electricity north west

Bringing energy to your door

NIA Progress Report

Programme Summary

31 July 2017

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REVIEW

Name	Role	Date
G Bryson	Innovation Engineer	10 July 2017
P Turner	Future Networks Delivery Manager	16 July 2017

APPROVAL

Name	Role	Signature & date
Steve Cox	Engineering & Technical Director	26 July 2017

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1 EXECUTIVE SUMMARY

Electricity North West is delighted to present this second summary of activities and learning from the projects funded under Ofgem's Network Innovation Allowance (NIA).

This summary will describe some of the findings and important learning from projects currently in flight, of which full information can be found in the associated annual reports on the ENA Smarter Networks portal.

During this second year of NIA-funded projects Electricity North West has closed six projects, expanded and built on ten current projects and registered two new projects, all of them reflecting the aims of the innovation strategy which was updated in March 2017.

The learning gained from the progression of these projects over the past year has developed as projects have progressed or come to a close. Highlighted below is some of what Electricity North West considers to be of significant importance for dissemination to the electricity community.

2 INNOVATION STRATEGY

In March 2017 Electricity North West updated its innovation strategy. The strategy still provides a clear link between the values and drivers for innovation objectives and project selection and delivery. It has been further developed to include thoughts on the future of DNOs and the potential emergence of the DSO.

The strategy is still easily accessible to stakeholders and demonstrates a clear and logical link from high level objectives to individual projects. The innovation strategy, this summary, the NIA project reports and many other supporting documents are easily accessible on the innovation pages of Electricity North West's website at www.enwl.co.uk/innovation.

Innovation is key to the success of the organisation. Electricity North West seeks to innovate continuously across its business activities to ensure that obligations to customers are met and that there is a response to customers' evolving needs and expectations.

Electricity North West is the leading network operator in innovation, providing flexible services at affordable prices with a well established track record. For further information on how Electricity North West has developed its strategy please see the previous NIA Summary Report which describes the company's strategy, innovation themes and the approach taken to the innovation and project lifecycle.

3 PROGRAMME OVERVIEW AND PROGRESS APRIL 2015 TO MARCH 2017

The following projects have been registered on the Smarter Networks Portal and have an annual report available on the portal and our own website.

Figure 1: NIA projects led by Electricity North West

Project							Joint	Timescales	Duration								
									2014	2015	2016	2017	2018	2019	2020	2021	2022
Demand Scenarios with Electric Heat & Commercial Capacity Options		✓	✓	✓		✓	No	May 2015 – Oct 2016				COMPLETED					
Distribution Asset Thermal Modelling			✓	✓			No	Jul 2015 – Jan 2017					COMPLETED				
P2/6 Rewrite		✓					Yes (ENW lead)	Jan 2015 – March 2016				COMPLETED					
Combined Online Transformer Monitoring				✓			No	Sep 2014 – Sep 2017									
Asset Risk Optimisation	✓	✓		✓			No	Jul 2015 – Jul 2017				COMPLETED					
Sentinel	✓	✓		✓	✓		No	Sep 2015 – Sep 2019									
Reliable Low Cost Earth Fault Detection for Radial OHL Systems	✓	✓		✓	✓		No	Oct 2015 – Oct 2017									
ATLAS		✓	✓	✓			No	Oct 2015 – Nov 2017									

Project							Joint	Timescales	Duration								
									2014	2015	2016	2017	2018	2019	2020	2021	2022
Cable Health Assessment – Low Voltage	✓	✓		✓			No	Nov 2015 – Nov 2018									
Value of Lost Load				✓	✓		No	Oct 2015 – Jan 2017									
Enhanced Voltage Control		✓		✓	✓		No	Nov 2015 – Nov 2018									
Investigation of Switchgear Ratings	✓	✓	✓	✓			No	Dec 2015 – Dec 2016				COMPLETED					
Detection of Islands	✓			✓	✓		No	Dec 2015 – Jun 2018									
Optimisation of Oil Regeneration				✓	✓		No	Feb 2016 – Feb 2022									
Tapchanger Monitoring	✓			✓			No	Feb 2016 – Feb 2020									
Future Network Modelling Functions			✓	✓			No	Mar 2016 – Sep 2017				COMPLETED					
Electricity & Heat			✓	✓	✓		No	Jul 2016 – Jul 2018									
Project Avatar					✓	✓	No	Oct 2016 – Dec 2019									

Find out more about all our NIA projects at www.enwl.co.uk/innovation.

