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NIA Project Registration and PEA Document

Date of Submission

Nov 2014

Project Reference Number

NIA_NGET0154

Project Registration

Project Title

Smart Grid Forum Work Stream 7

Project Reference Number

NIA_NGET0154

Project Licensee(s)

National Grid Electricity System Operator

Project Start

July 2014

Project Duration

1 year and 6 months

Nominated Project Contact(s)

Vandad Hamidi

Project Budget

£750,000.00

Summary

WS7 of the Smart Grid Forum, through its Steering Group "WS7 SG" for this study, wishes to undertake more detailed electrical power system analysis (using nodal network models) of the electricity system of 2030, with particular focus on the distribution networks, their design and, critically, their operation.

Essentially, this WS7 study is addressing the modelling compromises that are inherent in Transform's parametric network modelling approach. Transform's parametric representation of typical distribution networks are to be converted into nodal models in order to explore, through appropriate network studies, how the Transform solutions 'work' and what currently unforeseen challenges might emerge.

Nominated Contact Email Address(es)

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Problem Being Solved

The DECC/Ofgem Smart Grid Forum was created by the Department of Energy and Climate Change (DECC) and Ofgem to support the UK's transition to a secure, safe, low carbon, affordable energy system. The main issue discussed within the DECC/Ofgem Smart Grid Forum is how electricity network companies will address significant new challenges as they play their role in the decarbonisation of electricity supply. The Smart Grid Forum has established a number of Work Stream (WS) to examine particular aspects of future networks.

This Specification of work for a WS7 study is a continuation of work started by WS2 and continued by WS3 to deepen our understanding of what a future distribution network is and how it will operate.

The first issue, which was pursued in WS2 was; do smart grids make economic sense? WS2 (ref 2) answered this in the affirmative, albeit it at a very high level, with its cost-benefit analysis (CBA). This was followed by a detailed study into what this smart grid might consist of. WS3 addressed this with the Transform model (ref 3), based on the work of WS2, but providing much more detail about the

solutions that might be deployed and in what volume. However, the Transform model was not designed to validate the technical viability of the overall system it foresaw.

WS7 is a natural further progression into the detail, questioning how it can be ensured that the smart grid that Transform has described will be technically viable and to establish how the whole system might operate most efficiently and resiliently in a 2030 scenario with a clear focus on the impacts for our distribution networks. The purpose is to gain knowledge and confidence in our network/system development options to deliver a secure and affordable system and to feed this back into the development of commercial and regulatory analysis.

In summary therefore, this WS7 study is intended to carry out the technical analysis necessary to confirm in more detail how the types of networks described by the Transform outputs will be realised. This will both confirm its technical viability and provide an understanding of its characteristics, for example, to identify what control co-ordination may be required to ensure reliable and robust whole-system operation. Most importantly, it will, from a technical perspective, highlight any new roles and responsibilities that a DNO will be required to accept.

Method(s)

The preliminary "Schedule of Challenges for 2030" and respective "Questions to be Answered" have already been established by WS7, and provide the basis for the first two stages of work.

Stage 1 - Post Tender Discussions to confirm the availability of modelling tools, techniques and data sources, the approach proposed, depth and content of deliverables that will be required to address the issues identified in the list of Challenges and related Questions in Section 3 below.

Contract placed following Stage 1.

Stage 2 - Develop and agree two scenarios (i.e. 2030 scenarios), and the sensitivity testing to be applied, to be studied and the two 'base' networks to be used. The 'base' networks will be distribution focused but with sufficiently detailed representation of the whole system to ensure that whole systems issues can be modelled as required to address the Questions to be Answered.

Stage 3 At this point, the Lead Contractor shall provide a formal report on the findings to date. The Questions examined in Stage 2 will be reviewed with the Lead Contractor and WS7 SG members, in the light these findings, to ensure that there is a strong level of agreement about them, prior to commencement of the remaining three stages of work under the contract.

Discussions at this stage will confirm the use cases, and sensitivity analyses and will encompass the modelling tools and base networks described in Sections 4 and 5 here. The milestone at the end of Stage 3 will be confirmation by WS7 SG to the Lead Contractor of:

- The questions to be answered.
- The models to be used.
- The data (networks and scenarios) to be used
- the go ahead to proceed with the remainder of the contract

Stages 4,5 & 6

These Stages form the study execution phase. The base networks adopted in stage 3 will be developed (i.e. smart solutions and reinforcements applied) so that they are able to accommodate the plant/demand scenarios agreed in Stage 2. These 2030 networks will then be 'tested' in Stage 5 to see how they perform. It is expected that Stages 4 and 5 will iterate until viable 'solutions' are established which meet agreed performance criteria (see Para 6.2 below) . The approach to network modelling is discussed further in Section 4 of this report

Stage 4 – Propose developments to the 'base' networks to accommodate the 2030 scenarios, both at the level of power system architecture and power system equipment. This will highlight any material transition issues.

