electricity north west

Bringing energy to your door

Innovation Funding Incentive Annual Report 2013-2014

1 INTRODUCTION

This report sets out the details of Electricity North West's IFI funded activities for 2013/14. It begins with a brief description of our business plan for the RIIO-ED1 period then an overview of some highlights from 2013/14 followed by further details of specific project work we have completed in the year. It then describes an outlook for the coming financial year followed by a list of our collaborators then a short section describing benefits gained from IFI with a résumé of completed projects and concludes with our report of project descriptions and year-end figures.

2 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 2010-2015 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.

3 RIIO-ED1 INNOVATION STRATEGY

We have invested a significant amount of effort over the last 12 months in the preparation of our Innovation Strategy as part of our RIIO-ED1 submission. Our RIIO-ED1 innovation plan focuses on our stakeholders' priorities of reliability, affordability, sustainability and service. This has resulted in a request for a Network Innovation Allowance of 0.8% of allowed revenues which equates to approximately £24 million of funding for the RIIO-ED1 period. Our RIIO-ED1 Innovation plan can be found at http://www.enwl.co.uk/docs/default-source/enwl-wjbp-2014/enwl-140317-annex-23---innovation-strategy.pdf?sfvrsn=2

The focus of our innovation strategy in described in Table 1 below. Our strategy contains a detailed analysis of the challenges faced by UK electricity distribution owners and a comprehensive description of our plans to meets these challenges.

Affordable reliability	Optimise the life of 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 customer reliability through better understanding of macro asset performance and intervention timing.
	Offer new services and choice to new and existing customers
	Keeping our customers better informed
Sustainability	Enable customers to adopt low carbon technologies at an affordable cost
	Allow low carbon / renewable DG customers access to network capacity for less
	Reduce the carbon cost of our operations and investments

Table 1 – The Primary Drivers of Electricity North West's RIIO ED1 Innovation Strategy

4 OVERVIEW OF 2013/14

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

- We recently submitted out RIIO-ED1 'Well Justified Business Plan' that included a detailed description of our plans for innovation during the RIIO-ED1 period
- We made a significant contribution to the planning and delivery of the third Low Carbon Networks Conference in Brighton hosted by UKPN
- We have invested significant effort with the ENA R&D Working Group developing the rules and eligibility criteria for the RIIO-ED1 Network Innovation Allowance and steering the creation of the ENA Smarter Networks Portal
- We delivered a number of IFI projects as a pre-cursor to our successful LCNF Tier 2 project, Smart Street
- We started 12 new IFI projects in 2013/14 across a diverse range of areas that affect our business including fault management, investment optimisation, voltage management and asset management
- We concluded 10 projects that 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 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

5 IFI PROJECT SUCCESSES

Some highlights of our IFI project work in 2013/14 are presented below;

5.1 BIRDS AND POWERLINES – LANCASTER UNIVERSITY AND MARTIN MERE WILDFOWL AND WETLANDS TRUST

The following report was prepared by Chris Taylor (chris.taylor@wwt.org.uk) of Wildfowl & Wetlands Trust (WWT), Martin Mere and Lancaster Environment Centre, Lancaster University.

5.1.1 Background

Collisions with overhead line conductors is the most commonly recorded cause of death for some bird species in the UK (e.g. swans; Perrins & Sears 1991, Brown *et al*. 1992, Coleman *et al.* 2001). Large birds such as geese and swans are particularly susceptible because they tend to fly at overhead line height when commuting between feeding areas and their night-time roost, their size and relatively poor manoeuvrability makes them more likely to hit or bridge the conductors and their early morning and evening flights are made in poor light conditions when conductors are more difficult to see. Bird deflectors fitted to overhead lines are known to be effective in reducing collision rates (Frost 2008, Jenkins *et al*. 2010) but identifying spans where the birds are most at risk is not always straightforward because the birds' flight patterns vary with crop rotation (which affects their feeding distribution) and wind direction. To address this issue Electricity North West has sponsored the Wildfowl & Wetlands Trust and Lancaster University to carry out a study of swan and goose flight patterns in relation to overhead lines in Electricity North West's distribution area.

The project objectives are;

- Analyse swan and goose flight lines in relation to our overhead line network
- Identify high risk collision areas
- Assess the effectiveness of bird deflectors
- Analyse recorded data and develop recommendations for the future

5.1.2 Current Status

Bird collision data recorded by Electricity North West (collisions records), the North West Swan Study Group (Mute Swan mortality data) and WWT (Whooper, Bewick and Mute Swan post mortem records and ring recoveries) were collated. Electricity North West data were filtered and verified to ensure that only relevant/accountable strikes in the NW region (i.e. swan and goose collisions with conductors) were included in the analysis. The datasets were merged and incorporated into a GIS for density analysis which highlighted hotspot areas where the birds appeared to be at greatest risk of colliding with overhead line conductors (Figure 1).

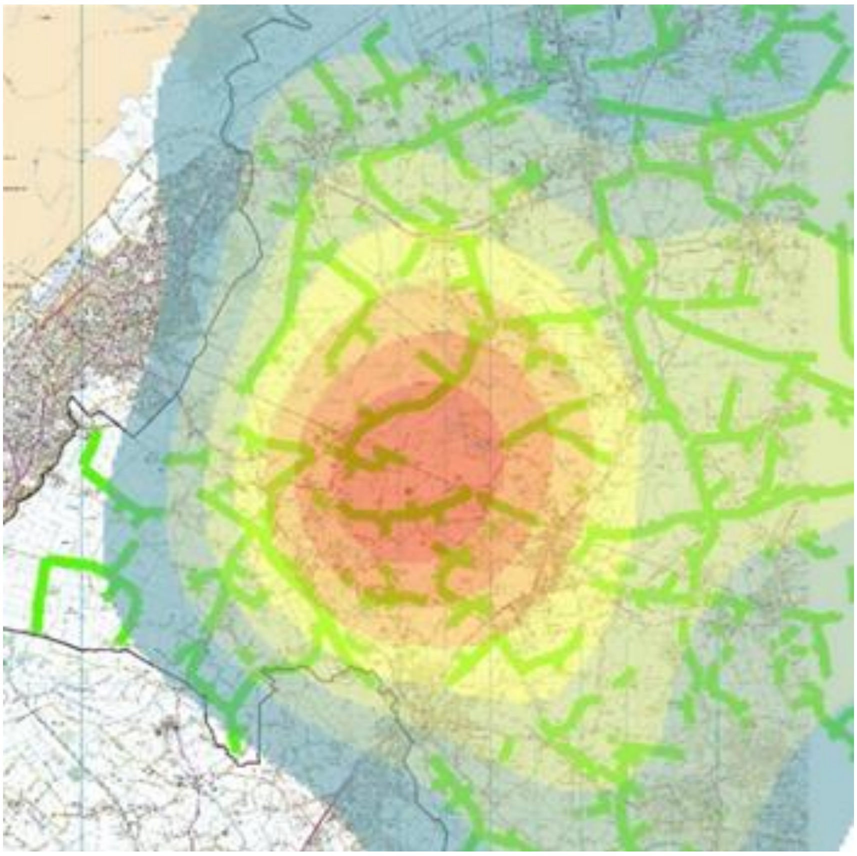

Figure 1 - Using existing data and GIS to highlight areas of higher risk (red) and areas where mitigation could be focussed. Green lines represent Electricity North West's Overhead Line Network centred over WWT Martin Mere

Next, information on the location and quality of deflectors were collected during site visits with visits focussed on areas with relatively high incidences of birds strikes identified under Objective 1. The location of the deflectors was digitised in the GIS and all information regarding the date of installation of the deflectors was included. Further work on searches for information on the timing, type and location of bird deflector deployment is on-going. A 'before' and 'after' assessment of collision frequency will then be undertaken for sites where sufficiently accurate data are available.

Methods were developed to obtain an accurate assessment of swan and goose flight heights. Observations of flight path and heights were recorded for approximately 1200 flights by swan and goose flocks around Martin Mere and the Ribble Estuary in winter 2013/14. Of these, approximately 50% of flights crossed an overhead line. Weather data was recorded daily and observations were made in a variety of weather conditions during the study. A further 119 flights were recorded at Cockerham Sands, near Lancaster. Data on the birds' flight lines and altitude of height have all been digitised in the GIS and are now ready for analysis (Figure 2).

