	The project financial benefits are derived from being able to better control voltages on LV feeders by offering the ability to mesh LV networks as required by local conditions of demand and generation. There are a number of other significant advantages to operating LV mesh networks including: • Lower network losses • Optimum power and energy transfer across the load cycle enabling more load/generation connections at lower cost • Improved power quality, reduced harmonic effects etc • Improved voltage control			
Expected Timescale to adoption	3 years		Duration of benefit once achieved	20 years
Probability of Success	75%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£82,194
Potential for achieving expected benefits	This project will provide a means for meshing of networks which will be demonstrated through other LCN Fund projects.			
Project Progress to March 15	There was a piece of work during this financial year to complete the work with EPS. (The Kelvatek work had already been completed). EPS completed the development and testing of their Link Box switch and the units are now ready for deployment. This project is now closed.			
Collaborative Partners				
R&D Providers	EPS UK, Kelvatek			

Project Title	ENA Recharges			
Description of project	A number of projects have been developed by the ENA Energy Networks Future Group to further investigate issues identified as having national significance in ensuring UK DNOs can fully participate in the migration to a low carbon economy. The initiatives cover a range of common issues for UK DNOs and their inception and delivery has ensured that the debates taking place to shape the required short and medium term national strategy are fully informed. Each project has been project managed by the ENA on behalf of all DNOs. The **Reactive Power (REACT)** project is highlighted here as an example. In the last 2 years, there have been significant difficulties in managing voltage levels during minimum demand periods. Analysis of this issue has shown that the root cause is related to the significant decline in reactive power relative to active power. Whilst minimum active power demands have fallen by around 15% in the last 5 years, reactive power has declined by 50% in this time. Current trends for 2012 show that this reduction is continuing, broadly, across the country. In order to better understand the challenge of manage voltage levels within licence standards and to plan for additional future reactive compensation requirements, a thorough understanding of the reactive power trend needs to be developed.			
Expenditure for financial year	External £63,835 Internal £1,852 Total £65,687		Expenditure in previous (IFI) financial years	External £160,764 Internal £18,194 Total £178,958
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Various			
Type(s) of innovation involved	Development (Small scale trials / prototypes)	Project Benefits Rating	Project Residual Risk	Overall Project Score
		20	6	26
Expected Benefits of Project	The benefits of this collaboration arise from ensuring all DNOs and National Grid share a common understanding of the various challenges facing the industry in the migration to smart electricity networks.			
Expected Timescale to adoption	1 year		Duration of benefit once achieved	1 year
Probability of Success	100%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£15,681
Potential for achieving	The success of the project is reflected in the successful development of national objectives for the migration to smart electricity networks.			

expected benefits	**Reactive Power (REACT):** The objectives corresponding to the First Year Report Stage 1 and the Second Year Six-month Report have been met within the last 12 months (May 2014 to May 2015) and the corresponding reports delivered. Two additional brief project status reports have also been delivered. The progress on the project includes: • The methodology to improve original DNO network models in order to mimic in time-series simulations the GSP behavior during periods of minimum load. • The identification of historic changes and trends using DNO network and monitoring data. • The quantification of effects on reactive power from PV penetrations, network changes and demand trends in primary substations. • The assessment of future reactive demand at GSPs of 4 DNOs for different trend-based scenarios.
Project Progress to March 15	A number of projects are in various stages of maturity including; • Vacuum Bottle Testing • G5/5 Rewrite • DC Injection Assessment • Smart Grid Forum - WS3, WS5 and WS7 (WS7 reported separately). • Smarter Network Portal • Technical Editor • LCN Fund Conference **Reactive Power (REACT):** The objectives corresponding to the First Year Report Stage 1 and the Second Year Six-month Report have been met within the last 12 months (May 2014 to May 2015) and the corresponding reports delivered. Two additional brief project status reports have also been delivered. It is important to highlight that the project was initially planned to start in May 2013 but it actually did in August 2013. The Second Year Final Report Stage 2 is on track and will be completed by August 2015. The outcomes of the project are in accordance with the initial objectives of the project proposal. More specifically, the following tasks have been accomplished: • Identification of historic network and demand changes and trends. • Quantification of effects on reactive demand during minimum load from different distribution-based factors (i.e., demand trends in primary substations, network changes, penetration of photovoltaics). • Assessment of future reactive demand at transmission-distribution interfaces of different DNOs. • Production of improved network models, which unlike original DNO models mimic transmission-distribution interfaces during periods of minimum load, to be used for further studies http://www.smarternetworks.org/Project.aspx?ProjectID=1460#project-details

Collaborative Partners	All UK DNOs
R&D Providers	ENA

Project Title	OHL Fault Location			
Description of project	A specific element of Electricity North West Ltd's Customer/Quality of Supply strategy is improving our performance in relation to the location and repair of faults on our overhead line network, one method of achieving this is the installation and trial of an automated fault location system. Significant analysis has been undertaken on our IIS performance data which had identified the location of Ofgem defined 'worst served customers' who suffer from a disproportionate number of faults due to a number of technical and economic reasons. The objective of this trial is to better understand the potential of such systems to identify OHL fault events and equally as importantly identify the location of faults on Electricity North West Ltd's OHL network			
Expenditure for financial year	External £0 Internal £4,685 Total £4,685		Expenditure in previous (IFI) financial years	External £41,196 Internal £3,768 Total £44,964
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Network reliability			
Type(s) of innovation involved	Development (Small scale trials / prototypes)	Project Benefits Rating	Project Residual Risk	Overall Project Score
		20	6	26
Expected Benefits of Project	The project financial benefits are derived from an improvement in our CI/CML performance. There is a high level of confidence that the section of network selected has sufficient coverage to test the system and its accuracy. The project NPV is based on a reduction in IIS penalties			
Expected Timescale to adoption	1 year		Duration of benefit once achieved	5 years
Probability of Success	75%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£95,983
Potential for achieving expected benefits	The system is based on the measurement, time stamping and subsequent comparison of EM pulses from arcing faults and has been proven in a test environment. The network installation does			

	not present any real technical challenges and it is believed the technique has a high probability of success
Project Progress to March 15	There were issues selecting suitable sites for connection and complexity of the connection. The project was suspended.
Collaborative Partners	None
R&D Providers	Altea

