Date of Submission

October 2015

NIA Project Registration and PEA Document

Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

Project Registration

Project Title	Project Reference
ATLAS - Architecture of tools for load scenarios	NIA_ENWL008

Project Licensee(s)	Project Start Date	Project Duration
Electricity North West Limited	Nov 2015	2 Years 1 Months

Nominated Project Contact(s)	Project Budget
Steve Cox, Head of Engineering (Project Champion) steve.cox@enwl.co.uk	£600,000

Problem(s)

Loading is the basis of the requirement for distribution network capacity. It thus supports all distribution network investment, either directly or indirectly. Trends in network loading are a combination of demand and generation, and are increasingly uncertain under the transition to a lower-carbon economy. In the last three years we have focused on developing understanding of winter peak loading on the network, and its future uncertainty. However given the modest outlook for peak demand, future load-related investment requirements are likely to be driven not just by changes in peak demand, but also by changes in minimum load / reverse power flows and in reactive power flows. There is increasing focus from National Grid and Ofgem on reporting and forecasting of these changes. More onerous compliance requirements at minimum demand at Grid Supply Points (GSPs) are likely in future based on implementation of the forthcoming European Demand Connection Code, and changes to the Statement of Works process. Our current load analysis and scenario processes do not address these needs, so there is a need to develop automated tools to deliver this wider scope of load analysis, and to do this consistently across all network assets. A better understanding of current and future loading, and how this compares to capacity, could also be used to improve information to connnections customers.

Method(s)

The ATLAS project is focused on the technical development of improved methods of load estimation, creation of scenarios, and indicative comparison to network capacity, rather than technical or commercial solutions to any loading constraints identified.

Phase 1 - Detailed scoping of requirements, plus identification and appraisal of potential methods for correcting baseline data and generating scenarios - 3 - 6 months

Phase 2 - Methodology development, including specification and creation / procurement of any new inputs to the future scenarios, a full prototype of the Grid and Primary tool (GSP Connection groups, GSPs, BSPs, Primaries) and partial prototypes of the secondary networks tool - 15-18 months

Phase 3 - Specification for final tools - Grid & Primary, secondary networks and any cross-over interface - 3 months

Scope

The scope of the future analysis needs to expand from the existing focus on peak loading in MVA, based on winter peak MW loading.

The expanded analysis will cover winter and summer conditions, both peak loading and minimum or reverse power flow, including the effects of generation. The outputs will include indicative comparisons to thermal capacity. Future loading will be expressed with

uncertainty eg scenarios and volatility measures.

This will be delivered in a consistent way across all distribution network assets - GSP, BSP, Primary and secondary networks - although the implementation will differ. In particular the Grid and Primary analysis will be per substation, corrected for weather and generation effects, and cover the range of active power flows, reactive power flows, apparent power, power factor and load factor over a year (P, Q, MVA, pf, LF). For the secondary networks, given the lack of historic data on loading and uncertainty in local geographical spread of new technology, there will be a simpler analysis, and future scenarios will be interpreted on a volume basis ie suggesting a number of assets exceeding capacity in future.

The project will deliver the methodology, prototypes and specifications for an enduring automated business solution to analysing current load, generating future scenarios and providing indicative capacity assessments.

The project will build on the analysis and tools developed in elements of the following other Electricity North West innovation projects

- Low Voltage Network Solutions (2011-2014) eg Future Capacity Headroom model of the secondary networks

- Demand Forecasts and Real Options (IFI) - 2013-2015

- Demand Scenarios with Electric Heat and Commercial Capacity Options (NIA) - 2015-2016 - developing peak demand scenarios at Grid and Primary

- Reactive Power Exchange Application Capability Transfer - REACT (2013-2015) with National Grid and all DNOs

Objective(s)

The ATLAS project will develop the Method to deliver historic estimates and future annual scenarios of asset loading to 2031, and make indicative comparisons of these to thermal capacity. This will provide inputs to network / business planning, information for stakeholders and help fulfil mandatory reporting requirements

This project supports four primary objectives.

1. to support efficent decisions about load-related investment in the RIIO-ED1 regulatory period (2015-2023)
2. to justify the plan for efficent load-related investment in the RIIO-ED2 regulatory period (2023-2031)
3. to more efficiently and accurately meet our 'Week 24' reporting obligations to National Grid, and support compliance with future restrictions on the operational envelope of GSPs.
4. to provide better information to stakeholders and customers, enhancing customer service.

By better understanding current and future loading, this will support the business to only provide necessary network capacity and investments, thus minimising the economic and environmental impact of the networks.

Success Criteria

1. Automate correction and analysis of peak and minimum load behaviour across all Grid and Primary substations
2. Deliver a prototype tool for annual P and Q load estimates and indicative capacity assessments across all Grid and Primary substations, including to automate delivery of a wider scope of estimates and scenarios of GSP Connection Group loadings to National Grid in the 'Week 24' submission, and for future regulatory reporting required by Ofgem.
3. Amend internal policies accordingly, and specify the business-as-usual approach for Grid and Primary substations
4. Deliver partial prototypes of load estimates and indicative capacity assessments across the secondary network, and specify the future business-as-usual system to be based on the improved load estimates expected to be available from 2018 onwards.

Technology Readiness Level at Start	Technology Readiness Level at Completion
2	6

Project Partners and External Funding

There are no project partners or external funding, but other DNOs and National Grid will be invited to review elements of the developing methodology.