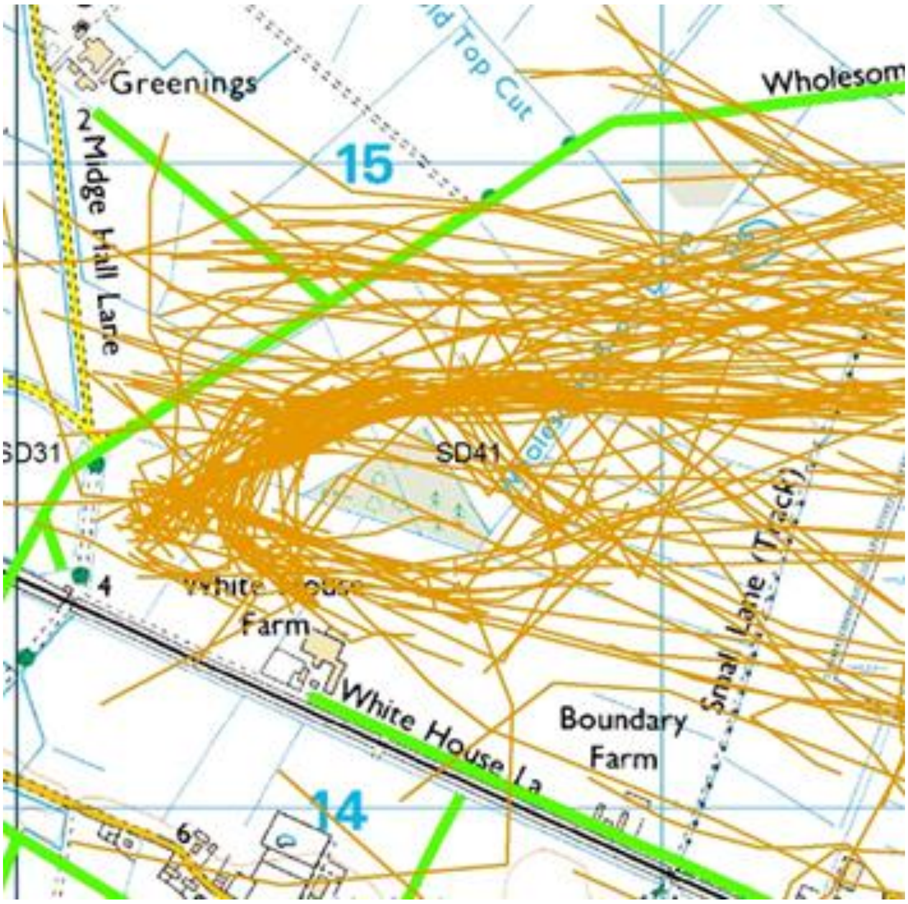

Figure 2 - Flight paths of Whooper Swans (orange) around HV Overhead Lines (green) and other landscape features for the time period November 2013 – January 2014.

Weekly surveys of Whooper Swans and geese were carried out approximately every three weeks to determine their main feeding locations around Martin Mere and the habitat at these sites. Further work on collation of habitat data and vegetation data from remote sensing for the modelling of swan distribution and flight heights in relation to vegetation and landscape is on-going.

The final stage of the project will include;

- Overlaying the flight path records with terrain data and developing statistical models to determine patterns and trends in the birds' flight behaviour
- Develop a multiple criteria risk model using parameters derived from the initial analyses to produce a risk map for swan and goose collisions in the NW region
- Undertake a cost-benefit analysis of mitigation measures
- Prepare a final report to Electricity North West and submit an M.Res. Thesis to Lancaster University

5.2 DYNAMIC THERMAL ANALYSIS OF LOW VOLTAGE (LV) UNDERGROUND CABLES - MANCHESTER UNIVERSITY

5.2.1 Background

Underground low voltage cables in urban networks have a high economic value realised through the amount installed combined with the costs associated with their installation and/or replacement. As has already been well documented 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. This combined with the observed increase in generation from domestic PV results in the potential for a significant change in the manner that LV networks are utilised. These changes have the potential to significantly alter existing power flows which may in turn lead to increased instances of cable thermal overloads risking premature cable aging induced by higher operating temperatures. The forecasted changes in the utilisation of underground LV networks is contrasted with the limited understanding of the behaviour and performance of underground cables and their potential to accept increased loadings whilst still achieving the expected economic lifetime.

5.2.2 Scope

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. This work will be combined with current projects investigating the thermal behaviour of distribution transformers and LV automation.

Project Deliverables include

Data collection focussed on collection of relevant data from Electricity North West's underground LV network (cable current, cable depth, cable temperature, soil thermal resistivity, ambient air temperature and soil temperature) and its preliminary analysis in order to improve understanding of the network's thermal behaviour.

Development of a thermal simulator to exploit cable thermal inertia and maximise cable capacity. The simulator will capture the relationship between cable current and temperature and will enable users to accurately estimate feasible load profiles that would not violate temperature constraints. It will also enable the prediction of future temperature profiles for any load current profile.

Development of thermal monitoring and control strategies once the appropriate thermal models are identified that can predict temperature of a cable segment. They will be utilised to infer the overall status of the network in terms of its underlying thermal state.

5.2.3 Current Status

The Smart Joint developed under Electricity North West's LCNF Tier 1 'Voltage Management' project have been utilised to facilitate data gathering. Figure 3 shows the exposed Smart Joint modified with thermocouples.

Figure 3 – Smart Joint and Marshalling Cabinet

A number of Smart Joints have been installed and data gathering and thermal model development is well underway.

5.3 STAY ANCHOR DEVELOPMENT - ANCHOR SYSTEMS (EUROPE) LTD

5.3.1 Background

Electricity North West own a significant number of wood poles as part of our overhead line network. 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. 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 was initiated to trial an alternative anchoring system, the Duckbill anchor.

5.3.2 ***Scope***

The Duckbill anchor system comprises a specially designed anchor which can be driven into the ground and locked in position. The anchor is fixed to high yield tie bars or tendons which are in turn connected to the wood pole in the traditional manner. The system has a number of advantages, not least that the tensile load can be applied immediately unlike concrete based anchoring systems.

The project has a number of specific objectives;

- To design and develop a backstay anchoring system that has the potential for a 30 year life with the current load condition exerted by a type 1 and a type 2 backstay anchor
- To ensure that a reasonable factor of safety is built into the system with respect to load and durability
- To ensure that the tendon design is flexible in installation method so as to achieve the best depth for installation by trial or by multiple anchors
- To develop a delivery system that is portable and efficient with respect to installation and load bearing
- To ensure that backstay replacement can be carried quickly and safely
- To remove the use of the ‘deadman’ anchoring method which requires works to be completed on site that is time consuming and unnecessary

5.3.3 Current Status

Prior to use in the field a finite element analysis model of the Duckbill Anchor was created to demonstrate the structural integrity of the anchor under its maximum load. The model was used in simulated typical ground conditions.

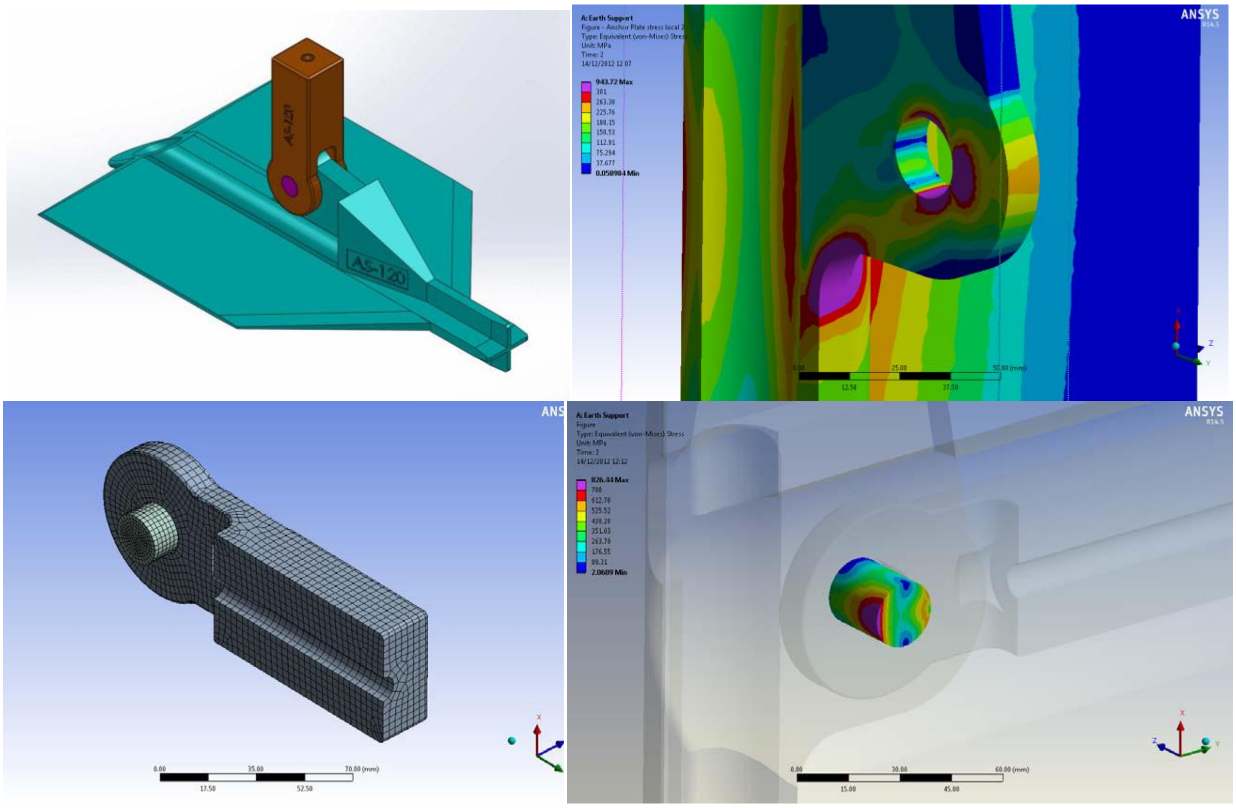

Figure 4 - Finite Element Model of the Duck Bill Anchor

The result of the analysis has shown that whilst some local yielding and distortion of the anchor may occur under the load specified, this would not cause the anchor to fail in such a way that it could no longer support the load. A number of Duckbill Anchors have been installed and are currently undergoing long term field trials.