Project Title	**Duckbill Anchors**					
Description of project	Electricity North West own a significant number of wood poles as part of our overhead line network and the nature and location of many of these assets give rise to a constant need for inspection and maintenance with the associated high costs. One critical aspect of the wood pole is the rod and block anchoring arrangement with the poles effectively tied to a buried concrete block and whilst this system has proved effective for many years, the on-going cost gives rise to the need to trial new systems that could offer better long term cost and performance. This project is trialling an alternative anchoring system, the Duckbill anchor					
Expenditure for financial year	External £21,122 Internal £0 Total £21,122		Expenditure in previous (IFI) financial years		External £35,647 Internal £2,229 Total £37,876	
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West		External £0 Internal £0 Total £0	
Technological area and / or issue addressed by project	Safety/Asset Management					
Type(s) of innovation involved	Development (Small scale trials / prototypes)	Project Benefits Rating		Project Residual Risk		Overall Project Score
		22		3		25
Expected Benefits of Project	A number of benefits will arise if this system is proven to be effective and can be used to replace the traditional approach. For example, type 1 load-lock anchors have a life of up to 20 years using a wire tendon, replacing this tendon with a galvanised steel bar will extend the life to 30 years. Also there are presently no type 2 load-lock anchors and the only option where lifting machinery cannot be used is a rod and block arrangement which is more costly to install. Electricity North West has over 14,000 stayed wood poles with a 30 year asset life leading to an average replacement rate of 477 per year at a cost of £500 per rod and block. This system may be suitable for use for approximately 50% of these occasions (where access for vehicles is suitable) so if it could be proven it could reduce the cost of installation by £5,963 per annum					

Expected Timescale to adoption	1 year	Duration of benefit once achieved	10 years
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£53,990
Potential for achieving expected benefits	The project is expected to deliver an additional solution to the traditional; approach that is not always appropriate in some circumstances		
Project Progress to March 15	The anchors were designed and trial installations were completed. Problems were encountered on installation techniques and equipment. This project is now complete		
Collaborative Partners	Anchor Systems (Europe) Ltd		
R&D Providers	None		

Project Title	**GenDrive - Smart 3-phase LV Voltage Regulators**				
Description of project	The distribution network controlled using transformers and tap-changing has proven reliable, however controllability of voltage is limited at best and faces the greatest challenge in remote and rural areas. An active series voltage regulator is proposed to provide a more stable and smarter local supply. The unit proposed will in effect prevent or at worst delay the cost of reinforcing problematic distribution circuits. GenDrive has developed single-phase power converters for renewable energy applications, primarily for small to medium scale wind turbines, and this project is to fund the development and test of an outdoor three-phase device.				
Expenditure for financial year	External £13,355 Internal £0 Total £13,355		Expenditure in previous (IFI) financial years	External £39,483 Internal £0 Total £39,483	
Project Cost (Collaborative + external + [DNO])	£ 225K+ DNO internal costs		Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0	
Technological area and / or issue addressed by project	Voltage Quality / voltage control on the LV network where voltage control through primary transformer tap changers is no longer sufficient. I.e locations where there are high levels of load or distributed generation				
Type(s) of innovation involved	Tech Transfer	Project Benefits Rating	Project Residual Risk	Overall Project Score	
		12	-3	15	
Expected Benefits	• The Creation of a system that can control the voltage on an LV				

of Project	feeder • Will be able to balance voltage across the phases • Will be able to correct power factor on each phase • Will reduce Total Harmonic Distortion • Neutral currents will be regulated and controlled The project financial benefits are derived from the avoidance of reinforcement costs and improvements in voltage quality		
Expected Timescale to adoption	2 year	Duration of benefit once achieved	10 years
Probability of Success	0%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	0
Potential for achieving expected benefits	The first stage of the project identified the limitations of the initial GenDrive approach which would have had limited ability to achieve the benefits sought. However a second design has been created that exceeds these. There was a good level of optimism that this project would deliver the technical benefits sought.		
Project Progress to March 15	The project had successfully been completed to the end of stage 2 and stage 3 was due to commence however the company was placed in Administration in March 2014. As a result the project was placed on hold and to date no further work has been carried out on it. Various options are being investigated to continue the project or end it. There has been no change in the project status since that time.		
Collaborative Partners	SSEPD, SPEN, UKPN, ENWL, NPG – via the Energy Innovation Centre		
R&D Providers	GenDrive Ltd supported by EATL		

Project Title	**Conservation Voltage Reduction**		
Description of project	In contrast to typical UK practice of using OLTCs as a means of primary voltage control, a technique termed Conservation Voltage Reduction (CVR) is often used on distribution networks overseas to control feeder voltage profiles. This project will investigate the potential of this CVR technique to manage and manipulate feeder voltage profiles. Its aim is to ascertain if it could realistically be used to facilitate the connection of intermittent renewable energy generation that may wish to connect to the network in remote locations where renewable energy resources are high but the network may be weak with regard to voltage control. The project will employ pole mounted 11kV capacitor banks with an integrated vacuum switch and controller which can be used to control the switching around various set points including power factor and voltage. In addition academic studies will be carried out to analyse the 'before and after' effects and to define the technical and financial benefits		
Expenditure for financial year	External £113,019 Internal £955	Expenditure in previous (IFI)	External £48,366 Internal £1,777

	Total £49,067		financial years	Total £40,067
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Voltage Control			
Type(s) of innovation involved	Small scale trials	Project Benefits Rating	Project Residual Risk	Overall Project Score
		25	2	27
Expected Benefits of Project	The primary benefit of this project will be in developing the knowledge that could be used to offer more economical connection agreements for intermittent generation, reducing energy and losses and if these benefits are realised, providing evidence and justification for a wider scale deployment of reactive power compensation			
Expected Timescale to adoption	2 year		Duration of benefit once achieved	10 years
Probability of Success	75%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£127,675
Potential for achieving expected benefits	CVR is a widely used technique in many counties and this project will demonstrate its viability to UK networks			
Project Progress to March 15	The University of Manchester has completed their analysis work on the use of HV capacitors for voltage regulation. They found that by adequately setting lower voltage targets at the primary substation, the adoption of capacitor banks can be more cost-effective than the network reinforcement. This project has now closed			
Collaborative Partners	None			
R&D Providers	Manchester University			

Project Title	Birds and Power Lines			
Description of project	Collisions with power-lines are the most commonly recorded cause of death for some bird species in the UK; it is of concern to DNOs because of the damage caused to conductors and the inconvenience to customers. Large birds such as geese and swans are particular susceptible because: (i) they tend to fly at power-line height on commuting between feeding areas and their night-time roost, (ii) their size and relatively poor manoeuvrability makes them more likely to hit or bridge the wires, and (iii) their early morning and evening flights are made in poor light conditions, when the conductors are more difficult to see. Bird deflectors fitted to the wires are known to be effective in reducing collision rates but identifying stretches of wires where the birds are most at risk is not always straightforward. This project is aimed at optimising the process for identifying where bird diverters should be fitted			
Expenditure for financial year	External £3,183 Internal £0 Total £3,183		Expenditure in previous (IFI) financial years	External £31,022 Internal £1,035 Total £32,057
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Asset Management			
Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score
		22	2	24
Expected Benefits of Project	The overall aim of the project is to provide guidelines for best practice in fitting bird flight diverters to overhead lines in areas close to wetlands, in terms of the alignment of OHL conductors likely to increase the risk of collisions by heavy birds such as swans and geese. This would serve to: • Improve customer supply, by reducing the frequency with which collisions result in a drop in outage or loss of supply • Reduce the amount of Electricity North West staff time spent on repairs and otherwise addressing bird collision issues			
Expected Timescale to adoption	2 year		Duration of benefit once achieved	10 years
Probability of Success	100%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£13,078
Potential for achieving expected	Good			