Potential for New Learning

There is particular potential for new learning in the following areas

- implementing corrections for weather and generation to historic time series of Grid and Primary loading

- identifying peaks and minimum from raw historic time series - given the spikes, data loss and switching / maintenance actions which need to be disregarded

- generating credible scenarios of minimum demand and reactive power flows

- specifying and integrating scenarios of distributed generation as part of minimum loading estimates

- understanding the potential scale of summer air-conditioning load across a distribution network

- better assessing the contribution of distributed generation to capacity at peak and minimum loading

- creating and integrating appropriate input sources from available data to estimate reactive power gain

- implementing methodologies for automatic indicative comparisons of load to capacity across all assets

- specify systems for load estimation, creation of scenarios and comparison to capacity, consistently for Grid and Primary and the secondary networks although not necessarily in the same system

Scale of Project

The methodology, new input sources, and tool specifications will be developed for the whole Electricity North West network area, covering all GSPs, GSP connection groups, BSPs, Primaries and secondary network assets (HV feeders, distribution transformers, LV feeders).

Protoypes may be delivered for more limited sets of assets, as proof of concept.

Geographical Area

See above 'scale of project'

Revenue Allowed for in the RIIO Settlement

None.

Indicative Total NIA Project Expenditure

£600,000

Project Eligibility Assessment

Specific Requirements 1

1a. A NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

A specific piece of new (i.e. unproven in GB, or where a Method has been trialled outside GB the Network Licensee must justify repeating it as part of a Project) equipment (including control and communications systems and software)	☐
A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)	☒
A specific novel operational practice directly related to the operation of the Network Licensees System	☐
A specific novel commercial arrangement	☐

Specific Requirements 2

2a. Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees ☒

Please answer one of the following:

i) Please explain how the learning that will be generated could be used by relevant Network Licenses.

The project will deliver the methodology, prototypes and specifications for an enduring automated business solution to analysing current load, generating future scenarios and providing indicative capacity assessments. This will be tailored to Electricity North West's systems and data, but available to all DNOs, since all DNOs face these challenges and may wish to adapt / adopt the project outputs for their own purposes.

ii) Please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the Project.

Electricity North West published its updated innovation strategy in March 2015. This Project addresses aspects of the challenges described in the 'Load Impact Modelling' section.

2b. Is the default IPR position being applied?

Yes	☒
No	☐

If no, please answer i, ii, iii before continuing:

i) Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties

ii) Describe any potential constraints or costs caused or resulting from, the imposed IPR arrangements

iii) Justify why the proposed IPR arrangements provide value for money for customers

2c. Has the Potential to Deliver Net Financial Benefits to Customers ☒

i) Please provide an estimate of the saving if the Problem is solved.

This project is about developing the approach to deliver loading information which is currently absent, without excessive cost to the DNO, in order to enable well-justifed and efficient load-related expenditure in future. That is the Problem being solved.

The Project is not specifically about saving money, as due to changes in the outlook for load growth, such as the speed of progress with energy efficiency and heat pump deployment, the justified expenditure may be higher or lower than the business plan submission. However by providing credible loading information, it enables efficient decisions on many tens of millions of pounds of investment, as described in the next section.

ii) Please provide a calculation of the expected financial benefits of a Development or Demonstration Project (not required for Research Projects). (Base Cost – Method Cost, Against Agreed Baseline).

The evaluation of financial benefits here concentrates on the value of better understanding just one element of loading within the scope of the project – reactive power exports from DNOs to National Grid at GSPs.

The scale of reinforcement expenditure for Electricity North West over 8 years in the RIIO-ED1 well justified business plan is around £100m, and the outputs of this project will provide the evidence to ensure this an efficient spend. Expenditure for managing reactive power exports from the distribution network to transmission was not included in the RIIO-ED1 well justified business plan.

The collaborative REACT project has just completed its two-year analysis led by the University of Manchester. REACT developed a high-level methodology for how DNOs could estimate reactive power exchanges at GSPs, which this project will further develop and implement. Within REACT, based purely on extrapolating recent past trends at Primary level for minimum active power demand and associated reactive power, the project identified that if DNOs were to be required under the forthcoming Demand Connection Code to avoid reactive power (Q) exports from GSPs, and this was achieved via shunt reactors switched in at times of low load (three significant assumptions), the capital cost to Electricity North West was estimated in the range of £15-40m by 2018. There would also be an associated losses impact, and further costs during ED1 if the network's underlying Q demand continued to fall.

So the scale of costs is potentially significant - the Methods developed in the ATLAS project would allow a DNO to better quantify the scale of the issues, allowing decisions to be taken outside of the ATLAS project on the most cost-effective way to solve problems related to minimum demand and associated reactive behaviour, so that appropriate solutions can be implemented. For example, the improved load scenarios would be used in the assessment of whether to install shunt reactors, tap-staggering at primary substations or alternative techniques.

iii) Please provide an estimate of how replicable the Method is across GB in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

It is anticipated that the Methods would be applicable to the Strategic Planning functions in every DNO licence area. However they may be more or less directly applicable, depending on the availability of data on the network and its loading e.g. history of P and Q at Grid and Primary substations by half hour, history of generation outputs, weather history, network susceptibility data, load estimates on the secondary networks.

iv) Please provide an outline of the costs of rolling out the Method across GB.

As outlined above, this would depending on the DNO's existing data and systems, but a budget estimate of £300-500k per licence area, so a GB roll-out cost of around £4-6m. The REACT project demonstrated that the Electricity North West network was relatively well served in terms of availabiity of historic load data.

2d. Does Not Lead to Unnecessary Duplication 

i) Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

The project builds on a number of previous Electricity North West projects (as listed in the Scope) and the REACT project. It will also learn from related work in the Scottish Power Flexnet project and Northern Power Grid's IFI / NIA projects on Demand estimation forecasting. However there is no duplication as no other project has tried to create an integrated approach to Grid and Primary and secondary networks load estimation and capacity assesment, or to include minimum demand and reactive power consistently with peak demand, and to create an approach to these which a DNO could apply to loading across its actual network assets.

ii) If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.