Stage 5 - Carry out the Studies (see 1.2) and report the results. The resilience of the system should be considered including its ability to be restored in the event of major failures.

Stage 6 - Identify potential new/changed activities/responsibilities necessary to allow successful operation of the 2030 system (the focus being the distribution system) and a comprehensive analysis of the results from Stage 5 will be carried out. This analysis will in turn provide answers to the questions set out in Section 3 in a form that is relevant to the respective stakeholders. There will also be a commentary on the reliance on input assumptions and therefore how stable/robust the answers are likely to be, together with

implications for future Research & Development.

Scope

WS7 of the Smart Grid Forum, through its Steering Group "WS7 SG" for this study, wishes to undertake more detailed electrical power system analysis (using nodal network models) of the electricity system of 2030, with particular focus on the distribution networks, their design and, critically, their operation.

Essentially, this WS7 study is addressing the modelling compromises that are inherent in Transform's parametric network modelling approach. Transform's parametric representation of typical distribution networks are to be converted into nodal models in order to explore, through appropriate network studies, how the Transform solutions 'work' and what currently unforeseen challenges might emerge.

Objective(s)

A key aim is to establish whether the roles and responsibilities of the parties that own, operate and interface with the electricity supply chain need to change and how.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The study outputs are likely to have several components. Firstly, there will be a set of generic nodal distribution network models that have been demonstrated to be technically viable to meet the needs of 2030 users. Secondly, there will be a report highlighting the specific methods/solutions that have been used to ensure the technical viability of these networks. This may suggest that early attention should be applied (e.g. specific demonstration projects during ED1) to particular methods/solutions to ensure that they can be successfully deployed when needed. Thirdly, the roles and responsibilities of a DNO in 2030 in terms of supporting whole system optimisation will be described and contrasted with the position today. Again, this would be expected to lead to specific pieces of further development work through ED1.

Project Partners and External Funding

n/a

Potential for New Learning

The Lead Contractor shall support WS7 SG in dissemination of progress and finding from this work, but is not required to set up or stage events. Learned Papers / Articles on the work are required to be passed in advance to the WS7 SG for agreement, and shall include acknowledgement of the Smart Grid Forum and the funding stream.

Scale of Project

The project seeks to look at 4 base networks and apply believable 2030 distribution network scenarios

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The work is applicable to GB electricity networks.

Revenue Allowed for the RIIO Settlement

Zero

Indicative Total NIA Project Expenditure

Total NIA project expenditure is £750,000

All project partners and external funding are shown below:-

- National Grid Electricity Transmission - £90,287
- Electricity North West Ltd - £52,013
- Northern Powergrid - £104,026
- Scottish Power Energy Networks - £104,026
- Scottish and Southern Energy Power Distribution - £104,026
- UK Power Networks - £156,039
- Western Power Distribution - £208,052

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

How the Project has potential to benefit consumer in vulnerable situations:

n/a

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

This project seeks to validate work carried out under WS3, which looked at the potential of smart solution to reduce capital expenditure on network infrastructure of approximately £1 billion

Please provide a calculation of the expected benefits the Solution

This project, if successful has the potential to validate the savings calculated by the transform model which are in excess of £1 billion.

Please provide an estimate of how replicable the Method is across GB

This project seeks to define requirements for network operators looking forward to 2030 and will be applicable across the whole UK network if successful.

All networks, including mesh networks will be considered.

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

Rolling out the method should not incur additional costs but rather reduce expenditure or validate expenditure.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 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 system 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

RIIO-2 Projects

- A specific piece of new equipment (including monitoring, control and communications systems and software)
- A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven
- A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)
- A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology
- A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution
- A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

All relevant Network Licensees are participating in the project and will be involved at all stages of the project

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

To be able to plan effectively in delivering a network that is able to deal with the changing energy futures, that include the electrification of heat and transport, the carbon reduction targets set by government whilst and at the same time remaining safe, reliable and cost effective.

- Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

- Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

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

A literature search and review of other similar work has been carried out, the project will not duplicate existing work.

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

n/a

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

n/a

Relevant Foreground IPR

n/a

Data Access Details

n/a

Please identify why the Network Licensees will not fund the project as apart of it's business and usual

activities

n/a

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

n/a

This project has been approved by a senior member of staff

Yes