benefits	
Project Progress to March 15	Overall, both the landscape and the flight behaviour assessments therefore found that there is an increased risk of birds being involved in a collision if the power line is: 1) in an open landscape – away from trees/hedges and buildings; 2) within 4–6 km of a site with nationally/internationally important numbers of swans; 3) in close proximity to surface water; and 4) collisions have already occurred on the wires. The results of the modelling process were used to generate a collision risk map for power lines in northwest England. A multi-level approach was adopted to determine the high and low risk areas for birds colliding with power lines, and to describe the stretches of wires most at risk. This included use of Environment Agency (EA) flood risk maps, to identify areas considered prone to future flooding. Key filters in the modelling process were: (a) distance to known swan site (< 2500m threshold), (b) distance from surface water (<2000m threshold), and (c) distance to the tree/hedge line (>300m threshold). The risk model was run at three levels: for the whole of the Electricity North West, for high risk areas (excluding NW Cheshire, as the effect of landscape variables had not been investigated for urban sites), and for the area around Martin Mere which provided both collision rate and flight behaviour data used to inform the development of the risk map. The proportion of power lines considered “at risk” of bird collisions was 15.3% for the whole of the 33kV distribution network (i.e. 1,392km of the 9,076km network), increasing to27.0% in high risk areas and 51.7% (479 of 926km) within areas that provided the best fit to the model. A comparison of the proportion of lines deemed to be in high risk zones where collisions had actually occurred was 27.8% for the whole of the network, rising to 32.3% in high risk areas and 56.1% for the “best fit” areas which provided the parameters for informing the modelling process. A synthesis of the flood risk map and the collision risk map identified a total of 265km of 431km in the best fit areas are within both high risk of collisions and also in the flood risk area. Flood risk areas coincided with 19.9% of power lines across the entire distribution network, increasing to 46.5% of power lines within the highest collision rate areas. A list of “at-risk” power lines (identified by their feature number) has been provided to Electricity North West as Geodatabase file, along with coordinates for the high risk area that can be used for generating the detailed risk maps, to inform future mitigation programmes. This project is now completed.
Collaborative Partners	Wildfowl & Wetlands Trust, Lancaster University
R&D Providers	Lancaster University

Project Title	Oil Cable Leaks - Fluid Filled Cables Repair System			
Description of project	The project seeks to identify, develop and assess self repairing systems for fluid filled cables such that damage to the sheath will self heal to avoid oil leakage losses and the resulting environmental damage and potential contamination of the cable that could compromise its performance and lead to premature failure. The project will review and rank a number of candidate self-repair technologies in test construction geometries that are capable of supporting in-situ cable self-repair for medium and high voltage cables			
Expenditure for financial year	External £58,000 Internal £0 Total £58,000		Expenditure in previous (IFI) financial years	External £74,910 Internal £1,509 Total £76,418
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Asset Management			
Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score
		22	2	24
Expected Benefits of Project	This project is aimed at the development of the necessary chemistry and technology and further costs would be incurred to commercialise the technique should it prove successful but the project benefits are derived from the avoided cost of exposing and repairing fluid filled cables			
Expected Timescale to adoption	3 year		Duration of benefit once achieved	10 years
Probability of Success	10%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£133,000
Potential for achieving expected benefits	The chemistry of this project is challenging however the potential benefits could be significant. Gnosys have identified a number of chemistries that have the potential to create the desired blocking effect when a fluid leak is present. These chemistries will be advanced through further stages and experimentation. There has been a good level of engagement with the ENA Fluid Filled Cables working group and their experience has been valuable. There is confidence that the chemistries identified will be able to provide the benefits identified at the start of the project.			
Project Progress to March 15	An interim report on stage 2 was produced in February 2014 which showed good progress on identifying healing additives and mechanisms. Aged oils from DNOs and lab oils from other parties is			

	allowing the project theories to be tested out in lab rigs. Stage 2 was competed in Sept 14, moving the project onto Stage 3 (Evaluation) which was project completed in March 15, all deliverables have been met with the final report issued in March 15.
Collaborative Partners	SP Power Systems/SSE/NPG/UKPN with the Energy Innovation Centre
R&D Providers	Gynosis

Project Title	**Cable Paper Meter**			
Description of project	Many HV cables in service in the UK and worldwide use paper as an insulation medium. Cable faults or mechanical damage can create a discontinuity in the external shielding of the cable exposing the paper to any moisture present in the surroundings (air, soil or water in ducts). Despite being impregnated with oil, paper retains its hygroscopic properties and will rapidly absorb water to the point where the cable may fail in service. If the cable does fail due to moisture ingress it becomes necessary to 'joint out' the failed section of cable. To ensure the repair is effective and lasting it is necessary to measure the level of moisture ingress into the cable paper insulation to ensure enough 'wet' paper is removed to avoid the insulation failing in the future. There are two main problems that jointers face. The first is to establish the level of moisture content in the cable at the point of the joint as this is undefined currently. The second is to decide how much of the cable needs to be replaced as a result of moisture ingress. This decision is very important as any further cuts in the cable significantly increase the price of repair due to the cost of excavation and customer minutes lost (CML). Currently a 'hot oil bath' method is utilised to determine the moisture content, and although this method is time consuming in the field and potentially hazardous, it is not objective, and with no clear standard. The project will establish if an alternative method can be developed using a multi frequency capacitance approach, and aims to develop a hand held cable paper moisture measurement meter.			
Expenditure for financial year	External £89,201 Internal £0 Total £89,201	Expenditure in previous (IFI) financial years	External £36,501 Internal £0 Total £36,501	
Project Cost (Collaborative + external + [DNO])	£231,450 (total project)	Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0	
Technological area and / or issue addressed by project	Asset Management			
Type(s) of	Development	Project	Project Residual	Overall

innovation involved		Benefits Rating	Risk	Project Score
		16	4	20
Expected Benefits of Project	The project benefits include a better ability to manage cable repairs, reduced time on assessing cable paper moisture levels, avoidance of the need to manage boiling oil in vehicles and a reduced chance of cable repairs failing due to high levels of moisture left in the papers			
Expected Timescale to adoption	2 year		Duration of benefit once achieved	10 years
Probability of Success	0%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	0
Potential for achieving expected benefits	Outputs from experimentation have been promising with a clear correlation between moisture content and impedance through multi-frequency scanning.			
Project Progress to March 15	The project successfully completed the first stage and showed good promise. A technology and system has been identified that can operate the necessary levels of sensitivity whilst also being small and portable for ease of use by cable jointers. The project investigated a number of approaches to ensure it was delivered to specification, but following thorough investigation in this project, the idea is now being abandoned as too technically challenging to deliver the expected results, with disagreements over the commercial terms. .			
Collaborative Partners	UKPN, NPG, SP			
R&D Providers	EA Technology			