6 OUTLOOK FOR 2014/15

Electricity North West has a full programme of IFI activities planned for the coming year. Our priority activities being planning for the forthcoming RIIO-ED1 period and the migration of our IFI projects to the Network Innovation Allowance and migration and embedding of successful innovation projects into business as usual.

7 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.

Project	**Collaborator**
STP M2	EA Technology Ltd
STP M3	EA Technology Ltd
STP M4	EA Technology Ltd
STP M5	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
Storage	Durham University
Distribution Transformer Real Time Thermal Ratings	Manchester/Liverpool University, Nortech, Schneider Transformers
LV Automation	Kelvatek/EPS
Customers	TFC
ENA Recharges	ENA
Demand Control	Manchester University/PB Power
OHL Fault Location	Altea
Duckbill Anchors	Anchor Systems Europe
PV Array Monitoring	Streamline/Bellrock
Network Modelling	CGI
LV Voltage Regulators	GenDrive
Transformer Investigation	ABB
Cable Temperature Sensor	Technology Partnership plc (TTP)
Ultra pole	Acuity Products
Birds and Power Lines	WWT, Lancaster University
Fluid Filled Cables Repair System	Gynosis
Statutory Voltage Limits	Impact Research Ltd
Fault Assistance	Kelvatek

Table 2 - List of Collaborators

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.

8 SUMMARY

The factors described earlier in this document have led to unprecedented 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.

9 PROJECTS COMPLETED IN 2012/2013

Project Title	Collaborative Partner	Outcome	Financial Benefits	Operational Benefits	Industry Benefits
Customer Research	Twenty First Century Communications	Since privatisation it is apparent that DNOs have lost the direct relationship with customers and this project initiated a significant customer engagement programme for Electricity North West	Measurable financial benefits are difficult to define for this project	This project has been used to enhance our Operational effectiveness in line with Ofgem's new broad measures of customer satisfaction introduced as part of DPCR5 (customer satisfaction is also one of the key output categories for RIIO)	The project has developed best practice methods of high volume call handing and customer information provision that could be transferred to other DNOs
Load Flow	Internal	Load flow studies are time consuming to complete and this project has provided enhanced capabilities to restore networks in the fastest possible time	Financial benefits are delivered through avoiding CMLs by quicker restoration of more customers	The load flow engine that was developed under this project is being utilised within our automatic network restoration systems.	The Load Flow engine was developed specifically for Electricity North West's NMS system
Oil Regeneration – Stage 2	Manchester University	The techniques and knowledge developed under this project allowed Electricity North West to reduce its planned RIIO transformer replacement project	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	This project has enhanced our ability to manage aged transformers at lower risk	The project was specifically aimed at Electricity North West's transformer fleet although the learning could be transferred to other DNOs
Duckbill Anchors	Anchor Systems (Europe) Ltd	A new anchoring system has been developed for overhead line poles	The project was developed for safety reasons	The project will improve the safety of the OHL network	The project has developed an improved system that is available to other DNOs

Project Title	Collaborative Partner	Outcome	Financial Benefits	Operational Benefits	Industry Benefits
Load Allocation Phase 2	Internal	The model developed under this project can produce highly accurate half hourly Loading data for each distribution transformer on a HV feeder which is compared with the rating of the feeder to define the 'spare capacity'. The outputs are being used across a number of different business areas from future investment forecasting to supporting post fault network restoration	Improved modelling of inherent capacity on the network as required by local conditions of increased demand and generation resulting in £1M in DPCR5 and £600k in RIIO-ED1 avoided cost	No identifiable benefits	Project specific to Electricity North West's network
Monitoring of PV Arrays	Bellrock	All weather stations have been installed and a full year's data has been collected and analysed. The analysis has been used to support a number of projects investigating LV network performance and voltage management and although this project is effectively complete data is still being downloaded and continually analysed	The financial benefits from this work are derived from the wider programme of current projects investigating and defining the performance of LV networks.	Partly based on this project Electricity North West has adopted a 'connect and manage' approach to LV PV which has reduced costs for our customers. The project has provided a higher level of confidence regarding the connection of PV on our LV network	The results of this project have been disseminated to other DNOs who are all carrying out similar studies into he long term effects of PV connections at LV

Project Title	Collaborative Partner	Outcome	Financial Benefits	Operational Benefits	Industry Benefits
Pole Mounted Fault/Load Monitor	Nortech	Although originally aimed at OHL networks the output from this project was a new design for a communicating ground mounted fault passage indicator (FPI). A significant number of the new FPIs have been installed on our network.	Financial benefits from this project are delivered by faster restorations for customers and reduced IIS penalties	The FPIs are being used every day to inform post fault switching on our network	The new FPI is available to other DNOs
Low Voltage Network Modelling	CGI	The project is complete and has delivered a working LV network model within DPlan. The platform is being extensively trialled and a final decision will be taken regarding implementation of a full version of DPlan within Electricity North West in due course	There are no direct financial benefits from this project as it was limited to a trial	There are no direct operational benefits from this project as it was limited to a trial	The DPlan platform is available to the rest of the industry
Substation Security	GMP	We have worked with local police forces and specialist security advisors to develop a number of techniques to complement more traditional security strategies. These initiatives have been successful in both stopping further	This project was one element of a wider strategy implemented to better protect our substation assets which has resulted in a 46% reduction in metal theft	Any reduction in substation theft brings operational benefits. These include for example, reduction in earthing tape theft, reduction in damage to substation perimeters and reduction in danger to the public	A number of initiatives delivered under this project have been disseminated to the rest of the industry through ENA security groups

Project Title	Collaborative Partner	Outcome	Financial Benefits	Operational Benefits	Industry Benefits
		increase in metal theft and in helping deliver a 46% reduction in theft instances			
Demand Control	Manchester University/PB Power	This project was a pre-cursor to Electricity North West's LCNF Tier 2 CLASS project	The CLASS project has the potential to deliver significant financial benefits to the UK	No identifiable benefits	The CLASS project has the potential to deliver significant carbon reductions to the UK by a reduction in the need for spinning reserve

Table 3 – Completed Projects

10 FINANCIAL REPORT

Distribution Network Revenue	£468,306,000
IFI Allowance	£2,342,000
Unused IFI Carry Forward 13/14	0
Number of Active IFI Projects	40
Summary of benefits anticipated from IFI projects - Sum of Projected NPV	£7,136,548
External expenditure on IFI projects in 13/14	£2,056,420
Internal expenditure on IFI projects in 13/14	£319,620
Total expenditure 13/14 on IFI projects	£2,376,040
Estimated benefits actually achieved from IFI projects to date	£3,401,092

Table 4 - 13/14 Summary Report on IFI Activities

12 PROJECT REPORTS

<table>
<tr><td>Project Title</td><td colspan="4">Strategic Technology Programme Overhead Line Networks</td></tr>
<tr><td>Description of project</td><td colspan="4">A DNO research and development collaboration hosted by EA Technology</td></tr>
<tr><td>Expenditure for 13/14 financial year</td><td>Internal £0
External £52,955
Total £52,955</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Internal £22,853
External £285,854
Total £308,707</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td></td><td colspan="2">Projected 14/15 costs for Electricity North West</td><td>Internal £7,585
External £42,983
Total £50,568</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The Module 2 programme for budget year 2013/14 aimed to optimise overhead network design, improve operational performance, maximise potential benefits, improve financial performance, and minimise risk associated with overhead networks. A full list of projects and deliverables is available from Electricity North West or EA Technology</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>16</td><td>9</td><td>25</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">If successful projects in this Module may increase the performance and reliability of OHL networks</td></tr>
<tr><td>Expected Timescale to adoption</td><td>Range 1-5 years - dependent on project</td><td colspan="2">Duration of benefit once achieved</td><td>Range 3-5 years - dependent on project</td></tr>
<tr><td>Probability of Success</td><td>Range 49-95% - dependent on project</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£42,652</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">Collectively, the 13/14 work programme demonstrates the development of innovative products, processes and techniques that improve the management of Overhead Networks. A full list of projects and deliverables is available from Electricity North West or EA Technology</td></tr>
<tr><td>Project Progress to March 14</td><td colspan="4">Only a small number of projects or project stages started in the Module during 13/14 have been completed since the majority are multi-stage projects that span more than one year</td></tr>
<tr><td>Collaborative Partners</td><td colspan="4">Other DNOs</td></tr>
<tr><td>R&D Providers</td><td colspan="4">EA Technology</td></tr>
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Project Title	**Strategic Technology Programme Cable Networks**				
Description of project	A DNO research and development collaboration hosted by EA Technology				
Expenditure for 13/14 financial year	Internal £1,308 External £63,724 Total £65,032		Expenditure in previous (IFI) financial years	Internal £13,381 External £323,510 Total £336,891	
Project Cost (Collaborative + external + [DNO])			Projected 14/15 costs for Electricity North West	Internal £9,191 External £52,083 Total £61,274	
Technological area and / or issue addressed by project	The Module 3 programme for budget year 2013/14 aimed to improve operational performance, maximise potential benefits, improve financial performance, and minimise risk associated with cable networks. A full list of projects and deliverables is available from Electricity North West or EA Technology				
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	Collectively, the 13/14 work programme demonstrates the development of innovative products, processes and techniques that improve the management of cable Networks. A full list of projects and deliverables is available from Electricity North West or EA Technology				
Project Progress to March 14	Only a small number of projects or project stages started in the Module during 13/14 have been completed since the majority are multi-stage projects that span more than one year				
Collaborative Partners	Other DNOs				
R&D Providers	EA Technology				

