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July 2019

Project Closedown Report Document

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Project Title

Risk Assessment and Modelling of Smart Network Solutions (RAMSES)

Project Reference

NIA_SSEN_0031

Funding Licensee(s)

Scottish Hydro Electric Power Distribution, Southern Electric Power Distribution

Project Start Date

October 2017

Project Duration

15 Months

Nominated Project Contact(s)

SSEN NIA Programme Delivery Manager –Joe McNeil

Year

2019

Scope

The project ran for a period of 15 months and was delivered across three work packages. The scope of each work package is shown below with clearly defined deliverables.

Phase One – Model Preparation

1. Create a consolidated list of smart network solutions e.g. energy storage & demand side response (DSR) for risk analysis modelling in phase two.
2. Summarise and document risk data from interviews with subject matter experts in the field of smart network solutions.
3. Utilise the PESTLE framework to detail risks associated with smart network solutions.
4. Create risk curves for each smart network solution that can be utilised as an input into the Imperial College (IC) model, utilised in phase two.

Phase Two – Model Analysis

5. Collate, review and quality check input data that will be fed into the IC model.
6. Run the IC model for the selected smart network solutions against desired scenarios.
7. Perform sensitivity analysis on model outputs to create more robust results.

Phase Three – Model Interpretation & Closedown

8. Report on the key insights from desk research, interviews and model analysis.
9. Create a list of key stakeholders interested in the process of risk communication and a brief profile of motivations and expectations.
10. Report on the risk communication framework to act as a high-level guidance on estimating and communicating risks for stakeholders.

11. Create a close down report summarising method, key learnings, recommendations and identified next steps.

Objective(s)

Understanding the risks and complexities of smart network solutions and how they are critical to allow network operators to balance costs, network reliability and resilience.

The objectives are:

1. Enable better understanding of the underlying risks that arise from deployment of smart network solutions.
2. Create a modelling tool that is able to test different investment strategies and calculate their associated risks.
3. Use model results to develop a new framework and communication strategy that highlights the risks associated with deployment of smart network solutions.

Success Criteria

This project will be a success if:

1) Understanding of risks associated with deployment of smart network solutions is improved vs current understanding and these learnings are documented coherently. Where understanding is not improved any further, a clear path to improving understanding is documented, as well as the failures/learnings encountered by this project.
2) A model is created that is able to test different investment scenarios in order to provide risk outputs, which can help inform investment and strategy decisions. Where a model is created to test different scenarios but is unable to provide usable risk outcomes to inform investment decisions then a clear roadmap on how to improve the model to meet this goal must be provided as well as documenting lessons learned/failures.
3) A framework/communication strategy is created that utilises the learning from this project to inform DNOs of the different risks associated with smart network solutions. Where learnings are inadequate to produce a framework/communication strategy then learnings must be documented with a clear research path necessary to meet this objective.

Performance Compared to the Original Project Aims, Objectives and Success Criteria

1. Enable better understanding of the underlying risks that arise from deployment of smart network solutions.

Success Criteria

Understanding of risks associated with deployment of smart network solutions is improved vs current understanding and these learnings are documented coherently. Where understanding is not improved any further, a clear path to improving understanding is documented, as well as the failures/learnings encountered by this project.

Performance

The project developed a risk register to document the different risks that could occur when deploying smart network solutions. A combination of desk research and engaging with experts who have operational experience in smart network solutions was conducted to populate the register. Separately, the project developed a method using an open source model (STOISIM) that enables the generation of probabilistic risk curves using information from research and interviews. This phase of work addressed the issue identified in the pro-forma, which is lack of knowledge around failure modes and risks of deploying smart network solutions. This also started to address another issue, which is the lack of a standard method to identify, categorise and quantify the different risks across the different solutions.

2. Create a modelling tool that is able to test different investment strategies and calculate their associated risks.

Success Criteria
A model is created that is able to test different investment scenarios in order to provide risk outputs, which can help inform investment and strategy decisions. Where a model is created to test different scenarios but is unable to provide usable risk outcomes to inform investment decisions then a clear roadmap on how to improve the model to meet this goal must be provided as well as documenting lessons learned/failures.

Performance
An extensive network modelling exercise using Imperial College's network model was conducted to quantify the risks of deploying smart network solutions from an energy unserved perspective. The outputs of this model allowed, for the first time, a comparison between the exact supply security contributions from traditional and smart network solutions in a multi-voltage network when not 100% reliable. This phase of work was key to understanding how much network operators can rely on different solutions under various scenarios of demand, network and technology reliability and capacity headroom. This helped to quantify the risks in a meaningful and comparable way, taking into account other key factors, allowing more informed decision to be taken when reinforcing parts of the network.

3. Use model results to develop a new framework and communication strategy that highlights the risks associated with deployment of smart network solutions.

Success Criteria
A framework/communication strategy is created that utilises the learning from this project to inform DNOs of the different risks associated with smart network solutions. Where learnings are inadequate to produce a framework/communication strategy then learnings must be documented with a clear research path necessary to meet this objective.

Performance
A communication strategy was created to disseminate the learnings from this project to the wider Energy audience. This included presentations at the Low Carbon Network Innovation (LCNI) conference and to the Open Networks Working Group 3 team. A final report was also created that communicates the new risk framework in detail and is available from { HYPERLINK "mailto:futurenetworks@sse.com" } upon request. The report also points to further research that could develop the learnings by engaging in a second phase of the project.

Details of how the Project is investigating/solving the issue described in the NIA Project Registration Pro-forma. Details of how the Project is performing/performed relative to its aims, objectives and success criteria.