Project Title	**Cable Dynamic Ratings**
Description of project	Underground low voltage cables in urban networks have a high economic value in terms of the amount installed combined with the costs associated with their installation and/or replacement and one of the key challenges facing DNOs is a significant increase in loading on LV networks from increased penetrations of electric vehicles and electric heating. It has been shown that a 10 to 20% market penetration of EVs alone could lead to an 18 to 36% increase in the daily peak demand placed on LV networks and combined with the observed increase in generation from domestic PV result in the potential for a significant change in the manner LV networks are utilised. The aim of this project is to fully understand the thermal behaviour of underground cables by developing models capable of temperature prediction for any given current profile at any instant in time. The acquired knowledge will then be used to make recommendations on strategies that could be employed to maximise cable capacity through network reconfiguration or

	automatic control			
Expenditure for financial year	External £62,064 Internal £395 Total £62,459		Expenditure in previous (IFI) financial years	External £0 Internal £2,262 Total £2,262
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Network Utilisation			
Type(s) of innovation involved	Research	Project Benefits Rating	Project Residual Risk	Overall Project Score
		18	5	23
Expected Benefits of Project	The project benefits are derived from being able to better understand the potential for releasing inherent capacity within our underground LV cable networks. By 2030 it is expected that domestic heat pumps will add an additional 2.75 GW (8kW for 6 hours) and domestic EV charging will add an additional 4 GW (3kW for 8+ hours) of demand at LV, even if optimally scheduled this is a doubling of demand from today. More accurate understanding of the performance of our underground LV cable networks will significantly add to our ability to meet this demand whilst managing the network within statutory limits			
Expected Timescale to adoption	3 year		Duration of benefit once achieved	10 years
Probability of Success	75%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£637,790
Potential for achieving expected benefits	A greater understanding of the thermal behaviour exhibited by underground LV cables could be used to inform circuit configuration, maintenance, asset management and the selection of available voltage regulation technology			
Project Progress to March 15	The work has developed the initial Finite Element models for LV cable types. There is further work to do on the use of these models and the development of an Excel based network design tool for LV cables to produce a maximum and minimum operating temperature envelope which can be used to demonstrate whether the cable can accept new LCTs. This IFI Project is now closed and an NIA project has been investigate the use of these models development of the design tool.			
Collaborative Partners	None			

R&D Providers	Manchester University

Project Title	**Transformer Investigation**				
Description of project	Electricity North West has 17 Bonar Long/NITRAN primary transformers that have to date experienced a substantially higher than average failure rate and concern has been expressed about both the fundamental design of these units, the potential need for a more pro-active inspection and management regime and the complete absence of support from the original manufacture. In addition to the specific issues related to Bonar Long transformers Electricity North West also has a significant number of primary transformers that are either rapidly approaching or have already exceeded their design lives as designated by the original manufacture. This project has three specific aims: • Investigation of the condition of Bonar Long/NITRAN transformers that have experienced an abnormally high failure rate and accelerated ageing for no apparent reason. • Generally develop a better understanding of the internal condition of our primary transformers and the link between internal condition and non-intrusive testing • To provide support to current IFI projects investigating the potential benefits of oil regeneration and other refurbishment techniques				
Expenditure for financial year	External £17,756 Internal £0 Total £17,756		Expenditure in previous (IFI) financial years	External £11,628 Internal £10,625 Total £22,253	
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0	
Technological area and / or issue addressed by project	Asset Management				
Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score	
		20	3	23	
Expected Benefits of Project	The immediate project financial benefits are derived from the potential to better manage the failure risk of transformers of this type and design but the longer term aim is to refine the health index scoring of transformers to more accurately reflect the asset condition scoring within CBRM				
Expected Timescale to adoption	3 year		Duration of benefit once achieved	10 years	
Probability of Success	50%		Project NPV = (PV Benefits – PV Costs) x Probability	£273,353	

		of Success	
Potential for achieving expected benefits	This work supports Electricity North West's wider transformer investigation programme with Manchester University		
Project Progress to March 15	All the tests and investigations were completed and the results have been presented to the Asset Management section to inform the asset replacement plans. This project has now closed.		
Collaborative Partners	ABB		
R&D Providers	Manchester University		

Project Title	**Cable Temperature Sensor**			
Description of project	This project is aiming to develop a low cost substitute for a CT that can be easily retro-fitted without supply interruption. There is a strong relationship between cable current and its operating temperature, so it is proposed to provide a simple, low cost retro-fit temperature sensor that can be used to deduce cable current to a reasonable accuracy level (e.g. +/-5 to +/-10%)			
Expenditure for financial year	External £0 Internal £154 Total £154		Expenditure in previous (IFI) financial years	External £42,184 Internal £890 Total £43,074
Project Cost (Collaborative + external + [DNO])	£ 206,000 + DNO internal Costs		Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Network Performance			
Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score
		17	4	21
Expected Benefits of Project	The project benefits are derived from the avoidance of reinforcement costs for the cable network due to perceived overloading. This data will allow a more accurate assessment of the loading on the cable network. There are also benefits in avoiding interrupting supplies to customers and avoiding breaking down cable boxes or opening cables to install CTs. CT technology is relatively costly for large scale deployment, particularly for monitoring at many points in a more distributed generation network or a "smart grid"			
Expected Timescale to adoption	2 year		Duration of benefit once achieved	10 years
Probability of	50%		Project NPV = (PV	£190,118

Success		Benefits – PV Costs) x Probability of Success	
Potential for achieving expected benefits	The project is expected to significantly reduce the costs of wide scale network monitoring		
Project Progress to March 15	Stage 2 (Proof of Concept Laboratory Prototype) was successfully completed in July 14. Stage 3 (Proof of Concept & Live Trial) began in Sept 14 with a Site trial in March 15. Project is now complete. TTP produced a prototype sensor which was deployed in an Electricity North West substation; the results from the deployment were encouraging. This project has now closed.		
Collaborative Partners	SSE/SP/NPG/UKPN		
R&D Providers	Technology Partnership (TTP)		

Project Title	**Demand Forecasts and Real Options Model**				
Description of project	Investment plans require DNOs to make assumptions about the timescales and location of demand growth. Existing methods of demand analysis and forecast do not capture and address this multi-faceted uncertainty in a structured way. This project is based on development and demonstration of a novel way of combining, analysing and adjusting demand data to produce forecast scenarios, and then will use these to consider options value for the first time. The outcome of the project will take these methods to a stage where they can be transferred to business as usual. The Project first involves developing technical understanding of the use of the network and then feeding that technical information into an options tool to allow a DNO to choose whether a technical and/or commercial (demand side management, DSM) solution to capacity release is appropriate.				
Expenditure for financial year	External £77,237 Internal £609 Total £77,846		Expenditure in previous (IFI) financial years	External £18,293 Internal £0 Total £18,293	
Project Cost (Collaborative + external + [DNO])			Projected 14/15 costs for Electricity North West	External £0 Internal £0 Total £0	
Technological area and / or issue addressed by project	Network Investment				
Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score	
		19	5	24	