<table>
<tr><td>Project Title</td><td colspan="5">Strategic Technology Programme Substations</td></tr>
<tr><td>Description of project</td><td colspan="5">A DNO research and development collaboration hosted by EA Technology</td></tr>
<tr><td>Expenditure for 13/14 financial year</td><td colspan="2">Internal £1,203
External £46,384
Total £47,587</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Internal £30,876
External £258,572
Total £289,449</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td colspan="2"></td><td colspan="2">Projected 14/15 costs for Electricity North West</td><td>Internal £6,599
External £37,397
Total £43,996</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="5">The Module 4 programme for budget year 2013/14 aimed to improve operational performance, maximise potential benefits, improve financial performance, and minimise risk associated with substations. A full list of projects and deliverables is available from Electricity North West or EA Technology</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Incremental</td><td>Project Benefits Rating</td><td colspan="2">Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>16.5</td><td colspan="2">9.5</td><td>26.0</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="5">If successful projects in this Module may increase the performance and reliability of substations.</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">Range 1-4 years - dependent on project</td><td colspan="2">Duration of benefit once achieved</td><td>Range 1-6 years - dependent on project</td></tr>
<tr><td>Probability of Success</td><td colspan="2">Range 30-95% - dependent on project</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£32,721</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="5">Collectively, the 13/14 work programme demonstrates the development of innovative products, processes and techniques that improve the management of substations. A full list of projects and deliverables is available from Electricity North West or EA Technology</td></tr>
<tr><td>Project Progress to March 14</td><td colspan="5">Only a small number of projects or project stages started in the Module during 13/14 have been completed since the majority are multi-stage projects that span more than one year.</td></tr>
<tr><td>Collaborative Partners</td><td colspan="5">Other DNOs</td></tr>
<tr><td>R&D Providers</td><td colspan="5">EA Technology</td></tr>
</table>

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 13/14 financial year	Internal £7,089 External £41,955 Total £49,044	Expenditure in previous (IFI) financial years	Internal £28,621 External £247,388 Total £276,009	
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	Internal £5,935 External £33,630 Total £39,565	
Technological area and / or issue addressed by project	The Module 5 programme for budget year 2013/14 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. A full list of projects and deliverables is available from Electricity North West or EA Technology			
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 13/14 work programme demonstrates the development of innovative products, processes and techniques that improve the management of electricity distribution networks. A full list of projects and deliverables is available from Electricity North West or EA Technology			
Project Progress to March 14 (Continued)	Only a small number of projects or project stages started in the Module during 13/14 have been completed since the majority are multi-stage projects that span more than one year			
Collaborative Partners	Other DNOs			
R&D Providers	EA Technology			

<table>
<tr><td>Project Title</td><td colspan="4">Pole Mounted Fault/Load Monitor</td></tr>
<tr><td>Description of project</td><td colspan="4">The aim of this project was to develop and trial a reliable non-contact Fault/load remote monitor up to 33kV</td></tr>
<tr><td>Expenditure for financial year</td><td>Internal £13,308
External £43,816
Total £57,124</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>Internal -£12,484
External £25,410
Total £12,926</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td></td><td colspan="2">Projected 14/15 costs for Electricity North West</td><td>Internal £0
External £0
Total £0</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">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</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>10</td><td>11</td><td>21</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">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</td></tr>
<tr><td>Expected Timescale to adoption</td><td>3 years</td><td colspan="2">Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td>75%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£198,887</td></tr>
</table>

Potential for achieving expected benefits	This project stems from a strategy of developing our infrastructure 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 14	After on-going analysis of the data received from the units and a comparison with fault data from our SCADA system it was evident that the Polestar units did not perform as well as initially thought and some discrepancies existed leading to a lack of confidence. It was been decided to extend this project to install alternative pole mounted FPIs and ground mounted EFIs as these devices are needed to facilitate network management 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. We have also collaborated with Nortech to develop a communicating FPI for ground mounted switchgear and are currently installing a number at strategic locations as part of a trial. ----------------------------------Report for 2013/14-- During the year 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 well into the delivery phase and the FPIs are being used every day to inform post fault switching on our network
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 attends six 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	Internal £2,069 External £32,187 Total £34,256	Expenditure in previous (IFI) financial years	Internal £48,461 External £16,576 Total £165,037
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	External £28,637 Internal £5,054 Total £33,691

Technological area and / or issue addressed by project	The EA Technology Ltd Forums address a range of different issues and are used to develop a common industry view on a wide 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 of Project	Financial - No specific financial reductions will result from participating in the Forums however, they have for many years provided an ideal opportunity for information exchange and both formal and informal industry collaboration. There have been a number of occasions when various EA Technology Ltd forums have been used to alert DNO's to specific issues of concern and many case studies and other outputs have resulted from participation. The Project NPV score has been calculated to be Medium (3) 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. For example the Protective Coatings Forum has been investigating reducing emissions of Volatile Organic Compounds which can be found in paints and solvents. The Protection Engineers Forum has been investigating protection mal-operation and component defects. The Overhead Line Engineers Forum and Cable Engineers Forum have identified defective materials and /or specifications. The Plant Engineers Forum has reported issues with some switchgear with inherent quality problems. The PD User Group Forum has used developed PD monitoring techniques that have saved significant amounts of time and money. The Network Planning and Design Engineers Forum has enabled development of planning tools and techniques.			
Project Progress to March 14	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 as they offer a very low-cost and effective means of accessing the latest technical developments across the industry			
Collaborative Partners	Other DNO's			
R&D Providers	EA Technology Ltd			

<table>
<tr><td>Project Title</td><td colspan="4">OLTC Monitoring</td></tr>
<tr><td>Description of project</td><td colspan="4">One of the stated aims of our R&D Strategy is to research new techniques to manage our ageing asset base and one of the most significant items of substations plant is the on-load tap changer (OLTC). It is estimated that the population on the UK distribution network is around 5000 and many different designs exist with a number of variations within the internal mechanism but all essentially provide the same function, to momentarily divert the load current being carried by a transformer to allow a physical change to made to the number of turns in the transformers winding thereby changing the output voltage. OLTCs, like many mechanical devices with stored energy mechanisms, are subjected to regular and repetitive low level mechanical stresses which over time can lead to stress and fatigue fractures that cannot easily be detected during routine maintenance and inspections. These fractures can eventually lead to catastrophic failure of the OLTC mechanism, in many instances whilst the OLTC is being switched between tap positions and is at its moment of maximum mechanical loading. It has been reliably estimated that across the UK there are up to five OLTC failures per year and at least one of these failures will lead to the loss of the transformer in addition to the OLTC. This project has taken a very early OLTC monitoring prototype developed under the SuperGen Amperes Project and made some minor modifications to facilitate data handling and retrieval and extended the monitoring to 25 OLTCs. The system will use the same type of opto-acoustic unit as the initial trial for data capture but will employ an embedded PC connected to our iHost system via GSM to remotely download the recorded data. Liverpool University will be responsible for data management and will also develop software algorithms that will interrogate the data highlighting trends of increasing vibration or acoustic energy emission that could indicate an incipient failure.</td></tr>
<tr><td>Expenditure for financial year</td><td colspan="2">External £2,138
Internal £6,729
Total £8,867</td><td>Expenditure in previous (IFI) financial years</td><td>External £268,659
Internal £9,094
Total £277,752</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td colspan="2"></td><td>Projected 14/15 costs for Electricity North West</td><td>External £17,000
Internal £3,000
Total £20,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">The project aims to develop our abilities to non-intrusively detect incipient defects within our substation plant using non-intrusive techniques.</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Development</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>17</td><td>4</td><td>21</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">A survey of Neders data reveals that almost 60% of OLTC failures are due to mechanical failure and the same survey reveals that of these failure 90% of the original equipment manufacturers are no longer still in business. It has been apparent for many years that better OLTC management techniques are required as the population grows ever older and after other organisations have failed to deliver the industries required monitoring solution, Liverpool University and Nortech have delivered a system in less than 12 months that we can begin to use to collect data. If the monitoring system can prevent the failure of one OLTC, it will have repaid the investment many times over</td></tr>
</table>

