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.

NIA Project Registration and PEA Document

Date of Submission

Aug 2024

Project Reference Number

NIA2_NGESO083

Project Registration

Project Title

Construction Planning Assumptions Methodology Review

Project Reference Number

NIA2_NGESO083

Project Licensee(s)

National Energy System Operator

Project Start

March 2024

Project Duration

1 year and 4 months

Nominated Project Contact(s)

innovation@nationalgrideso.com

Project Budget

£370,000.00

Summary

The current approach to develop the Construction Planning Assumptions (CPA) required to plan for connection applications to the power grid was not developed to capture the core characteristics of the future net-zero energy system. To address this challenge, this project will review the current CPA methodology, models and tools and propose key relevant updates to (i) capture emerging technologies (e.g., batteries and electrolysers), (ii) define uncertainty scenarios (e.g., based on statistical methods) and (iii) standardise and automate the process to improve the efficiency of the connections process and the experience for ESO, TOs and clients

Nominated Contact Email Address(es)

Innovation@neso.energy

Problem Being Solved

Construction Planning Assumptions (CPA) must be provided by ESO to TOs as part of a connection application to be used as the basis for the system studies that the TO is required to carry out for the connection, and subsequently identify any reinforcement works required to accommodate that connection. To perform this work, ESO has developed a model (POUYA2) to provide relevant data sets to TOs to perform connection studies However, as the nature of the new customers, generation, and demand, applying to, and connecting to, the transmission system has changed over previous years, it has become necessary to adapt how these assumptions are created and provided. To be more specific, the CPA process must be updated in consideration of the following factors:

- The number of connection applications has increased exponentially within the last three years.

- The type of technologies applying to connect to the GB network has also changed; the most dominant technologies are battery energy storage, wind farms and electrolysers.
- The traditional approach of developing CPA results in connection dates in the next decade.
- The existing model (POUYA2) requires new functionalities to cater for the needs of the changing energy landscape.
- Brand new or updated CPA methods are needed for new technologies, e.g., batteries and electrolysers.
- Revision of POUYA2 and CPA methodology – including related to scenario definition, consideration of uncertainty, and relevant scenario overlay and summary inputs – are required to facilitate the interaction between ESO and TOs and thus prioritise and quickly progress new connections.
- Increased standardisation and automation are needed to facilitate processing the increased number of connections and improving the experience for ESO, TOs, and clients.

Method(s)

The project will be delivered in three work packages.

WP1: CPA methodology and POUYA2 review (Months: 01-05)
Aim: Reviewing and benchmarking CPA methodology, including POUYA2 and other tools and processes relevant to the connection process such as collection of input data sources and production of outputs. This WP involves two workshops on (i) review of the structure of POUYA2, and identification of key files and methods (e.g., load, energy resources, etc.) and (ii) use of data, including loading of inputs and production of outputs.
Deliverables will include:
-Detailed presentation to ESO on initial review of CPA methodology, key mathematical models, including probabilistic modelling assumptions, of POUYA2.
-Report and presentation on review of CPA methodology, mathematical formulation of POUYA2, and benchmarked performance.

WP2: Modelling requirements for a changing energy future (Months: 04-12)
Aim: Propose new modelling features, based on discussions with TOs and academic best practice, such as models for new technologies (e.g., electrolysers and batteries) and stochastic processes compatible with POUYA2 and CPA approach.
Deliverables will include:
Detailed presentation to ESO on modelling considerations associated with uncertainties and risks, formulation of scenario for the use of TOs, etc. (e.g., number of samples needed and convergence guarantees).
Report and presentation on proposed approaches for the consideration of emerging low carbon technologies and identified uncertainties and probabilistic sampling approaches.