Expected Benefits of Project	Project benefits include: Past Demand - Review and improve our analysis of past actual demand (including uncertainty) Forecast Demand - Review and improve our methods for producing forecast peak demand which reflect uncertainty, combining information on peak trends and external scenario information e.g. economic activity, energy efficiency and low-carbon technology uptake. Real Options Tool – Using past and future demand as inputs to create a 'real options' tool to support economically efficient decision-making about load-related investment and DSM for a specific location. This will include the option value of DSM. We will work with the University of Manchester to design and validate the method in the options tool.		
Expected Timescale to adoption	2 year	Duration of benefit once achieved	10 years
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	Methodology enables benefits of order of £4m
Potential for achieving expected benefits	Through this Project, Electricity North West seeks to better understand its recent past demand level and future demand level and associated uncertainties. This will be used to prioritise work to address sources of uncertainty. The detailed results will be of most relevance to Electricity North West, but it is anticipated that certain aspects of approach and methodology will be relevant to other network licensees facing similar problems.		
Project Progress to March 15	The learning from this IFI project is being taken forward, along with other development areas, in a new Network Innovation Allowance (NIA) project on 'Demand Scenarios with Electric Heat and Commercial Capacity Options'. Outputs from the IFI project will be reported within the NIA reporting in 2016. Up to March 2015, the IFI project reviewed the existing methodology and inputs to Electricity North West's Grid and Primary demand forecast per substation asset, and secondary networks programme forecast via the 'Future Capacity Headroom Model', developing incremental improvements to be finally implemented as BAU in the summer 2015 scenario sets. The University of Manchester identified how a real options approach could be applied to grid & primary DNO investment problems, supported by an Excel tool. A prototype tool was constructed collaboratively to produce cost and risk metrics comparing traditional reinforcement versus 'Capacity to Customers' post-fault demand side response, given demand uncertainty. Testing indicated the role of the tool, but identified some calculation errors. Further work developing the tool and investigating case studies will continue in the NIA project.		
Collaborative Partners	None		
R&D Providers	The University of Manchester		

Project Title	Mobile LV Distribution Board Development			
Description of project	The aim of this project is to fund the development and construction of a Mobile LV Distribution Board (that meets all operational and safety requirements). The LV board would be trailed on active fault repairs for a 3 month period to understand whether it is a viable solution to reducing supply interruption timescales			
Expenditure for financial year	External £0 Internal £7,813 Total £7,813		Expenditure in previous (IFI) financial years	External £3,206 Internal £5,671 Total £8,877
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Quality of Supply			
Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score
		18	5	23
Expected Benefits of Project	The project benefits are derived from a reduction in CMLs			
Expected Timescale to adoption	1 year		Duration of benefit once achieved	10 years
Probability of Success	100%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£132,891
Potential for achieving expected benefits	Various methods of enhanced transient fault management and underground fault location for low voltage networks are being adopted with the single aim of restoring supplies to customer more quickly following a fault			
Project Progress to March 15	Initial trials were held successfully and further performance data was then gathered. The trials showed that the equipment could be utilised at short notice to restore supplies to vulnerable customers or avoid 12 hour failures. Customer surveys were carried out on-site and their comments were positive. The main challenge with the project was managing the safety on-site, as the restoration involved running leads down pavements and in houses. Risk assessments were carried out for each installation and careful use of protective ramps and barriers were used. The technique is now deployed in business-as-usual, with a slightly modified design with additional protection incorporated to improve safety and reduce risk.			

Collaborative Partners	None
R&D Providers	None

Project Title	**Ultrapole**		
Description of project	The aim of this project is to develop a low cost wood pole testing device that uses an ultra-low frequency non-destructive testing technique. There are currently several invasive instruments on the market for detecting wood rot in wooden poles used by the distribution network operators (DNOs) which are based on both acoustic (hammer in nail, tap and listen) and ultrasonic (slice shadow) technologies. Current products on the market adopt a variety of techniques but all are restricted to detecting rot in very close proximity to the point at which the measurements are being taken. To satisfy the DNOs' objective of assessing the condition of their pole assets, there is a need for an instrument that is easy to use in the field, takes non- intrusive measurements, and has the ability to operate at ground level over the entire length of the pole. Such an instrument would prevent the need for digging around the base of the pole disturbing previously good ground conditions, or climbing the pole to take measurements at height. This project is to conduct a study into the feasibility for such a device.		
Expenditure for financial year	External £12,500 Internal £98 Total £12,598	Expenditure in previous (IFI) financial years	External £2,500 Internal £829 Total £3,329
Project Cost (Collaborative + external + [DNO])	£ 75,000	Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Asset Management. Testing of wood poles by existing methods such as hammer test can be subjective in nature and result in the inappropriate replacement of poles with residual life. As the result of testing is localised to the point of test, abnormalities elsewhere along the length of the pole can go undetected which can result in the failure of the overhead line under adverse weather conditions leading to CI and CML penalties for the company.		

Type(s) of innovation involved	e.g. ~~Incremental~~ ~~Tech Transfer~~ Significant ~~Radical~~	Project Benefits Rating	Project Residual Risk	Overall Project Score
		19	4	23

Expected Benefits of Project	Cost reductions	The ability to scan very rapidly long pole lengths for the presence of 'acoustic

		anomalies' such as the presence of rot in the pole. Increased knowledge and understanding of condition of wood poles, allowing targeted maintenance and replacement based on condition of asset. Reduced costs of surveying poles (no climbing of pole). More accurate rot assessment (scanning whole pole) therefore less waste from misdiagnosis.	
	Managing the transition to a low carbon economy and promoting energy savings	Unnecessary pole replacements could be avoided resulting in reduced field trips and reduced emergency repairs	
	Ensuring a secure and reliable gas/electricity supply	Reduction in unplanned outages due to more management information for pole stock state of health.	
	Supporting improved environmental improvement	Sawmill based system should lead to improved purchasing of suitable stock with an opportunity to promote environmentally friendly sources.	
	Safety	Increased safety factors are the main benefit, with reduction in root digging and pole climbing except for emergency repairs. If this non-intrusive testing methodology is proven it will reduce risk exposure for linesmen, operational staff and third parties.	
	Network performance	Reduced failure of wood poles leading to reduced CIs/CMLs from overhead lines and improved network performance.	
Expected Timescale to adoption	3 years	Duration of benefit once achieved	25 years
Probability of Success	10%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£802,753
Potential for achieving expected benefits	The proposed technique is commonly used in other industries and has been demonstrated to be effective on wood poles under test conditions.		
Project Progress to March 15	The project started in January 2014. Initial kick off meeting completed. Supply of test material established and test equipment ordered. The principle was to scan up the pole for any rot throughout the pole with a portable instrument. From the work carried out in stage 1, the initial experimentation and analysis		

	showed losses in propagation up the pole of half the original expected resulting scan range of 1 to 1.5 metres. Furthermore to develop a field instrument with suitable couple medium between the instrument and the poles carried further risk. The project didn't continue to stage 2. Stage 1 Exploration, Science Review/Technology Assessment was completed in Sept 14, there were some significant delays in legals when Electricity North West and Northern PowerGrid wished to drop off from the project, preventing moving to Stage 2. Stage 2 is now currently running under NIA funding with SSEPD, SSEPD & UKPN.
Collaborative Partners	UKPN/NPG/SP/SSE through the Energy Innovation Centre
R&D Providers	Acuity Products