Expected Timescale to adoption	3 years	Duration of benefit once achieved	15 years
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£139,682
Potential for achieving expected benefits	The techniques employed in this device are well proven in a range of other applications and it is expected to deliver the required system		
Project Progress to March 14	Over 20 monitoring systems have been deployed under this project and a number of additional monitors have been installed as part of Electricity North West's CLASS LCNF Tier 2 Project. The data is being continually monitored and analysed to understand and define OLTC degradation		
Collaborative Partners	WPD		
R&D Providers	BFI Optilas/MHA IES/Nortech/Liverpool University		

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 £51,407 Internal £12,050 Total £63,457		Expenditure in previous (IFI) financial years	External £107,816 Internal £215,816 Total £323,632	
Project Cost (Collaborative + external + [DNO])			Projected 14/15 costs for Electricity North West	External £0 Internal £5,000 Total £5,000	
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 Rating	Project Residual Risk	Overall Project Score	
		19	4	23	

<table>
<tr><td>Expected Benefits of Project</td><td colspan="3">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</td></tr>
<tr><td>Expected Timescale to adoption</td><td>3 years</td><td>Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td>50%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£451,878</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="3">The deliverables to date include;</td></tr>
<tr><td>Project Progress to March 14</td><td colspan="3">All functional design completed
Equipment procured and tested
Topographical surveys of the line routes completed
Tower Loading calculations completed
Modifications to Electricity North West Ltd's control room software completed
RTU power supply redesigned
OHL temperature sensors tested in Manchester University’s HV test lab
Substation end communicating weather stations and data logging RTUs designed and installed
Remote communicating weather stations and data logging RTUs
Further delays have been encountered regarding outages. These issues are now resolved and it is expected the final items can be installed during 2014</td></tr>
<tr><td>Collaborative Partners</td><td colspan="3">None</td></tr>
<tr><td>R&D Providers</td><td colspan="3">Nortech, Gridsense</td></tr>
</table>

Project Title	Live Alert			
Description of project	Live Alert proposed a new project to develop a vehicle mounted warning system that would alert any person nearby by audible and visual indications that the vehicle has become live. It is envisaged that the system would be fitted to a range of vehicles used by OHL teams and other field staff exposed to live working. The system would warn users of the vehicle not to approach if, for example, a broken conductor fell onto the vehicle and it has become energised with respect to earth. The system is effectively a voltage alarm that can sense when its electrical potential exceeds a preset limit and operates without any connection to earth, it has a self contained test facility to confirm its operation before use and an internal data logger			
Expenditure for financial year	Internal £0 External £0 Total £0	Expenditure in previous (IFI) financial years	Internal £0 External £11,662 Total £11,662	
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	Internal £0 External £20,000 Total £20,000	
Technological area and / or issue addressed by project	The project is split into four stages as follows; • Design and develop a new sensing system and power inverter • Design and develop a refined prototype incorporating the new sensor and power supply • Manufacture 10 units for on site evaluation • Implementation of Pilot/Simulation exercise The final Deliverable will be a plastic/metal enclosure, approximately 200 x 100 x 100mm in size that has sockets to enable the connection of external power, external audio amplifiers for warning, external warning lights and a USB connection for downloading the past recorded incident data. The project will deliver ten prototypes for full testing and evaluation			
Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score
		18	5	23
Expected Benefits of Project	This project is being proposed for its potential safety benefits rather than any financial benefit incentives.			
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	£34,675	
Potential for achieving expected benefits	The technical developments required for delivery of this unit should not be underestimated and the project team have shown enthusiasm and commitment in successfully meeting these challenges			
Project Progress to March 14	In spite of previously being reported as closed, this project has now re-started following the delivery of a revised proposal for further work to correct anomalies in the sensor system			

Collaborative Partners	CE Electric, Scottish Power, SSE
R&D Providers	Live Alert

<table>
<tr><td>Project Title</td><td colspan="4">Load Flow</td></tr>
<tr><td>Description of project</td><td colspan="4">The objective of this project is to develop and trial a real time online load functionality for Electricity North West Ltd’s distribution network management system.</td></tr>
<tr><td>Expenditure for financial year</td><td>External £41,696
Internal £24,239
Total £65,935</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>External -£4,063
Internal £101,043
Total £96,980</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td></td><td colspan="2">Projected 14/15 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="4">Network Utilisation</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Development</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>19</td><td>4</td><td>23</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">Financial – The financial benefits from this project are mainly derived from increasing the capability and performance of Electricity North West Ltd’s Transmission Restoration System by enabling on-line load flow models to be performed within the 3 minute window of opportunity following a major fault on the 123 and 33kV networks.

Network Performance - This project is primarily aimed at improvements in Quality and continuity of Supply. A number of initiatives have been completed successfully in recent years to improve QoS and it is widely felt that technology based solutions are now required to make further improvements, an element is the development of an online load flow solution that is readily available for use by Control staff in their day to day activities.

Safety - A safety benefit will result from all those situations where the load flow is used to check operational switching decisions prior to the switching instructions being physically performed on the network. The control staff will have the ability to check the impact of any switching by simulating the switching instructions and check the resultant power flow.</td></tr>
<tr><td>Expected Timescale to adoption</td><td>1 year</td><td colspan="2">Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td>75%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£231,730</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">Load flow studies are time consuming to complete and this project will provide enhanced capabilities to restore networks in the fastest possible time</td></tr>
</table>

Project Progress to March 14	The load flow engine that was developed under this project is being utilised within our Automatic Network Restoration systems. The project is now closed
Collaborative Partners	TNEI
R&D Providers	Internal – Electricity North West NMS Software Development Team

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 £119,935 Internal £6,682 Total £126,617		Expenditure in previous (IFI) financial years	External £5,833 Internal £0 Total £5,833	
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	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		
Project Progress to March 14	The following milestones were delivered as part of this project; • A draft policy document for oil re-generation procedure. • 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. • 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 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 The project is now closed		
Collaborative Partners	None		
R&D Providers	Manchester University		

Project Title	**Storage**
Description of project	This project proposal is aimed at developing and installing an Energy Storage System (ESS) on Electricity North West Ltd’s Network, it is intended to carry out initial research on the technical and economic factors and ESS specification development funded under IFI and then install an ESS funded by other means

Expenditure for financial year	External £0 Internal £0 Total £0			Expenditure in previous (IFI) financial years	External £170,614 Internal £13,005 Total £183,619
Project Cost (Collaborative + external + [DNO])				Projected 14/15 costs for Electricity North West	External £63,750 Internal £11,250 Total £75,000
Technological area and / or issue addressed by project	The project has two elements • 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 • The purchase and installation and monitoring of an energy storage system, funded under First Tier Low Carbon Network Fund				
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 14	The project has continued to deliver a number of reports describing technical and economic benefits of ESS, a number of academic papers have been published and three PhDs have been drafted for consideration.
Collaborative Partners	SP Power Systems
R&D Providers	Durham University

Project Title	**Distribution Transformer Real Time Thermal Ratings**			
Description of project	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			
Expenditure for financial year	External £82,824 Internal £39,972 Total £122,796	Expenditure in previous (IFI) financial years	External £531,621 Internal £37,798 Total £569,420	
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	External £42,500 Internal £7,500 Total £50,000	
Technological area and / or issue addressed by project	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			
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 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			

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	£791,193
Potential for achieving expected benefits	The project is expected to deliver the required results		
Project Progress to March 14	The project required the development of new sensors and new mathematical models and most of the design and planning work is complete. The first two transformers were installed in early 2013 and data is being gathered to support the project aims of the development of new real time rating models. A further group of 6 transformers is currently being installed at the time of writing		
Collaborative Partners	None		
R&D Providers	Schneider Transformers/Manchester University/Liverpool University/Nortech		

Project Title	**Thermodynamic Models Options for Upgrading Cooling for Distribution Transformer**			
Description of project	This project is related to the previous project 'distribution transformer real time thermal ratings, once the thermal models have been completed it is intended to install non-intrusive sensors on 100 distribution transformers			
Expenditure for financial year	External £17,741 Internal £4,459 Total £22,200	Expenditure in previous (IFI) financial years	External £0 Internal £545 Total £545	
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	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			
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 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		
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	£45,042
Potential for achieving expected benefits	The project is expected to deliver the required results		
Project Progress to March 14	The project has not fully started as the outputs from the previous work on distribution transformer real time thermal ratings will form the key inputs. Minor expenditure was incurred on some early scoping work		
Collaborative Partners	None		
R&D Providers	Schneider Transformers/Manchester University/Liverpool University/Nortech		

