electricity north west

Bringing energy to your door

NIA Progress Report

Programme Summary

31 July 2019

VERSION HISTORY

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REVIEW

Name	Role	Date
Geraldine Paterson	Innovation Engineer	23 July 2019
Paul Turner	Innovation Manager	23 July 2019

APPROVAL

Name	Role	Date
Steve Cox	Engineering & Technical Director	31 July 2018

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1 EXECUTIVE SUMMARY

Electricity North West is delighted to present this fourth 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 and recently closed down, of which full information can be found in the associated annual reports on the ENA Smarter Networks portal.

During this fourth year of NIA-funded projects Electricity North West has closed a further four projects, and has registered five new projects. There are currently 11 projects in flight all of which reflect the aims of the innovation strategy which was updated in June 2019.

Highlighted below is a brief synopsis of what Electricity North West considers to be important for dissemination to the electricity community.

2 INNOVATION STRATEGY

Electricity North West updated its innovation strategy in June 2019. The strategy still provides a clear link between the values and drivers for innovation objectives and project selection and delivery and includes our thoughts on the future of distribution network operators (DNOs) and the potential emergence of the distribution system operator (DSO).

The strategy is 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.

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 was also heavily involved in the formation and production of the National Innovation Strategy published by the ENA in March 2018.

3 PROGRAMME OVERVIEW AND PROGRESS APRIL 2015 TO MARCH 2018

The following projects have been registered on the Smarter Networks Portal. In-flight projects have an annual report available on the portal and on our own website. For completed projects a closedown report is available on the NIA portal and our 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 led)	Jan 2015 – March 2016				COMPLETED					
Combined Online Transformer Monitoring				✓			No	Sep 2014 – Sep 2022									
Asset Risk Optimisation	✓	✓		✓			No	Jul 2015 – Jul 2017					COMPLETED				
Sentinel	✓	✓		✓	✓		No	Sep 2015 – Dec 2023									
Reliable Low Cost Earth Fault Detection for Radial OHL Systems	✓	✓		✓	✓		No	Oct 2015 – Oct 2017					COMPLETED				
ATLAS		✓	✓	✓			No	Oct 2015 – Nov 2017					COMPLETED				

Project							Joint	Timescales	Duration								
									2014	2015	2016	2017	2018	2019	2020	2021	2022
Cable Health Assessment – Low Voltage	✓	✓		✓			No	Nov 2015 – Aug 2021									
Value of Lost Load				✓	✓		No	Oct 2015 – Oct 2018					COMPLETED				
Enhanced Voltage Control		✓		✓	✓		No	Nov 2015 – Nov 2018						COMPLETED			
Investigation of Switchgear Ratings	✓	✓	✓	✓			No	Dec 2015 – Dec 2016				COMPLETED					
Detection of Islands	✓			✓	✓		No	Dec 2015 – Sep 2018						COMPLETED			
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						COMPLETED			
Project Avatar					✓	✓	No	Oct 2016 – Dec 2021									

Project							Joint	Timescales	Duration								
									2014	2015	2016	2017	2018	2019	2020	2021	2022
Interface	✓	✓		✓	✓		No	Oct 2018 – Oct 2021					■	■	■	■	
Machine Learning	✓	✓		✓	✓		No	Oct 2018 – Oct 2021					■	■	■	■	
VOLL 2				✓	✓		No	Nov 2018 – May 2020					■	■	■	■	
Reflect		✓	✓	✓	✓		No	Mar 2019 – Mar 2021						■	■	■	

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

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		■	■	■	COMPLETED				
Smart Grid Forum workstream 7 DS2030			✓	✓		✓	Yes (NGC lead)	Jul 2014 – Sep 2015	■	■			COMPLETED				
Improved Statistical Ratings for Distribution Overhead Lines			✓	✓			Yes (WPD lead)	Jul 2015 – Jan 2018		■	■	■	■	COMPLETED			
Environmentally Acceptable Wood Pole Pre-treatment Alternatives to Creosote (APPEAL)	✓						Yes (SP EN lead)	Mar 2016 – Sep 2018			■	■	■	COMPLETED			

Project							Joint	Timescales	Duration								
									2014	2015	2016	2017	2018	2019	2020	2021	2022
Management of plug in vehicle uptake on distribution networks			✓	✓	✓	✓	YES (SSE lead)	Mar 2016 – Jan 2018						COMPLETED			
Engineered Pole Products	✓			✓			Yes (UKPN lead)	July 2018 – Jan 2020									

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

Further areas of new learning have been observed during 2018/19. In addition to the learning gained from NIA projects Electricity North West one NIC project ongoing. Our Second Tier projects Smart Street and Respond have been closed down and the outcomes of these projects can be found on the project websites.

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

Key learning from specific NIA projects includes:

4.1 Value of Lost Load

Following a detailed programme of research involving 6,000 customer surveys, the Value of Lost Load (VoLL) project has reached completion.

The project study demonstrated that VoLL is now higher than when estimated during the last major study for Ofgem in 2013. VoLL estimates are substantially higher for less affluent groups, particularly those classified as 'fuel poor'. When adjusted to reflect income, the VoLL of customers with vulnerabilities is also well above the average. This finding demonstrates that Ofgem's focus on identifying and tackling consumer vulnerability in the energy market is justified. VoLL was also found to be higher than the average in the 30-44 age group, which is likely to reflect the greater impact of interruptions on families with children. Predictably VoLL was higher than average for customers without a mains gas supply, where electricity is the primary source of energy.