Project NIA-ENWL003 – Review of Engineering Recommendation P2/6 was registered by Electricity North West but the majority of the work is delivered through a dedicated ENA working group chaired by Electricity North West. It was agreed that the first stage of this project, the research stage, would be funded through the NIA. There is a further piece of work which is ongoing which will be funded by other means as agreed by all DNOs involved.

The following projects have been registered, led and reported by other organisations, but are supported by Electricity North West.

Figure 5: NIA projects supported by Electricity North West

Project							Joint	Timescales	Duration								
									2014	2015	2016	2017	2018	2019	2020	2021	2022
Reactive Power Exchange Application Capability Transfer (REACT)		✓	✓	✓			Yes (NGC lead)	May 2015 – May 2017		■	■	■					
Smart Grid Forum workstream 7 DS2030			✓	✓		✓	Yes (NGC lead)	Jul 2014 – Sep 2015	■	■							
Improved Statistical Ratings for Distribution Overhead Lines			✓	✓			Yes (WPD lead)	Jul 2015 – Jan 2018		■	■	■	■				
Environmentally Acceptable Wood Pole Pre-treatment Alternatives to Creosote (APPEAL)	✓						Yes (SP EN lead)	Mar 2016 – Sep 2018			■	■	■				
Management of plug in vehicle uptake on distribution networks			✓	✓	✓	✓	YES (SSE lead)	Mar 2016 – Jan 2018			■	■	■				

The individual project progress and completion reports reflect the depth of work completed. Our projects reflect a variety of delivery mechanisms and a wide range of partner engagement from business and customer experts, technology producers and developers as well as industry bodies and collaborations.

4 AREAS OF SIGNIFICANT NEW LEARNING

A number of areas of significant new learning have been observed during 2016/17. In addition to the learning gained from NIA projects Electricity North West has two Second Tier and one NIC project ongoing and the business is currently engaged in transferring the CLASS Second Tier project to business as usual.

The learning gained is shared at dissemination events and on our website and influences all projects that Electricity North West is involved in.

Key learning from specific NIA projects includes:

Value of Lost Load

Results from the first phase of the VoLL survey are currently being analysed. As was anticipated, early indicators have identified distinct variations in VoLL across a broad spectrum of customers.

The application of a revised segmented VoLL will be attractive because it does not involve a significant change in the way that DNOs assess the benefits of lost load mitigation. Rather, it allows them to refine their models to produce a more precise method for prioritising investment. Early analysis suggests that optimised customer communications strategies might provide a financially efficient means of mitigating the impact of supply interruptions over other support mechanisms. For instance, the survey suggests that a phone call made directly to a domestic customer's land line is three times as important in mitigating the impact of lost load than updates provided via social media.

In the forthcoming phase of research, we intend to extend this analysis to reviewing the interaction between expectations of enhanced support and the duration of supply interruptions.

ATLAS

The ATLAS project focuses on developing new methodologies and tools for the long-term forecasting of active (P) and reactive (Q) power demand, for use in strategic planning of the network.

Building on learning from our Demand Scenarios NIA project, a prototype integrated P forecasting model was successfully developed for all our GSP, BSP and primary substations. This draft model was able to quantify daily and seasonal effects on true and latent demand in each scenario – from factors including uptake in new technology (eg electric vehicles, air conditioning, heat pumps), distributed energy resources (eg PV, wind and CHP, flexible gas plant), alongside the impacts of economic growth, energy efficiency and demographics on underlying domestic and non-domestic demand.

This work incorporated a new approach to deriving the weather-dependence of customer demand on each substation, as opposed to applying the same national factor to every substation. This required five years of processed half-hourly true demand data to be provided per substation, in order to derive the temperature and daylight correlations.