Required Modifications to the Planned Approach During the Course of the Project

We required three additional months due to an unforeseen increase in timescales required for model results and sensitivity analyses. A higher number of sensitivity analyses as part of the project ensured results were as robust as possible and covered a wider range of possible scenarios. This delivered learning of the highest possible quality. There will be no other changes to the project.
Project length moved from 12 – 15 months.

The Network Licensee should state any changes to its planned methodology and describe why the planned approach proved to be inappropriate.

Lessons Learnt for Future Projects

The RAMSES project has provided new learning about the risk assessment of smart network solutions. It developed a methodology to identify the sources of risk, to assess the systemic security of supply and to compare the financial return of different grid reinforcement options. With the results generated, the project can be concluded to move from TRL (Technology Readiness Level) 2 to TRL 3 and is now an experimental proof of concept. The next steps are to validate these insights using real network reinforcement cases and demonstrate its applicability in a relevant environment to move it to TRL 6.

For these findings to be exploited by network operators, these insights need to be embedded into a techno-economic framework/tool that assists network planners in examining and communicating the benefits and risks of different reinforcement strategies for particular distribution networks. This is therefore the proposed focus on the next phase of the RAMSES project after which we expect the findings to be widely exploitable.

The key steps in this next phase are:

Application of the RAMSES model in real reinforcement projects
In order to reach full applicability of the RAMSES model to real reinforcement projects the smart network solution modelling approach needs to be improved and relevant grid aspects which were previously simplified need to be added, such as network interconnections, lines/feeder reliability, 132/33 and 33/11kV substation's bus-bar configurations, and common mitigation measures for each type of contingency.

Enhancement of the smart network solution risk register
The risk register developed as part of this project needs to be further extended, as currently, only two types of smart network solutions (lead-acid battery and a general type of DSR) are included. It will be necessary to improve the risk register and widen its extent to cover more technologies. In this task, it is also important to address the potential commercial risks of using smart network solutions and the differentiation of behaviour between types of service providers.

Development of a tool to compare reinforcement options
The project validated the usefulness of the approach to use a techno-economic tool to plan the network reinforcement robustly when using smart network solutions.

The results of the project indicate that a tool applicable for real reinforcement projects can be developed. This tool will allow the network planner to compare different investment strategies and decide on which possible reinforcement strategy to proceed with taking into account real security contributions of smart network solutions. However, this needs to take into consideration that certain grid aspects still need to be fully integrated to make the RAMSES model applicable to real reinforcement projects.

A future phase of the project could address the remaining gaps and investigate among others how the use of this tool can be integrated into the overall network planning process and be centred on the requirements of its users. To make it applicable to real reinforcement projects the financial tool needs to be extended to also include different types of reinforcement options covering all the possibilities of asset and reinforcement strategies (e.g. combination of localisation and assets, both traditional and smart), standardised expected capacity provision per asset, and considering grid characteristics and location where the asset is connected.

The likelihood of a further phase taking place is dependent on modelling activities occurring elsewhere within the Energy industry. At present we have put plans for a phase two on hold until we are sure the work isn't being replicated elsewhere.

Recommendations on how the learning from the Project could be exploited further. This may include recommendations on what form of trialling will be required to move the Method to the next TRL. The Network Licensee should also state if the Project discovered significant problems with the trialled Methods. The Network Licensee should comment on the likelihood that the Method will be deployed on a large scale in future. The Network Licensee should discuss the effectiveness of any Research, Development or Demonstration undertaken.

The Outcomes of the Project

A detailed technical Closedown report created by the Carbon Trust is available that provides the outcomes of this project in significant detail. Please contact { HYPERLINK "mailto:futurenetworks@sse.com" } to request your copy.
High level outcomes are shown below:

- Methodology to measure risks associated with smart network solutions was created.
- Imperial College's model was modified to analyse risks of smart network solutions.
- A CBA model was created to demonstrate monetary risks of smart network solutions vs traditional reinforcement.
- TRL moved from 2 – 3.
- A communication strategy was developed and executed where learnings from the project were shared with the wider Energy Industry audience.
- A closedown report was created, which communicates the new risk framework methodology that was utilised as part of this project.

When available, comprehensive details of the Project's outcomes are to be reported. Where quantitative data is available to describe these outcomes, it should be included in the report. Wherever possible, the performance improvement attributable to the Project should be described. If the TRL of the Method has changed as a result of the Project, this should be reported. The Network Licensee should highlight any opportunities for future Projects to develop learning further.

Data Access Details

Any further information required can be obtained from { HYPERLINK "mailto:futurenetworks@sse.com" }. Alternatively, our partners at the Carbon Trust and Imperial College can also be contacted.
A description of how any network or consumption data (anonymised where necessary) gathered in the course of the Project can be requested by interested parties. This requirement may be met by including a link to the publicly available data sharing policy.

Foreground IPR

All learnings from this project have been shared within this Closedown report. Access to the model used for this project can be gained by contacting Imperial College London or the Carbon Trust.

A description of any foreground IPR that have been developed by the project and how this will be owned.

Planned Implementation

It is planned that the learning from this project will be further tested in a second phase and will result in the development of a techno-economic tool which supports the decision-making process about different reinforcement options including integrating smart network solutions. The development of such a tool to compare reinforcement options has not been done before and will allow these learnings to be effectively implemented to support robust network reinforcement decisions.

Other Comments

N/A

Standards Documents (Electricity projects only)

N/A