Project Title	**Ferranti PV System**				
Description of project	The proposed project aims to install three 4 kWp photovoltaic arrays on the roof of the Ferranti Building at The University of Manchester. Each array will mimic residential-scale installations currently found in the UK, also considering different azimuths. In addition, monitoring equipment will be installed to assess the electrical behaviour of the panels (eg, active/reactive power, harmonics) and the corresponding weather characteristics (e.g., sun radiation, temperature) – both with high sampling rates (1 minute). The monitoring of these PV arrays will allow a much better understanding of the electrical behaviour of this technology and its correlation with weather conditions in the North West of England. This will allow validating and, crucially, improving the PV generation profiles.				
Expenditure for financial year	External £48,600 Internal £0 Total £0		Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0	
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0	
Technological area and / or issue addressed by project	Asset Management				
Type(s) of innovation involved	Research	Project Benefits Rating	Project Residual Risk	Overall Project Score	
		20	2	22	
Expected Benefits of Project	The project financial benefits are derived from the better understanding of how PV arrays function and their impact on the				

	network. This improved understanding could result in changes to LV design policy and allow the right solution to be targeted for the increase in distributed generation and its effect on the power quality		
Expected Timescale to adoption	2 years	Duration of benefit once achieved	10 years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£150,637
Potential for achieving expected benefits	This project will provide improved PV profiles which will be used in future LV network planning		
Project Progress to March 15	The installation of the PV arrays is complete and initial analysis of the outputs has taken place. The monitoring and analysis of the outputs to improve the PV profile will be ongoing by UoM. This project has now closed.		
Collaborative Partners			
R&D Providers	The University of Manchester		

Project Title	**Statutory Voltage Limits**		
Description of project	Distribution network operators (DNOs) are required to supply electricity to customers within two mandatory operating standards relating to voltage and total harmonic distortion (THD). These standards have existed for many years and have their origins based on the requirements of appliance technologies from the 1960s. Modern appliances particularly those with switched mode power supplies; for example modern audio visual appliances, are designed to operate across a much wider voltage and THD range as they are designed to operate in many countries. The adoption of low carbon technologies (LCTs) such as heat pumps, electric vehicles and micro generation by customers is likely to result in networks that are at present compliant with existing standards to breech these limits. If these standards could be relaxed even by a relatively small amount, significant savings could be made on the reinforcement expenditure on network infrastructure required to maintain compliance with these standards Electricity North West seeks to determine evidence that either: • customers would not notice a minor change in voltage and THD standards, or • at what levels do changes in voltage or THD become noticeable to customers • If they do notice the change, customer perception of power quality and overall satisfaction are not adversely affected		
Expenditure for financial year	External £274,064 Internal £99,582	Expenditure in previous (IFI) financial years	External £96 Internal £11,779

	Total £373,646			Total £11,875
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Network Investment			
Type(s) of innovation involved	Research	Project Benefits Rating	Project Residual Risk	Overall Project Score
		21	3	24
Expected Benefits of Project	Managing the transition to a low carbon economy	Unnecessary reinforcement costs arising from voltage compliance and power quality compliance issue may be avoided facilitating the adoption of LCTs at lower cost to customers		
	Promoting energy savings	Reduced maintenance trips and installation of assets		
	Supporting improved environmental improvement	Savings in embodied carbon and carbon savings associated with avoiding the installation of new assets		
	Other benefits	Reduced DUOS costs for customers from reduced installation of assets.		
Expected Timescale to adoption	1 year	Duration of benefit once achieved	10 years	
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£587,792	
Potential for achieving expected benefits	The project is based on network modelling and customer research and should establish the impact on customers of LCTs that affect network voltage levels			

Project Progress to March 15	The following milestones were delivered as part of this project:
	• Identification of high risk networks for targeted monitoring, including micro generation clusters and heavily loaded circuits.
	• Analysis of voltage complaints and identification of customers potentially exposed to breaches in statutory voltage limits.
	• Development and assessment of effective batch reporting mechanisms to capture voltage and THD measurements from a variety of devices used to monitor LV networks including:
	  • GridKey and Nortech monitoring units, developed under the LCN funded LV Networks solutions Tier One project;
	  • Bidoyngs, an intelligent auto reclosing fuse developed by Kevlatek Ltd in partnership with Electricity North			

	West as part of a previous IFI; • Electrocorder voltage and current loggers supplied by Acksen Ltd. • Collation and interim analysis of targeted and routinely captured network monitoring data. • Development of customer engagement materials / survey instrument and completion of the customer survey phase of this project to examine public attitudes to voltage and power quality limits. A statistically robust sample of approximately 2,000 customer surveys was conducted during the period 2014/15 to coincide with anticipated LV peak demand in winter and maximum export capacity of micro generation over summer. Surveys were segmented to include both customers exposed to voltage outside current ESQCR regulations (as confirmed by network monitoring) along with a control group supplied well within power quality limits. Sampling was designed to capture the experience of a diverse range of domestic and I&C customers of differing profile types on networks reflective of the wider Electricity North West distribution region. The project is now in the data analysis phase and the next steps are as follows: Our Project Partner, Impact Research is conducting detailed quantitative analysis, comparing customer feedback with actual network data, to determine if customers notice a minor change outside existing voltage standards and if they do, to establish the levels at which they become sensitive. The research will be weighted by age; gender and social class and is designed to distinguish where factors other than voltage excursions might influence customer satisfaction with service. The final report will be peer reviewed and the preliminary results published in August 2015. The finding will be presented to Ofgem's technical team, DECC and the ENAs Voltage Limits Group and is expected to form a framework to discuss: • Research activity around ESQCR technical compliance and obtain clarity of the current ESQCR regulations and guidance notes in respect of voltage limits, which are presently considered too restrictive. • The viability of extending the present UK +10/-6% limits up to or beyond the current EU +/-10% limits and examine the advantages and risks of doing so. This Voltage IFI has been run in parallel with our work on the LCN Fund Second Tier CLASS Project, which uses voltage changing techniques and critically has a robust customer trial element embedded within the methodology. The CLASS close down report is due to be published in September 2015 and early finding of both this project and CLASS appear to provide customer evidence to suggest that a modest reduction may be possible in certain networks without any detriment to service, supporting WPD's proposal, last year, to extend current limits based on the output of its LCN Fund LV templates project.
Collaborative Partners	None
R&D Providers	Impact Research Ltd