Project Title	**Load Allocation Phase 2**			
Description of project	The primary objective of this project is to better understand the capability of the network to accept new loads and to understand the constraints in terms of asset ratings and location and the potential costs and opportunities to Electricity North West. The principal aim is to build a software platform to facilitate modelling of the financial and ratings impact of proposed new 'smart grid' demands. The proposed model will enable a range of scenarios to be developed based on different penetrations of new demands that do not follow either the load or demand profile of traditional network loads with the objective of identifying the potential reinforcement locations and costs			
Expenditure for financial year	External £39,337 Internal -£10,525 Total £28,812	Expenditure in previous (IFI) financial years	External £307,655 Internal £68,314 Total £375,969	
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	The construction of a total system peak loading model to evaluate the relationship between load and cost and allow Electricity North West to quantify the volume and value of network side response available			
Type(s) of innovation involved	Development (Small scale trials /	Project Benefits Rating	Project Residual Risk	Overall Project Score

	prototypes)	22	8	30

Expected Benefits of Project	The benefits of this project will arise from an ability to better understand the headroom on the network to accommodate new projected loads and therefore the financial implications of the potential investments required to ensure we can accommodate the projected loads. It is clear that the best projections for the rates of penetration levels and locations of new loads arising from the move to a low carbon network are estimates at best and we require new dynamic tools and techniques to begin to firm the potential costs to Electricity North West. This type of approach would allow a regular reassessment of the network capacity as new demand develops according to the projected electric vehicle roll-out, possibly from the plugged in places initiative for example, new heat pump load or any combination of the expected change in the use of the network over the coming period.

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	£245,400

Potential for achieving expected benefits	The approach is based on mining known information that currently resides in a number of different databases, it is low technical risk
Project Progress to March 14	The project is complete, and has enabled Electricity North West to base our investment plans for the take up of low carbon technologies in RIIO-ED1 on the current levels of loading on a per circuit basis and the remaining capacity of the feeders based on their individual circuit ratings. Minor expenditure occurred in this financial year through taking the project into business as usual
Collaborative Partners	None
R&D Providers	Internal

Project Title	**Low Voltage Network Automation**
Description of project	Traditionally LV feeders are designed and operated on a fit and forget basis where the circuit is predominantly static with its configuration only being altered for maintenance activities or when customers complain of unacceptable power quality. All low voltage feeders are protected by fuses and many are fitted with link boxes interconnecting with other low voltage feeders to allow loads to be supplied from alternative sources during maintenance or after faults. 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

Expenditure for financial year	External £657,780 Internal £5,463 Total £663,243	Expenditure in previous (IFI) financial years	External £557,312 Internal £22,096 Total £579,407

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	Optimal utilisation of low voltage networks			
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	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			
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 required the development of novel switches and telemetry RTUs although experience from previous projects has informed the development process			
Project Progress to March 14	The project is on-going with a number of devices at various stages of testing and development. This project work is now being taken forward through Electricity North West's LCNF T2 Street Smart Project			
Collaborative Partners	None			
R&D Providers	Kelvatek, EPS			

Project Title	**Customer Research**		
Description of project	In line with Ofgem's new broad measures of customer satisfaction introduced as part of DPCR5 (customer satisfaction is also one of the key output categories for RIIO), Electricity North West intends to carry out research into innovative techniques to improve the satisfaction levels of customers affected by our activities (either loss of supply or more general enquiries)		
Expenditure for financial year	External £129,382 Internal £130,238 Total £259,620	Expenditure in previous (IFI) financial years	External £46,205 Internal £237,782 Total £283,987
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 Performance			
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	As heating and transport migrate to the electricity network over the coming years a reliable and uninterrupted electricity supply will become even more important to society. Since privatisation it is apparent that DNOs have lost the direct relationship with customers and this project is intended to be the start of a significant customer engagement programme for Electricity North West			
Expected Timescale to adoption	5 year	Duration of benefit once achieved	5 years	
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£837,024	
Potential for achieving expected benefits	Our current approach to customer service can almost certainly be improved by understanding their requirements and taking some targeted actions, this project has a very good chance of success			
Project Progress to March 14	The project delivery phase is complete and the focus is on learning dissemination and implementation of the project outcomes into business as usual within Electricity North West			
Collaborative Partners	None			
R&D Providers	Twenty First Century Communications			

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		
Expenditure for financial year	External £96,056 Internal £7,050 Total £103,107	Expenditure in previous (IFI) financial years	External £69,818 Internal £12,547 Total £82,365
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	External £76,531 Internal £13,505 Total £90,036
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 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 expected benefits	The success of the project is reflected in the successful development of national objectives for the migration to smart electricity networks			
Project Progress to March 14	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 • Reactive Power/National Grid • Smarter Network Portal • Technical Editor • LCNF Conference			
Collaborative Partners	All UK DNOs			
R&D Providers	ENA			

Project Title	**Demand Control**		
Description of project	As the volume of renewable generation increases in order to deliver the UK decarbonisation challenge then given the likely types of low carbon generation, the overall system inertia is likely to progressively decrease leading to a higher demand for spinning reserve. To assist with addressing this challenge, it is proposed to investigate how distribution network operators can quickly and economically provide demand response services to the transmission system operator to manage frequency		
Expenditure for financial year	External £0 Internal £1,090 Total £1,090	Expenditure in previous (IFI) financial years	External £31,601 Internal £0 Total £31,601
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	System stability and management			
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 benefits are derived from developing DNOs ability to provide ancillary services to the transmission system operator. This project will establish the scope of the required implementation and will create a clear criterion for a future larger project to deliver the necessary infrastructure			
Expected Timescale to adoption	1 year	Duration of benefit once achieved	5 years	
Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£29,687	
Potential for achieving expected benefits	The project demonstrated that the distribution network could provide significant support to the transmission network if so required			
Project Progress to March 14	The project is complete and this work formed the basis of Electricity North West 2012 LCNF Tier 2 CLASS Project			
Collaborative Partners	National Grid			
R&D Providers	Manchester University			

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 -£4,995 Internal £0 Total -£4,995	Expenditure in previous (IFI) financial years	External £46,191 Internal £3,768 Total £49,959
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 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 14	The system has been specified and delivered but installation has been delayed due to technical and resourcing issues. Currently internally debating the future of this project and assessing all options available			
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 £22,997 Internal £1,045 Total £24,043	Expenditure in previous (IFI) financial years	External £12,650 Internal £1,184 Total £13,834
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	External £34,000 Internal £6,000 Total £40,000
Technological area and / or issue addressed by project	Safety/Asset Management		

<table>
<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>Overall Project Score</td></tr>
<tr><td>22</td><td>3</td><td>25</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">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</td></tr>
<tr><td>Expected Timescale to adoption</td><td>1 year</td><td colspan="2">Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td>75%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£53,990</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The project is expected to deliver an additional solution to the traditional; approach that is not always appropriate in some circumstances</td></tr>
<tr><td>Project Progress to March 14</td><td colspan="4">All design work has been completed and the anchors are currently under test and trial

This project is now complete</td></tr>
<tr><td>Collaborative Partners</td><td colspan="4">Anchor Systems (Europe) Ltd</td></tr>
<tr><td>R&D Providers</td><td colspan="4">None</td></tr>
</table>

Project Title	Monitoring of PV Arrays				
Description of project	This project is to install environmental and network monitoring stations at 10 PV arrays on Electricity North West's network and then use the data to refine models of the LV network under development. Weather stations developed for the Dynamic Line Ratings project, a sunlight monitor (solarimeter) developed for the Stockport Smart Fuse project and voltage and current monitors developed for the LV Network Solutions project will be installed at the 10 largest PV array locations. The aim of this is to gather at least one year's performance data (export, effects of temporary cloud cover, ambient temperature, fog, frost) and analyse this against the types of PV installed (including the angle of inclination, orientation) to better understand the capability of our network to accommodate larger PV installations. In addition to specific analysis of the resulting data it will also be used to test LV network models under development to compare simulated results with measurements. The data is being hosted on a bespoke software application developed by Bellrock (Strathclyde University spin out) and analysed by Manchester University				
Expenditure for financial year	External £28,915 Internal £8,819 Total £37,734		Expenditure in previous (IFI) financial years	External £54,741 Internal £4,535 Total £59,276	
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 Capacity				
Type(s) of innovation involved	Development (Small scale trials / prototypes)	Project Benefits Rating	Project Residual Risk	Overall Project Score	
		24	4	28	
Expected Benefits of Project	Release of additional network capacity and the connection of low carbon technologies				
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	£314,722	
Potential for achieving expected benefits	The project is not technically challenging however the expected benefits are derived from the analysed data showing that LV circuits have additional capacity to connect low carbon technologies				

Project Progress to March 14	All weather stations have been installed and a full year's data has been collected and analysed. The analysis has been used to support a number of projects investigating LV network performance and voltage management and although this project is effectively complete data is still being downloaded and continually analysed
Collaborative Partners	Bellrock
R&D Providers	Manchester University

