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

Feb 2025

Project Reference Number

NIA_SPEN_0105

Project Registration

Project Title

Intelligent Connections Explorer (ICE)

Project Reference Number

NIA_SPEN_0105

Project Licensee(s)

SP Energy Networks Transmission

Project Start

January 2025

Project Duration

0 years and 9 months

Nominated Project Contact(s)

Parham Momeni

Project Budget

£510,300.00

Summary

The process for new connections is overly reliant on manual interventions for engagement, leading to prolonged delays and inefficiencies. Customers face wait times for preliminary phases, connection details, and programmes due to the lack of a system for indicative views of the network they are looking to connect to.

ICE will integrate accurate estimation of substation capacity, new connections costs and timelines, and a route planner that identifies optimal solutions. Creating the ability for SPT to have clearly identifiable guidance on the best solution at the earliest stage in the connections process. This enables a holistic view of SPT's network area and assists transmission operators and developers to have a greater understanding of where would be most beneficial for all parties for a new connection.

Third Party Collaborators

DSCIENCE Ltd

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

The process for new connections is overly reliant on manual interventions for engagement, leading to prolonged delays and inefficiencies. Customers face wait times for preliminary phases, connection details, and programmes due to the lack of a system for indicative views of the network they are looking to connect to. This results in delayed responses, disjointed applications, and outdated information that hampers customer decision-making.

For SPT, the manual gathering and processing of data are time-consuming and open to human error, causing bottlenecks in the application process. The system's inability to interact with dynamic data prevents the visualisation of network capacities and the impact of ongoing projects. Ultimately, the inefficiencies of manual processes drive up operational costs, and the lack of integration creates data management complexities. We believe the proposed Intelligent Connection Explorer (ICE) would alleviate these pain points in our process.

Method(s)

ICE will integrate accurate estimation of substation capacity, accurate estimation of new connections costs and timelines, and a route planner that identifies optimal paths of Overhead Lines (OHL) for new connections to the transmission network. The project will develop and deploy a number of innovative methods.

- Holding a suitably abstracted graph model of the current, planned and proposed substation and OHL network. This graph model is used to run a power flow determining the feasibility of taking a new connection at a particular node.
- Using various geospatial layers and a graph-based optimisation algorithm to generate the likely route an OHL connection would take from a developer's site to a target substation. The constraints considered will include such things as avoiding built up areas, waterways, wind farms amongst others while minimising the length of a transmission line.
- Using historical connection costs and timelines to provide more accurate forecasts of the likely cost of a connection and the proposed energisation dates.
- Finally and crucially ICE brings together all the aspects described above into a single user-friendly view enabling all of them to be considered and discussed when embarking on a new connection.

Scope

ICE platform:

ICE will have both internal and external views. The internal view will provide greater detail for SPT to assess the relevant single line diagrams, in-progress connections and wider network plans required for a new connection, while the external view will be a visual tool with only non-confidential material viewable. This will be used on pre-application calls to allow staff to bring to life our network for the customer. ICE will allow users to visualise network substations on a map view. It will allow users to describe the location and characteristics of a new connection and evaluate optimal solutions for a connection and the associated substation, costs and timelines. SPT users will be able to add, save, edit, or delete proposed substations or connections in real-time, but it will not be accessible to external users.

Network Scope:

We will look to include all existing and planned substations on the SPT network. Developing the Network Scope should allow us to view the network as a whole through this tool, including substations from 33kV and above.

Capacity Estimator Scope:

ICE must be able to assess new connections for various substation types, including those that combine demand and generation connections, mesh grid substations, and others. This phase will explore and establish optimal methods for handling these calculations, with all approaches reviewed by the project partners. The Capacity Estimator element will determine the capacity available at substations all across SPT's network.

Cost and Timeline Estimators:

The tool will evaluate the use of SPT historical data and machine learning to provide alternative and potentially more accurate costs and timelines.

Route Planner:

The route planner will allow potential circuit routes from an identified substation back to the user's site to be shown, and will include geospatial layers (e.g., roads, transmission, and distribution OHLs, wind farms, etc) and explore the need for voltage-specific routes, tower locations, user-edited routes, and exporting in common geospatial formats. This phase will also explore the possibility of routing underground cables.

Objective(s)

The Intelligent Connection Explorer will integrate accurate estimation of substation capacity, accurate estimation of new connections costs and timelines, and a route planner that identifies optimal paths of Overhead Lines (OHL) for these connections. Creating the ability for SPT to have clearly identifiable guidance on available capacity, routing, costs, and programme timelines at the earliest stage

in the connections process. This enables a holistic view of SPT's network area and assists transmission operators and project developers to have a greater understanding of where would be most beneficial for all parties for a new connection.