WP3: Inputs, outputs and assumptions (Months: 06-15)
Aim: Review inputs and outputs of POUYA2 and provide justifications to modify (or keep) them and standardise them. A third workshop will take place to explore the potential implementation of updates from WP3 and WP4.
Deliverables include:

-Report and presentation on modelling assumptions, e.g., types of offers, attrition rates, and scenarios
-Detailed presentation to ESO on standardised input and output formats and local area definition selecting options which best convey necessary details identified by key stakeholders to enable appropriate decision-making
Final report and presentation on recommended POUYA2 and CPA methodology updates based on outputs from WP3 and WP4 (Month 15)

Scope

This project aims to review the current CPA process and propose updates to properly support the connections of emerging technologies associated with a net-zero carbon transition. Accordingly, the scope of the work includes:

-A high-level review of the overall CPA process including pre CPA assumptions (e.g., sent and in-flight offers, attrition assumptions, queue position, etc.) and CPA production (e.g., triggers, option to reuse CPA, local area definition, use of POUYA2, etc.).
-A dedicated review of POUYA2 with particular focus on (i) input data, and collection and processing of outputs, (ii) mathematical models used to assess the connection of different technologies, and (iii) consideration and assessment of uncertainties.
-Proposals to update the CPA process, based on state-of-the-art models, to (i) properly model emerging technologies such as batteries and electrolysers, (ii) capture increasing uncertainty levels associated with the decarbonisation of the energy sector, (iii) automate the connections process, and (iv) address areas of improvement highlighted by ESO and TOs.

The below activities will be carried out to deliver this scope:
Review and benchmarking of POUYA2

-A review of the application of POUYA2 to various connection studies will be performed, placing focus on mathematical formulation, probabilistic modelling assumptions (e.g., assessment of correlation, convergence guarantees, number of samples needed, etc.), input data sources and outputs, and high-level computational performance.
-The source code will be reviewed in dedicated workshops where the NGESO team will present specific parts of the tool. The aims of the workshops will include i) analysing the structure of the model and identifying the key files and methods with the relevant process to review, ii) exploring the use of data, specifically loading and processing of inputs and production of outputs, and iii) exploring the application of proposed and updated models (e.g., electrolysers and batteries).

Propose models to capture the characteristics of the changing energy landscape.
-Building on inputs from TOs on critical modelling features (existing and required) and academic best practice, options to enhance POUYA2 with dedicated models for emerging low carbon technologies (e.g., battery storage and electrolysers) will be explored.
-Stochastic processes to capture the impacts of uncertainty and express the information in a small subset of scenarios that can be overlayed will be explored. Based on TO feedback, the information should ideally be expressed as a single scenario when possible.
-Simulation of identified uncertainties and probabilistic sampling approaches to demonstrate differences in input data set generation. Note that UOM will not have access to the tool and will not be able to generate different output data sets, only showcase differences in input data).
Review and propose standards for current modelling assumptions and inputs and outputs of the model.

-Review and analysis of output data representation, selecting options which best convey necessary details identified by key stakeholders to enable appropriate decision-making. This activity aims to develop standardised and editable input and output data sets (e.g., in python data frames) to seamlessly populate POUYA2 and facilitate interactions with TOs.
-Review and justify existing modelling assumptions that have been flagged by TOs (e.g., attrition rates) and, when appropriate (e.g., considering POUYA2 compatibility), propose new modelling assumptions, e.g., use of different types of offers (e.g., send and in-flight), dynamic attrition rates that consider timing and other factors (e.g., specific intelligence, historical data, etc.), local area definition (e.g., using recursion theory), etc.

Stakeholder-informed selection of the developed modelling features and procedures.
-Periodically present to, and discuss with, ESO and stakeholders (especially TOs) the findings of the projects and planned next stages.
-Collect stakeholder feedback to inform the different tasks of this project, e.g., list of modelling assumptions to be revised and modified.

Objective(s)

The aim of the project is to review the current CPA methodology and POUYA2, provide additional justification for key assumptions, and propose new functionalities to meet the changing CPA requirements and enhance the connection application process. Specific objectives and activities of the project include:

- A review and benchmarking of the POUYA2 tool
- Identify and propose models to capture the characteristics of the changing energy landscape.
- Review and propose standards for current modelling assumptions and the inputs and outputs of the model
- Stakeholder-informed selection of the developed modelling features and procedures.

Consumer Vulnerability Impact Assessment

The ESO does not have a direct connection to consumers, and therefore is unable to differentiate the impact on consumers and those in vulnerable situations. Customers will benefit from a faster and most cost-effective connections process that better supports the net zero carbon transition.