Project Title	Substation Security			
Description of project	This project was initiated in response to the significant increase in metal theft across our network and has encompassed the following • Metal theft – A marking system for copper earth tapes and cables • Active tracking –tracking devices attached to vulnerable assets • Security hardening of identified site			
Expenditure for financial year 14/15	External £117,686 Internal £0 Total £117,686		Expenditure in previous (IFI) financial years	External £160,026 Internal £1,630 Total £161,656
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Security			
Type(s) of innovation involved	Small scale trials	Project Benefits Rating	Project Residual Risk	Overall Project Score
		24	2	26
Expected Benefits of Project	Reduction in theft from substation			
Expected Timescale to adoption	1 year		Duration of benefit once achieved	10 years
Probability of Success	90%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£194,586
Potential for achieving expected benefits	The project adopts techniques from other industries for use on electricity networks			
Project Progress to March 14	We have worked extensively with local police forces and specialist security advisors to develop a number of innovative techniques to complement more traditional security strategies. These techniques have been used to better secure our network and reduce the number of customers suffering supply interruptions due to criminal activity. These initiatives have been successful in both stopping further increase in metal theft and in helping deliver a 46% reduction in theft instances This project is now closed.			
Collaborative Partners	GMP			
R&D Providers	A specialist security advisor			

Project Title	Kelvatek Fault Assistance Service			
Description of project	ENW makes extensive use of Kelvatek's LV equipment for managing faults on the low voltage network, as well as Kehui's TP22 and TP23, and the EATL Sniffer device. Although the devices are widely used to reduce CI and CML figures, it is possible to get further benefits by analysing the data provided by the devices. Analysis of the data is a specialised subject area, and only several key 'champions' are capable of performing this analysis, and this is limited by their availability and limited access to algorithmic analysis tools. To address this issue it is the aim of this project for Kelvatek to set up a fault assistance centre (FAC) that will actively monitor the equipment installed on ENW's LV network. As fault and load data is recorded and communicated back from devices on the distribution network it will be analysed at the FAC and the results of this analysis passed back to ENW			
Expenditure for financial year	External £63,739 Internal £325,133 Total £388,872		Expenditure in previous (IFI) financial years	External £0 Internal £952 Total £952
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and / or issue addressed by project	Network Performance			
Type(s) of innovation involved	Incremental	Project Benefits Rating 19	Project Residual Risk 4	Overall Project Score 23
Expected Benefits of Project	The project benefits are derived from a reduction in the costs of managing LV transient faults, currently estimated at £1.5M p.a. across the entire network			
Expected Timescale to adoption	1 year		Duration of benefit once achieved	10 years
Probability of Success	100%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£578,130
Potential for achieving expected benefits	The project is primarily about integration and enhancement of existing systems and therefore has a high probability of success			
Project Progress to March 15	The Fault Support Centre has been trialled for 12 months. When a transient is identified Kelvatek restoration equipment is fitting and			

	the Fault Support Centre is notified. The FSC then actively monitors the circuit remotely and provides pre-location fault reports of possible positions to ENW. The fault is then pin pointed and repaired before it becomes permanent. The IFI project and trial has proved successful enough to move to a 6 month Transition project to develop the back end process to improve conversion rates. Other Network Operators are need starting to trial the service developed by Kelvatek and ENW. The IFI project is complete and the process is transitioning to BAU.
Collaborative Partners	None
R&D Providers	Kelvatek

Project Title	**Work Stream 7 Distribution System 2030**		
Description of project	The DECC/Ofgem Smart Grid Forum was created by the Department of Energy and Climate Change (DECC) and Ofgem to support the UK's transition to a secure, safe, low carbon, affordable energy system. The main issue discussed within the DECC/Ofgem Smart Grid Forum is how electricity network companies will address significant new challenges as they play their role in the decarbonisation of electricity supply. The Smart Grid Forum has established a number of Work Stream (WS) to examine particular aspects of future networks. The WS7 study is a continuation of work started by WS2 and continued by WS3 to deepen our understanding of what a future distribution network is and how it will operate. WS7 is undertaking more detailed electrical power system analysis (using nodal network models) of the electricity system of 2030, with particular focus on the distribution networks, their design and, critically, their operation. WS7 is a natural further progression into the technical detail, questioning how it can be ensured that the smart grid that Transform (WS2/WS3) has described will be technically viable and to establish how the whole system might operate most efficiently and resiliently in a 2030 scenario with a clear focus on the impacts for our distribution networks.		
Expenditure for 14/15 financial year	Internal £0 External £51,030 Total £51,030	Expenditure in previous (IFI) financial years	Internal £0 External £0 Total £0
Project Cost (Collaborative + external + [DNO])	£750k as listed in NIA registration	Projected 15/16 costs for Electricity North West	Internal £0 External £0 Total £0 **(transfer to NIA)**
Technological area and / or issue addressed by	Essentially, this WS7 study is addressing the modelling compromises that are inherent in Transform's parametric network modelling approach. Transform's parametric representation of		

<table>
<tr><td>project</td><td colspan="4">typical distribution networks are to be converted into nodal models in order to explore, through appropriate network studies, how the Transform solutions ‘work’ and what currently unforeseen challenges might emerge.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">This project seeks to validate work carried out under WS3, which looked at the potential of smart solutions to reduce capital expenditure on network infrastructure of approximately £1 billion.</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">10 years</td><td>Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">75%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>n/a – analysis framework</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The DS2030 project is expected to achieve its intended benefits. It will provide a set of generic nodal distribution network models that have been demonstrated to be technically viable to meet the needs of 2030 users. These models have now been developed and their viability will be demonstrated in the coming months.

The models will be used to show how specific methods/solutions can be used to ensure technical viability of the networks and when particular methods/solutions may need to be applied. This analysis will be provided in the Stage 4 & 5 results report.

The final Stage 6 report for the project will use the outcomes of the studies to address the questions posed by the Smart Grid Forum about future distribution system operation, including a discussion of the roles and responsibilities of a DNO in 2030 in terms of supporting whole system optimisation, contrasted with the position today. Where appropriate this will highlight further specific development work that could be carried out.</td></tr>
<tr><td>Project Progress to March 15</td><td colspan="4">Works during the second half of 2014 focussed on defining the four representative networks that will be used for the study and the future scenarios that will be applied. The base networks were finalised and agreed in November 2014 and, following additional development work, the scenarios were finalised in early 2015.

In addition, an international review was conducted to capture learning from work in other countries and this was concluded in September 2014. An updated version will be produced towards the end of the study to ensure any more recent work is identified.

Towards the end of 2014, the key questions the DS2030 project aims to answer were reviewed. Minor revisions were agreed with the project Steering Group and WS7 in February 2015.