<table>
<tr><td>Project Title</td><td colspan="4">Load Allocation Phase 2</td></tr>
<tr><td>Description of project</td><td colspan="4">The IFI funded Load Allocation project was initiated in 2011 to support a key element of our future network strategy, namely maximising the potential of our existing assets to support future load growth expected from the decarbonisation of heating and transport. The project has met all the defined objectives at and has enabled a range of scenarios to be developed based on different penetrations of new demands that do not follow either the load or demand profile of traditional network loads with the objective of identifying the potential reinforcement locations and costs

For Phase 2 of the project a number of additional tasks were developed to exploit the capabilities of the software developed for Stage 1

• Running revised scenarios as required for RIIO-ED1
• Project documentation / reduce reliance on external contractors.
• Review sensitivity to various inputs, especially clustering
• Aspects related to Ofgem's Smart Grid Forum work WS2/ WS3 analysis
• Revisions to 2011/12 baseline
• Refresh CEPA analysis on background demand level and extend to 2031
• Extend the FCH to winter 2030 (2030/31)
• Create new adjustment input(s) to FCH for consistency with G&P baseline
• Improve / develop the FCH model
• Identification of overlap with Connections
• Improvements to the input / output process –
• Summer loading of OHLs
• CRMS v. LTDS definition of primaries.</td></tr>
<tr><td>Expenditure for financial year</td><td>External £20,328
Internal £6,695
Total £27,023</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>External £93,334
Internal £2,584
Total £95,918</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td></td><td colspan="2">Projected 14/15 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="4">Optimising Network Investment</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>Overall Project Score</td></tr>
<tr><td>18</td><td>3</td><td>21</td></tr>
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Expected Benefits of Project	The benefits of the Load Allocation project were initially thought to be limited to a better understanding of the potential headroom on Electricity North West Ltd's network to accommodate new projected loads and therefore the financial implications of the potential investments required. Following delivery of the first model is in fact being used by a number of different areas across the business to derive financial value and the model has illustrated the potential of the approach to deliver more accurate results to the wider business. The benefits from this stage will be achieved through building on the previous work and refining the model and outputs based on the latest projections available		
Expected Timescale to adoption	3 year	Duration of benefit once achieved	5 years
Probability of Success	75%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£58,2273
Potential for achieving expected benefits	The software development is not technically challenging but required a number of different data sets to be accessed and interrogated and is therefore its creation is quite an extensive and time intensive exercise		
Project Progress to March 14	The model developed under this project can produce highly accurate half hourly loading data for each distribution transformer on a HV feeder which is compared with the rating of the feeder to define the 'spare capacity'. The outputs are being used across a number of different business areas from future investment forecasting to supporting post fault network restoration This project is now complete		
Collaborative Partners	Internal		
R&D Providers	Internal		

Project Title	**Low Voltage Network Modelling**		
Description of project	Electricity North West Ltd's low voltage network is vast comprising some 120,000 feeders supplied from 33,000 transformers and the scale of the asset base precludes the economic use of SCADA monitoring as used at HV, one of the key elements of our innovation strategy is to develop better modelling tools where required. Current design and modelling tools for LV networks are very limited and early comparisons with recorded data from the range of monitoring points being installed show they are producing inaccurate results and this has further highlighted a perceived need for better LV simulation capabilities. The proposal is to engage CGI (formerly Logica) to develop an LV modelling tool based on their DPlan software platform that can be used to simulate the effects of various loading scenarios on LV networks		
Expenditure for financial year	External £133,979 Internal £2,828 Total £136,807	Expenditure in previous (IFI) financial years	External £131,591 Internal £0 Total £131,591
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 Development			
Type(s) of innovation involved	Development	Project Benefits Rating	Project Residual Risk	Overall Project Score
		24	2	26
Expected Benefits of Project	• Advanced LV network analysis visualization and optimisation • Fully utilising smart meter derived data in conjunction with smart grid sensor time series data • Low cost domestic generation/LCT connection • Ability to model the network outcomes (WS3) of smart interventions (DSR, Storage, DER) in advance			
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	£354,971	
Potential for achieving expected benefits	DPlan is a recognised network modelling tool and is widely used by a number of network companies proven to deliver reliable results. The challenge lies in ensuring the LV network data used is accurate and a significant			
Project Progress to March 14	The project is complete and has delivered a working LV network model within DPlan. The work highlighted a number of issues with data quality that needed to be resolved before the network data could be loaded. The platform is being extensively trialled whilst still within the trial period and a final decision will be taken regarding implementation of a full version of DPlan within Electricity North West in due course			
Collaborative Partners	None			
R&D Providers	CGI, Manchester University			

Project Title	**LV Voltage Regulators**		
Description of project	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 £31,810 Internal £0 Total £31,810	Expenditure in previous (IFI) financial years	External £12,783 Internal £0 Total £12,783
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	Voltage Quality		

Type(s) of innovation involved	Development (Small scale trials / prototypes)	Project Benefits Rating	Project Residual Risk	Overall Project Score
		20	4	24
Expected Benefits of Project	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	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£150,637	
Potential for achieving expected benefits	The project is based on incremental technology developments and is therefore low risk			
Project Progress to March 14	This project is currently on hold pending the resolution of commercial issues			
Collaborative Partners	SP Power Systems/SSE/NPG/Energy Innovation Centre			
R&D Providers	GenDrive			

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	External £9,773 Internal £0 Total £9,773	Expenditure in previous (IFI) financial years	External £150,253 Internal £1,630 Total £151,883	
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	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	IEA Smart Grids for Customers			
Description of project	Whilst there is considerable focus on the technological aspects of delivering Smart Grids, little is understood of the extent to which consumers are willing to embrace new technologies (or otherwise) and initiatives that enable their use of energy to be actively managed..This project has been sponsored by the International Energy Agency (IEA) (within the IEA Implementing Agreement on Demand Side Management (DSM) Technologies and Programmes, a collaboration of 20 countries) to focus on investigating the role of consumers in delivering effective Smart Grids. EA Technology, are the IEA Operating Agent			
Expenditure for financial year	External £9,925 Internal £3,863 Total £13,788	Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0	
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	External £46,750 Internal £8,250 Total £55,000	
Technological area and / or issue addressed by project	Smart Grids			
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 is expected to assist with customers' acceptance of smart grid technology and processes by assessing; • The impact of energy markets on the role of customers • The interaction between technology and customers • Identification of Risks and Rewards associated with Smart Grids from the perspective of customers • The identification of offers and programmes that help ensure Smart Grids meet the needs of customers • Identification of the factors that need to be addressed in order to ensure Smart Grids are able to achieve their full potential by ensuring that all industry stakeholders, including customers, benefits from their deployment		
Expected Timescale to adoption	3 year	Duration of benefit once achieved	5 years
Probability of Success	100 %	Project NPV = (PV Benefits – PV Costs) x Probability of Success	£43,644
Potential for achieving expected benefits	The project is expected to deliver the specified benefits		
Project Progress to March 14	The final Task Group meeting was held in March 14 and the reports and publications are currently being disseminated		
Collaborative Partners	DNOs in UK, Korea, Netherlands, Norway and Sweden		
R&D Providers	EA Technology/IEA		

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 £48,366 Internal £701 Total £49,067	Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	External £0 Internal £20,000 Total £20,000

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 14	All equipment has been delivered and will be installed during summer 2014			
Collaborative Partners	None			
R&D Providers	Manchester University			

Project Title	**Primary Voltage Control**		
Description of project	This IFI project is to review and adjust the voltage control at a number of primary substations to provide voltage headroom for generation A balance must be achieved between reducing the HV network voltage sufficiently to create headroom for DG, and not reducing it so much that low voltage problems are created. From initial studies it is believed that Load Drop Compensation (LDC) may have the potential to achieve this balance by increasing the voltage set point as demand increases, and lowering the set point as demand reduces. In some instances, a permanent reduction in the Automatic Voltage Control (AVC) set point may be sufficient, particularly for geographically compact cable networks where excessive voltage drop may not be a problem. It is proposed to study a number of primary substations following principles defined in Electricity North West's Code of Practice 370 Voltage Control for 132kV, 33kV and 11/6.6kV Systems		
Expenditure for financial year	External £8,100 Internal £2,364 Total £10,464	Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0
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	Voltage Control for DG				
Type(s) of innovation involved	Development	Project Benefits Rating		Project Residual Risk	Overall Project Score
		22		4	26
Expected Benefits of Project	Electricity North West has connected over 30MW of clustered micro generation in recent years as a result of various government incentive mechanisms and our traditional means of predicting load growth have proved inadequate. It is widely held that managing voltage limits and thermal capacity will be fundamental challenges to UK DNOs in the migration to a low carbon economy and this approach will provide another method of accommodating further renewable energy penetration on our existing network by developing a better method to control voltages				
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	£52,267	
Potential for achieving expected benefits	The project is based on establishing if the perception that better voltage control could allow more DG connection is in fact correct				
Project Progress to March 14	Final reports have been delivered and the results are currently being disseminated				
Collaborative Partners	None				
R&D Providers	PB Power				

