Energy Networks Innovation Process

Annual Project Progress Report Document

The voice of the networks

Date of Submission: 26/07/2023

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Notes on Completion: Please refer to the NIA Governance Document to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas.

Project Title (*This cannot be changed once registered*)	Project Reference
VFES - Vulnerability Future Energy Scenarios	NIA_SSEN_0063
Funding Licensee(s)	**Project Start Date**
Scottish and Southern Electricity Networks - Distribution	August 2022
Project Duration	**Year**
8 months	2023
Nominated Project Contact(s)	
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1. Scope

VFES statistics, foresight and predictions will be modelled within both SSEN regions. The findings will be shared in a format which can be replicated by other DNOs. As the findings will relate to people, communities, and lifestyle changes, as opposed to network assets and distribution equipment, the methodology and principles for VFES should be replicable for other industries.

In scope will be:

- working with academia to use tried and tested foresighting techniques for assessing potential changes to communities and the lifestyles of consumers which could affect their energy usage patterns and potentially greater reliance on electricity giving rise to new forms of vulnerability
- partnering with data analytics, mathematicians, and machine learning experts to spot trends in consumer vulnerability data and PSR statistics using innovative machine learning technology to better forecast where vulnerability is likely to occur
- reviewing of the findings and suggestions uncovered during the project and validating reportable outcomes
- a report detailing the learnings and opportunities for further insight to enable more robust vulnerability forecasting

2. Objective(s)

The objectives of the VFES project are to explore how the use of new foresighting techniques, along with data analytics and expert validation can be used to identity and forecast consumers in vulnerable situations as we move toward net zero.

The project will produce a report detailing how far, and how accurately, foresighting and machine learning can predict network requirements based on customer, community, and wider societal factors.

3. Success Criteria

VFES will be a success if the partners produce: - a combined report detailing how far, and how accurately, foresighting, machine learning, and expert validation/stakeholder engagement can predict network requirements based on customer and community factors.

4. Performance compared to the original project aims, objectives and success criteria

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.

Project Background

The move to net zero will make customers ever more dependent on a secure, affordable, and reliable electrical supply. There is greater potential to impact customers in vulnerable situations as well as to inadvertently create new forms of vulnerability. Current Distribution Future Energy Scenarios (DFES) don't effectively take consumer vulnerability into account. Vulnerability Future Energy Scenarios (VFES) aims to better understand potential changes and impacts. VFES will explore a triangulated method using innovative forecasting techniques which, if successful, could better inform operational practises. It may also allow better informed investment planning which takes vulnerability into account and won't leave vulnerable customers and communities behind.

Problem Being Solved

The energy landscape is changing quickly, with increases in low-carbon distributed generation, electric vehicles, demand side response, low carbon heat, flexibility and energy storage transforming how networks need to serve customers. The GB distribution networks are also broadly aligned with the data used to produce their future energy scenarios. Across the board, these DNO DFES forecasts are however lacking credible data, research and foresighting on potentially vulnerable customers and communities, and how this will change and evolve as we move to net zero. Without taking factors into account which relate to vulnerability, fuel poverty, medical care at home and other major lifestyle shifts, fairness in the transition to net zero is at risk. All the DNOs have stated ambitions "not to leave people behind" in the transition to a low carbon future. To do this effectively we must strive to know what makes our customers and communities more or less resilient, where vulnerability and fuel poverty are most prevalent and which factors will drive change in the coming years.

Method(s)

Ensuring a fair, inclusive and safe transition to net zero requires forethought and strategic planning.

Project VFES will bring together academia, data, and expert knowledge, triangulating these three approaches to develop a robust methodology.

The project will test for the first time if combining them will give a clearer, and more reliable, forecast of Vulnerability Notes on Completion:

The three methods are:
- Foresighting – Provided by Imperial College London (ICL)
- Machine Learning – Provided by The Smith Institute
- Expert Validation - Provided by policy experts at National Energy Action

5. Required modifications to the planned approach during the course of the project

The Network Licensee should state any changes to its planned methodology and describe why the planned approach proved to be inappropriate. Please confirm if no changes are required.

No required modifications required.

6. Lessons learnt for future projects

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 lessons learned will be drawn together during the final report. This is intentional as the academia foresighting methodology, and the machine learning method used in the first two thirds of VFES are vastly different ways of approaching the subject matter.

The final report will include not only lessons learned, but suggestions for next steps, or ways in which the industry could embed and improve upon the findings.

7. The outcomes of the 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.

The research so far has been twofold:

8. The Smith Institute have concluded their Machine Learning activity successfully. After identifying seven distinct groups of locations that SSEN service, with each group having similar demographic features driving vulnerability, and each requiring distinct strategies for investment of time, effort, and money, as well as by government and other organisations to address the underlying drivers of vulnerability.
   These seven groups cover different locations across England and Scotland: The Smith Institute suggest that a single investment strategy for Scotland and another for the south of England is insufficient to address the varying causes of vulnerability that customers experience. The Smith Institute indicate the need for investment strategies that are geographically tailored to address locational drivers of vulnerability. Such strategies might be tailored help for the elderly and those who require ongoing care in one location, but tailored help for those who claim mental health or disability benefits in another.
   To identify groups with common drivers of vulnerability, The Smith Institute performed a mathematical analysis of demographic data and of SSEN Priority Services Register, using machine learning to model the complex relationships that exist between the two. The Smith Institute then used these complex relationships to understand what drives vulnerability in each location that SSEN service. Finally, The Smith Institute found natural groupings of vulnerability drivers using these results, attaining a mathematically sound and data driven understanding of the vulnerability landscape across SSEN's areas of operation.

9. The foresighting work by a team from Imperial College London is nearly complete and producing interesting results. The report asks:
   a. How will the changes of the future reshape our relationships with energy? and
   b. What new vulnerabilities might emerge as we shift towards net zero?

   The report will then present a foresighting project that explores how lifestyles might change in the future, and how this will shape our relationships with energy. It delivers a set of strategic visions for the energy sector that can be used as tools to embed vulnerability considerations into future network planning.

The next phase is to conduct an expert review commencing in July, when the final foresighting report is agreed. This expert review will look to compare the vastly different worlds of Machine Learning and Academic Research, along with the differing messages coming from the calculations and the foresighting.

The review will focus on where there is commonality with Machine Learning and the foresighting work. It should also look for suggestions which could be adopted within the energy industry and how these may be able to benefit consumers.

8. Data Access & Quality Details

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.

For information how to request data gathered in the course of this project, see Network Innovation Competition (NIC) and Network Innovation Allowance (NIA) Data Sharing Procedure at https://ssen-innovation.co.uk/innovation-strategy/.

9. Foreground IPR

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

N/A