Since the start of 2015, efforts have focussed on defining the detailed methodologies to be used in the network analysis studies.</td></tr>
</table>

	These were presented as a series of discussion papers which were reviewed and agreed by the Steering group and WS7. This stage was largely concluded by May 2015 and studies are now commencing. Both projects have been transitioned to the NIA scheme. Further information is available at the Smarter Networks Portal, please see http://www.smarternetworks.org/Project.aspx?ProjectID=1623#downloads
Collaborative Partners	n/a
R&D Providers	Consortium led by Parsons Brinckerhoff and including The University of Manchester, PPA Energy, Chiltern Power and Grid Scientific.

Project Title	**GridiView**					
Description of project	GridiView Reporter is a mobile application designed to allow any user to report no power, lines down or damaged equipment from any location via a bespoke Smartphone application.					
Expenditure for financial year	External £167,917 Internal £1,314 Total £169,231		Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0		
Project Cost (Collaborative + external + [DNO])			Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0		
Technological area and / or issue addressed by project	During storm conditions damage to the network could occur over a wide geographical location (often in remote areas) and the objective of this project is to provide a Smartphone application to allow any user to report information directly to DNOs regarding outages or damaged equipment and lines. The Smartphone application would incorporate an expert system to guide the user through a series of questions regarding the damage and would be 'tagged' to GPS data available in the phone. This information would then be combined with network location data to provide DNOs with enough information to direct appropriate resources to the specific location					
Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score		
		12	3	15		
Expected Benefits of Project	The project financial benefits are derived from a better ability to target resources more effectively and a reduced time to restore supplies.					
Expected Timescale to adoption	Range 1-3 years - dependent on project and ENWL's NMS replacement programme		Duration of benefit once achieved	5 years		

Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£264,400
Potential for achieving expected benefits	Our current approach to customer service and supply restoration can certainly be improved by this project and has a very good chance of success over the next few years as we renew our Network Management System and this information can be integrated into BAU.		
Project Progress to March 15	The initial test deployment, extended demonstration and addition of Android client are complete and we have been monitoring how the platform runs for an extended period and making refinements to the application. The next stage is to explore how we integrate Grid Reporter with our existing outage management systems.		
Collaborative Partners	SSEPD		
R&D Providers	Open Grid Systems Ltd.		

Project Title	**Live Alert – Energised Alert**			
Description of project	The Energised Alert is a high voltage detection device, currently capable of detecting voltages of above 2kV. The project's objectives are to: • To extend the voltage sensing range downwards from 2000 Volts • To undertake a full market appraisal • To undertake full evaluation of technology whilst in operation • This project aims to take the Energised Alert from TRL 4 to 8.			
Expenditure for financial year	Internal £650 External £3,252 Total £3,902		Expenditure in previous IFI financial years	Internal £0 External £0 Total £0
Project Cost (Collaborative + external + [DNO])	£ 76,395		Projected 2015/16 costs for £0	Internal £0 External £0 Total £0
Technological area and / or issue addressed by project	The Energised Alert senses any increase in electrical potential, above a predetermined threshold, of devices to which it is attached. Once triggered it is linked to an audible alarm, allowing the recognition and management of this potentially deadly hazard in a controlled manner. Its use will, therefore protect the operator, other employees and any members of the public in the vicinity from casual, but more importantly, avoidable electrocution.			
Type(s) of innovation involved	~~e.g. Incremental Tech Transfer~~ Significant ~~Radical~~	Project Benefits Rating 14	Project Residual Risk -5	Overall Project Score 19
Project Progress	• Stage One of the project, to design and develop the sensing			

March 2015	system was completed successfully and met the deliverable set at the start of the project. • Stage Two, to design and develop a refined was completed successfully and met the deliverable set at the start of the project. • Stage Three, to manufacture and evaluate 10 energised alerts units is complete • Stage Four was completed and issues surrounding over sensitivity were identified. • The project was stalled pending legal authorisation to the extension of the project to solve the issues identified in Stage Four. • Stage Four extension was agreed and has now been completed, there are 10 prototype units ready for live trials. • Stage Five was added to the project during the stage 4 extension, however this has now been cancelled due to the IFI funding closing. This project is now closed.		
Expected Benefits of Project	Successful development of the Energised Alert would: • Help prevent electrocution accidents and fatalities • Ensure 'live line' maintenance can be carried out in a safe manner • Allow operators to proactively respond to incidents on their network		
Expected Timescale to adoption	1years	Duration of benefit once achieved	25 years
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£227,017
Potential for achieving expected benefits	The project is now closed		
Project Progress to March 15	• Stage One of the project, to design and develop the sensing system was completed successfully and met the deliverable set at the start of the project. • Stage Two, to design and develop a refined was completed successfully and met the deliverable set at the start of the project. • Stage Three, to manufacture and evaluate 10 energised alerts units is complete • Stage Four was completed and issues surrounding over sensitivity were identified. • The project was stalled pending legal authorisation to the extension of the project to solve the issues identified in Stage 4. • Stage Four extension was agreed and has now been completed, there are 10 prototype units ready for live trials. • Stage Five was added to the project during the stage 4 extension, however this has now been cancelled due to the IFI funding closing.		
Collaborative	Northern PowerGrid, Electricity North West, SPEN, SSEPD, Energy		

Partners	Innovation Centre, Live Alert
R&D Providers	Live Alert

Project Title	Fault Location		
Description of project	This project will be a feasibility study into the use of fault location techniques, particularly for 11kV networks, to assist with fault response in both BAU and more importantly in storm situations. This work will allow Electricity North West to identify both commercially available and trial systems. Electricity North West, in Stage 2, will approach the relevant vendors to understand the technology and how it can be installed with a view to a possible trial or if necessary, further development works of some techniques. The outcome would be a complete feasibility study into distance to fault technologies, their effectiveness, costs, the market and the installation methodologies		
Expenditure for financial year	External £54,000 Internal £3.032 Total £57,032	Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0
Project Cost (Collaborative + external + [DNO])		Projected 15/16 costs for Electricity North West	External £0 Internal £0 Total £0
Technological area and/or issue addressed by project	Network Performance		
Type(s) of innovation involved	Research	Project Benefits Rating: 20	Project Residual Risk: 4 / Overall Project Score: 24
Expected Benefits of Project	The project financial benefits are derived from an improvement in CI/CML performance and a reduction in Guaranteed Service payments. The project is based on a reduction in IIS penalties of £50,000 pa for 8 years. In addition to the financial benefit there will also be additional benefits including service improvements to worst served customer and an improvement the customer satisfaction scores leading to a better regulatory position.		
Expected Timescale to adoption	2 years	Duration of benefit once achieved	8 years
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£263,444
Potential for achieving expected benefits	The output of this project will inform the scope of a future NIA project which will deploy the systems.		

Project Progress to March 15	The University completed the feasibility study on the different techniques. The output of this project was used to scope the new NIA project on fault location. This project has now closed.
Collaborative Partners	
R&D Providers	The University of Manchester