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 £31,022 Internal £1,035 Total £32,057	Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0

<table>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td colspan="2"></td><td colspan="2">Projected 14/15 costs for Electricity North West</td><td>External £5,000
Internal £0
Total £5,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="5">Asset Management</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Development</td><td>Project Benefits Rating</td><td colspan="2">Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>22</td><td colspan="2">2</td><td>24</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="5">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</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">2 year</td><td>Duration of benefit once achieved</td><td colspan="2">10 years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">100%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td colspan="2">£13,078</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="5">Good</td></tr>
<tr><td>Project Progress to March 14</td><td colspan="5">Work completed so far includes;
• Identification of high risk collision areas
• Assessment of the effectiveness of bird deflectors
• Analysis of swan and goose flight lines in relation to power lines topographical features, vegetation, crop rotation and weather

The project is now in the data analysis phase and the objectives are:
• Overlaying the flight path records with terrain data and developing statistical models to determine patterns and trends in the birds' flight behaviour
• Developing a Multiple Criteria Risk Model using parameters derived from the initial analyses to produce a risk map for swan and goose collisions in the NW region
• Development of a cost-benefit analysis of mitigation measures
• Delivery of a final report to Electricity North West and submission of an M.Res. thesis to Lancaster University</td></tr>
<tr><td>Collaborative Partners</td><td colspan="5">Wildfowl & Wetlands Trust, Lancaster University</td></tr>
<tr><td>R&D Providers</td><td colspan="5">Lancaster University</td></tr>
</table>

Project Title	**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 £74,910 Internal £1,509 Total £76,418		Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0
Project Cost (Collaborative + external + [DNO])			Projected 14/15 costs for Electricity North West	External £25,500 Internal £4,500 Total £30,000
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	2 year		Duration of benefit once achieved	10 years
Probability of Success	50%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£242,843
Potential for achieving expected benefits	The chemistry of this project is challenging however the potential benefits could be significant			
Project Progress to March 14	Samples have been delivered to Gynosis for testing and is on course to complete on schedule			
Collaborative Partners	SP Power Systems/SSE/NPG/UKPN			
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. This project aims to develop a hand held cable paper moisture measurement meter				
Expenditure for financial year	External £44,065 Internal £5,332 Total £49,397		Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0	
Project Cost (Collaborative + external + [DNO])			Projected 14/15 costs for Electricity North West	External £17,850 Internal £3,150 Total £21,000	
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	
		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	75%		Project NPV = (PV Benefits – PV Costs) x Probability of Success	£66,939	
Potential for achieving expected benefits	The project is investigating a number of approaches to ensure it is delivered to specification				
Project Progress to March 14	The project is on course to complete in 2015 and all planned milestones have been met				
Collaborative Partners	UKPN, NPG, SP				
R&D Providers	EA Technology				

<table>
<tr><td>Project Title</td><td colspan="4">Cable Dynamic Ratings</td></tr>
<tr><td>Description of project</td><td colspan="4">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</td></tr>
<tr><td>Expenditure for financial year</td><td>External £0
Internal £2,262
Total £2,262</td><td colspan="2">Expenditure in previous (IFI) financial years</td><td>External £0
Internal £0
Total £0</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td></td><td colspan="2">Projected 14/15 costs for Electricity North West</td><td>External £48,450
Internal £8,550
Total £57,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Network Utilisation</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Research</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>18</td><td>5</td><td>23</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">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</td></tr>
<tr><td>Expected Timescale to adoption</td><td>3 year</td><td colspan="2">Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td>75%</td><td colspan="2">Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£637,790</td></tr>
</table>

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 14	The project has only recently started
Collaborative Partners	None
R&D Providers	Manchester University

<table>
<tr><td>Project Title</td><td colspan="4">Transformer Investigation</td></tr>
<tr><td>Description of project</td><td colspan="4">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</td></tr>
<tr><td>Expenditure for financial year</td><td colspan="2">External £11,628
Internal £10,625
Total £22,253</td><td>Expenditure in previous (IFI) financial years</td><td>External £0
Internal £0
Total £0</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td colspan="2"></td><td>Projected 14/15 costs for Electricity North West</td><td>External £51,000
Internal £9,000
Total £60,000</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Asset Management</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Development</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>20</td><td>3</td><td>23</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">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</td></tr>
</table>

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 of Success	**£273,353**
Potential for achieving expected benefits	This work supports Electricity North West's wider transformer investigation programme with Manchester University		
Project Progress to March 14	Several inspections have been carried out with the results currently being analysed		
Collaborative Partners	ABB		
R&D Providers	Manchester University		

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 £3,206 Internal £5,671 Total £8,877		Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0
Project Cost (Collaborative + external + [DNO])			Projected 14/15 costs for Electricity North West	External £15,516 Internal £2,738 Total £18,254
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	75%		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 14	Initial trials have been held successfully and further performance data is being gathered
Collaborative Partners	None
R&D Providers	None

<table>
<tr><td>Project Title</td><td colspan="4">Cable Temperature Sensor</td></tr>
<tr><td>Description of project</td><td colspan="4">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%)</td></tr>
<tr><td>Expenditure for financial year</td><td colspan="2">External £42,184
Internal £890
Total £43,074</td><td>Expenditure in previous (IFI) financial years</td><td>External £0
Internal £0
Total £0</td></tr>
<tr><td>Project Cost (Collaborative + external + [DNO])</td><td colspan="2"></td><td>Projected 14/15 costs for Electricity North West</td><td>External £20,613
Internal £3,638
Total £24,250</td></tr>
<tr><td>Technological area and / or issue addressed by project</td><td colspan="4">Network Performance</td></tr>
<tr><td rowspan="2">Type(s) of innovation involved</td><td rowspan="2">Development</td><td>Project Benefits Rating</td><td>Project Residual Risk</td><td>Overall Project Score</td></tr>
<tr><td>17</td><td>4</td><td>21</td></tr>
<tr><td>Expected Benefits of Project</td><td colspan="4">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”</td></tr>
<tr><td>Expected Timescale to adoption</td><td colspan="2">2 year</td><td>Duration of benefit once achieved</td><td>10 years</td></tr>
<tr><td>Probability of Success</td><td colspan="2">50%</td><td>Project NPV = (PV Benefits – PV Costs) x Probability of Success</td><td>£190,118</td></tr>
<tr><td>Potential for achieving expected benefits</td><td colspan="4">The project is expected to significantly reduce the costs of wide scale network monitoring</td></tr>
<tr><td>Project Progress to March 14</td><td colspan="4">The project is on target for delivery in 2015 and has met all milestones</td></tr>
</table>

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 (DSM) solution to capacity release is appropriate			
Expenditure for financial year	External £18,293 Internal £0 Total £18,293		Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0
Project Cost (Collaborative + external + [DNO])			Projected 14/15 costs for Electricity North West	External £126,650 Internal £22,350 Total £149,000
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 and distributed generation (DG) scenarios 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	£4.1M

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 14	The project has only recently started
Collaborative Partners	None
R&D Providers	Manchester University

Project Title	**Ultra pole**			
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			
Expenditure for financial year	External £2,500 Internal £829 Total £3,329	Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0	
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	External £12,750 Internal £2,250 Total £15,000	
Technological area and / or issue addressed by project	Asset Management			
Type(s) of innovation involved		Project Benefits Rating	Project Residual Risk	Overall Project Score
		19	4	23
Expected Benefits of Project	Managing the transition to a low carbon economy	Unnecessary pole replacements could be avoided resulting in reduced field trips		
	Promoting energy savings	Reduced field trips, reduced emergency repairs and improved network performance		
	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.		
	Other benefits	Increased safety factors are the main benefit, with reduction in root digging and pole climbing except for emergency repairs. Improved network performance		
Expected Timescale to adoption	2 year	Duration of benefit once achieved	10 years	

Probability of Success	50%	Project NPV = (PV Benefits – PV Costs) x Probability of Success	
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 14	The project has only recently started		
Collaborative Partners	UKPN/NPG/SP/SSE		
R&D Providers	Acuity Products		

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 • If they do notice the change, it would not in the view of customers be sufficient to offset the cost of remedy. • at what levels do changes in voltage or THD become noticeable to customers			
Expenditure for financial year	External £96 Internal £11,779 Total £11,875	Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0	
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	External £285,600 Internal £50,400 Total £336,000	
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 14	The project has only recently started			
Collaborative Partners	None			
R&D Providers	Impact Research Ltd			

Project Title	**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 £0 Internal £952 Total £952	Expenditure in previous (IFI) financial years	External £0 Internal £0 Total £0
Project Cost (Collaborative + external + [DNO])		Projected 14/15 costs for Electricity North West	External £314,500 Internal £55,500 Total £370,000
Technological area and / or issue addressed by project	Network Performance		

Type(s) of innovation involved	Incremental	Project Benefits Rating	Project Residual Risk	Overall Project Score
		19	4	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 14	The project has only recently started			
Collaborative Partners	None			
R&D Providers	Kelvatek			