Regarding Q demand forecasting, the proposed methodology combines historical trends in Q/P ratios at primaries with the P forecast mentioned above, and then uses time-series network modelling to capture the considerable impacts of the network above the primary on Q at BSPs and GSPs. This Q modelling was successfully validated using half-hourly monitored demand data, overcoming significant changes in time-series modelling of extended 132 to 33kV networks and in applying analytical approaches on big data (half-hourly demand data across all GSP, BSP and primary substations). This identified that special concern needs to be taken to find the desired balance between computational cost and memory limitations in a practical application of the modelling.

Oil Regeneration

For the second stage of oil regeneration to be successful and accelerate the migration of moisture from the papers into the oil, thereby 'cleaning' the papers, requires the transformer to be maintained at a temperature of 65-85°C. This stage was initially conducted with the transformer on load, but just being on load was found to be not enough to maintain the temperature. Electricity North West investigated methods to maintain the temperature and now applies thermal blankets to the transformer in addition to the transformer on load. The blankets cover the main tank and half of the radiators with care taken not to enclose the tapchanger.

Asset Risk Optimisation

The success of this project has allowed Electricity North West to make the decision to move to a wide scale implementation of an optimisation software package. The project has allowed Electricity North West to understand the potential role of optimisation in improving efficiency to deliver risk mitigation targets. It has further promoted the possibility of applying the technique to other workstreams. Electricity North West believes that over time the application of the techniques will assist in driving efficient delivery in all areas of the business.

Distribution Asset Thermal Modelling

The analysis carried out in this project has shown that electric vehicle charging has little effect on the acceleration of thermal ageing and the reduction of a distribution transformer's life. This is due to the cyclic nature of charging meaning that the higher load and temperature during charging is compensated by the lower values at other times.

Future Network Modelling

The analysis carried out in this project has shown that significant changes are required to model networks in the future such as:

- Planning capabilities are making a step change from worst case deterministic evaluation to a probabilistic time-series risk base approach in many cases
- The capability to provide load data topologically linked to a temporally indexed running arrangement will become more important so that historical switch states and running arrangements and their effects can be taken in to account
- The planning capability at low voltage will need significant enhancement with disruptive low carbon technologies driving the need for unbalanced four wire power-flow analysis and MPAN-level load and generation time series data
- Operational planning capabilities in relatively short time horizons will need to be delivered to support effective DSO enablement.

Reliable, low cost earth fault detection for radial OHL system faults

Initial load measurements from the units installed in the field suggest that load currents could be lower, on average, than values determined by network modelling packages. An ancillary benefit of the OHL FPIs could be to inform planning activities, removing uncertainties, through improved visibility of the overhead line network and its relative loading levels.

BAU transition

Electricity North West is or is in the process of transferring elements of some of its NIA projects into business as usual.

The Demand Scenarios project is already providing more granular information and has allowed much improved peak load forecasting. This improved forecasting has been used to improve reporting and load related planning since summer 2016.

The combined online monitoring project has produced a code of practice on transformer management which is being used by the business to carry out oil regeneration along with refurbishment of bushings, tap changers and other ancillary equipment.

As stated previously the company is currently purchasing an asset risk optimisation software package to allow the rollout of this concept across the business.

The learning from the Distribution Asset Thermal Modelling project is being used to inform the development of the thermal ratings tool as part of the Celsius project.

Additionally the learning from Second Tier project CLASS has provided the knowledge to roll this out as a business as usual solution funded under a directly remunerated service mechanism to provide services to National Grid.

Summary

Our continuous improvement journey is led by the needs of our customers. Our approach to innovation is underpinned by the aim to understand and respond to the changing needs of our customers. Collaboration with partner organisations is vital in this arena and we have found it invaluable to work with our project partners within the NIA to ensure that potential innovation solutions deliver customer benefits.

We recognise that significant learning can be gained from these NIA projects and aim to disseminate this information and any lessons learned to the DNO community and the wider electricity industry.