Success Criteria

The success of the project will be determined by its ability to assess the suitability of the current CPA process, and proposed relevant updates, to address connection needs to support the net-zero carbon transition. Accordingly, the project success will be measured in

terms of its ability to meet the following objectives:

- Review the current CPA methodology and identify potential gaps and improvements, including consideration for stochastic characteristics of technology operation and scenarios.
- Review the key modelling assumptions and current use of POUYA2 in the context of CPA.
- Identify the suitability to model key emerging technologies (e.g., storage, electrolysers, etc.) and, when appropriate, propose suitable modelling updates.
- Analyse the current process to provide inputs to and extract outputs from POUYA2, and propose options to automate the process.

Project Partners and External Funding

The University of Manchester will be carrying out the work, no additional external funding required.

Potential for New Learning

The project will create new learning in various areas:

- Treatment of new technologies, i.e., BESS, electrolysers and embedded generation in economic dispatch for connection studies
- Modelling uncertainty for connections studies
- Statistical methods to create snapshots from probabilistic analysis

This learning will be disseminated to industry, TOs, DNOs and customers in meetings through ENA events, conferences, and publications.

Scale of Project

The project spans 15 months with one project partner, with a total budget of £370. The project consists of desktop-based research and workshops with relevant teams across the ESO and TOs.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will be based upon the GB ESO area of operations.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£370,000.00

Project Eligibility Assessment Part 1

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations

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

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

The CPA process is critical for the effective connection of the clean technologies needed to bring a net-zero carbon future. Accordingly, it is critical to update the CPA process to expedite the connection of the increasingly high number of renewable energy-based new connections, and properly capture the impacts of emerging technologies (e.g., batteries and electrolysers) and the increasingly uncertain energy landscape on the power grid.

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

n/a

Please provide a calculation and/or description of the expected benefits of the solution

n/a

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

As the project addresses the CPA process used in GB, the outputs of the project would be fully replicable across GB.

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

If the project identifies updates to be made to the existing CPA process and models the only cost of rolling out would be those associated with updating the tool, which would only involve the required workforce.

Requirement 3 / 1

Involve Research, Development or Demonstration

Projects 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

Involve Research, Development or Demonstration - Please select all that apply

☐ 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

This project has potential to deliver benefits to both ESOs and TSOs by improving the CPA process. The CPA process feeds directly into the system studies that the TO is required to carry out for a connection, and subsequently identify any reinforcement works required to accommodate that connection. Enhancing the accuracy of modelling assumptions, improving the quality of input data, and developing advanced data processing methods that would result in increased confidence in CPAs has the potential to accelerate earlier connection dates for customers. Standardizing and automating the CPA process would reduce the time spent by engineers, both in ESO and TOs, preparing CPAs

n/a

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. Networks must explicitly mention similar projects that they have considered and how these differ.

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

The CPA process and POUYA2 modelling is unique to ESO, a review of this methodology is too high risk and based on state-of-the-art know how to form part of ESOs business as usual activity. As a result this project will not be duplicating any 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

The proposed updates for the CPA process will be based on state-of-the-art know how from academic literature and recent research projects utilising know how from other industries that has not before been applied to an electricity system operation environment.

Relevant Foreground IPR

Please provide a list of the relevant foreground IPR that will be generated in the course of the project e.g. reports, models, tools etc.

- Reports with potential improvements to CPA methodology
- New models for new technologies (e.g., electrolysers, batteries) and consideration for stochastic characteristics of new connections
- Proposed changes to modelling tool

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:
A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click 'Contact Lead Network'. National Grid ESO already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
Via our Innovation website at https://www.nationalgrideso.com/future-energy/innovation
Via our managed mailbox innovation@nationalgrideso.com
Details on the terms on which such data will be made available by National Grid ESO can be found in our publicly available "Data sharing policy relating to NIC/NIA projects" at https://www.nationalgrideso.com/document/168191/download.

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

The proposed updates for the CPA process will be based on state-of-the-art know how from academic literature and recent research projects, some of which may not have been previously demonstrated in an electricity system operation environment. As a result, some of the updates may involve high levels of uncertainty and risks which would not fall into BAU activities.

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

There is a technical risk related with taking forward this project as the review and updates to the methodology will be based on state-of-the-art know how from academic literature and recent research projects from other industries which may not be applicable to this application.

This project has been approved by a senior member of staff

☑ Yes