VoLL estimates vary significantly relative to the scale and duration of an outage. The study also demonstrated that it is possible to mitigate the impact of an outage and lower VoLL by offering various support mechanisms to customers.

One of the key objectives of this study was to investigate potential changes in VoLL in a low carbon future. The analysis established that VoLL for domestic customers using Low Carbon Technologies (LCTs) is significantly higher than the average and this was particularly apparent for users of electric vehicles (EVs) who expressed a VoLL of almost 25% above the average. This is a significant finding and has important implications for future network investment strategies and design policy as it suggests that VoLL is set to increase in line with the projected uptake of LCTs.

The results of this study provide evidence that a single uniform VoLL may no longer be appropriate and the research allows a much more representative VoLL model to be established. This more sophisticated approach will significantly improve efficient targeting of investments and ensure those investments are based on a much richer and more representative understanding of customers' needs.

It concludes that the current universal VoLL undervalues the needs of certain customers, for example those dependent on LCTs, off-gas customers and the fuel poor. Similarly, it may over-represent the needs of other customer groups.

The research demonstrates the different impacts of supply interruptions across a range of domestic and SME sub-groups. It reveals that the range of values is almost double when considering the lowest to highest estimates reported.

The conclusions and recommendations report published on 5 October 2018, makes suggestions for how a revised VoLL might be applied, summarises the standard industry data used in the study and provides details of other external data sources that could be exploited to enhance the proposed VoLL calculation tool.

A revised, segmented VoLL model is 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 strategies which focus on the impact of decisions. This alternate approach would enable DNOs to re-distribute investment without increasing customers' bills to deliver the greatest value now and into the future. These findings are likely to have an impact on Electricity North West's social obligations and influence how the company adapts its response to customers on the priority services register and the company's solutions for addressing fuel poverty.

4.2 Detection of Islands

The purpose of this project was to produce a proof of concept paper and associated functional specification on the use of SCADA and ADMS to detect and fragment islands formed on the distribution network.

Our project partner, WSP, carried out some modelling on Electricity North West's network out of Heysham GSP.

The modelling results showed that there is a significantly wider load range over which an island can be sustained when using the new G99 settings compared to the older G59 settings, thereby significantly increasing the risk of island formation.

Once an island is formed, it can be detected by the presence of voltage and frequency in the isolated network.

An ADMS or network management system (NMS) has the functionality to detect the status of network switches and includes a tracing facility that can identify if part of a network is energised from a grid supply point. By correlating the information of switch statuses at strategic locations and the measurement of local network parameters such as voltage and frequency the detection of an island can be achieved.

If it is acceptable to be operated as an island, the network switches that are associated with the potential island network should be monitored as well as the voltage and frequency of the island network. As frequency is currently not monitored in the distribution network, deploying frequency monitoring devices at strategic locations of a distribution network that have a high probability of forming an island should be explored.

When re-connecting to the grid after the fault is cleared, generators must be controlled so that voltage magnitude, phase and frequency between the island and main grid are within the limits for synchronisation as unsynchronised reclosing can result in damage to network assets and customer equipment.

Alternatively, if the island needs to be shut down it can be done manually and reenergised from the DNO network in stages. This is of course an economic decision which must consider CI and CML costs.

4.3 Sentinel

Installation for the Sentinel project has progressed during the year. It is hoped that data from this new fault location equipment could significantly improve our ability to locate overhead line faults.

Since December 2018, 19 sentinel units have been installed and these are all reporting back to the Kelvatek server. Analysis is ongoing to identify the operational trigger values for the previously developed algorithms. Initial results have shown that the devices have a reach of approximately 1.5km.

4.4 Enhanced Voltage control

This project investigated new Automatic Voltage Control settings to cater for increasing levels of generation on the distribution network.

Modelling and simulation work was conducted by our project partner, Fundamental, which resulted in new settings which were applied at a trial site and monitored for 12 months. The trial site was chosen as historic voltage control schemes have struggled because the net power flow measured at the transformer is at or about 0MW and the power factor constantly fluctuates due to reactive power flow. Analysis of the new settings showed that they:

- achieved smooth paralleling of the transformers,
- overcame the 'voltage rise at the point of common coupling' issue introduced by distributed generation,
- offset the voltage drop across the feeders, and
- paralleled adjacent substations successfully

Following the successful outcome of the trial Fundamentals produced an "Enhanced Automatic Voltage Control Settings Calculation Guide" which guide provides the knowledge required to design and calculate the settings to accommodate for basic and advanced voltage control applications. Fundamentals also produced some guidance on voltage managed connections for generators. Electricity North West is currently updating internal policies to reflect the findings of this project and allow enhanced settings to be used for generators.

5 BAU TRANSITION

Electricity North West has been in the process of transferring elements of some of its NIA projects into business as usual as previously reported in 2017 and 2018. This financial year the reliable, low cost earth fault detection for radial OHL system faults project which specified, developed, tested, and demonstrated communicating FPI units for 6.6/11kV overhead distribution networks has moved in to BAU. The FPIs are being integrated into Electricity North West's existing network management system allowing for real time fault detection that can speed up tele-controlled switching, improve field staff deployment and increase efficiency of automatic restoration systems.

As stated previously as part of the Enhanced Voltage Control project Fundamentals produced an "Enhanced Automatic Voltage Control Settings Calculation Guide" and guidance for voltage managed connection which are currently being incorporated into our voltage control policy to reflect the findings of this project and allow enhanced settings to be used for generators.

6 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.