Key Objectives:

- Provide a quick and accurate connection summary to Transmission Customers.
- Save on internal staff time typically taken to prepare solutions and discuss with Transmission Developers.
- Increase the quality of information provided to our customers at pre-application stage.

Consumer Vulnerability Impact Assessment

N/A

Success Criteria

In addition to the below milestones, we would be measuring the success on this tool when used for the purposes of pre-application discussions based on our customer surveys to ensure our reputation remains the same or increases under Ofgem's Quality of Connection Incentive.

Milestones:

Input data complete: All the data deemed necessary by the third party to design and create the network model used to build the tool will have been obtained from the relevant SPT teams.

Release of Alpha Version: After validation and verification (V&V) of the network model by the relevant engineering departments, an initial version of the tool will be released to SPT staff for further V&V.

Network Capacity Estimator: Using SPT data sets relevant to the capacity of substations across SPT's network, V&V from the relevant engineering departments will ensure the final output is accurate.

Timeline Estimator: Using SPT data sets relevant to the timelines associated for developing transmission projects, V&V from the relevant departments will ensure the final output is accurate.

Release of Beta Version: An updated version of the tool will be released to SPT staff for V&V, integrating the Capacity, Timeline and estimators developed in previous milestones.

Cost Estimator: Using SPT data sets relevant to the costs associated for developing transmission projects, V&V from the relevant departments will ensure the final output is accurate.

OHL Route Planner: V&V from the relevant departments will ensure the final output is accurate to what we would expect when designing an OHL route.

Underground Cable Route Planner: V&V from the relevant departments will ensure the final output is accurate to what we would expect when routing cables for connection to the transmission network.

Web Application: V&V from relevant SPT departments will ensure that the various elements of the tool provide accurate information similar to that typically provided within an SPT Pre-Application call. The tool will be useable by SPT Staff without the need for engineering knowledge.

Project Partners and External Funding

The project will involve two key partners: SPT and DScience LTD.

SPT: SPT will provide the necessary network data, including information on historical costs and timelines. SPT will assist in communication between DScience LTD and the necessary internal stakeholders, as well as guide and steer the development of the ICE platform, ensuring it meets the operational needs and the defined scope.

DScience LTD: As the developer of phase one, DScience LTD will be responsible for building and developing the ICE platform in phase two. They will develop the logic for estimating substation capacity, connection costs, project timelines, and planning OHL routes, ensuring the platform is robust and fit for purpose.

Potential for New Learning

Through this project we expect to have greater visual granularity of likely connection viability for developers looking to apply within the

SPT region. We will be expecting to view how valuable a tool this would be across the various TOs and perhaps even being adopted by the NESO. If successful, this could benefit all developers looking to make Transmission Connections. The learnings here will be improved ways of interacting with customers in a method that has never been done across the industry and improved data collection of knowledge spread across the business.

Scale of Project

The project intends to build and develop a number of key innovations and then combine them in a uniquely effective manner. These are described in 2.2 Method(s). Given the complexity of each of these innovations and that each must be developed to generate the "holistic" view required, the scope and investment are low. A smaller scale project wouldn't manage to deliver improved customer service and data gathering to inform developers of what an application could look like if they chose to connect to our network.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

SP Transmission (SPT) Licence Area

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£510,300

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 proposed Intelligent connections Explorer (ICE) project directly supports the UK's net-zero goals by streamlining the process for connecting renewable energy sources to the transmission grid. By optimising the connection process, it reduces delays, minimises speculative applications and supports the necessary scaling of the grid.

This project addresses inefficiencies in manual data gathering, reduces the time and human error involved in assessing new connections to the grid. This speeds up new connections projects but also lowers operational costs, which can indirectly benefit consumers through more efficient and cost-effective grid management.

ICE has the ability to support customers going through a time of real change. Given Connections Reform, TM04+, is due to set in during 2025, customers will be looking for greater insight into our network. We believe understanding the reality of availability on the grid and how their projects could fit into the technology plans under CP2030 will be a real concern. Therefore, producing a tool that can take into account a variety of factors, to allow for pre-application detail prior to committing to an application would be welcomed by industry.

We also believe beyond the NIA phase we have the ability to develop this for the whole of the Transmission Network in GB. Supporting the need for specific technologies to be implemented into specific regions across the nation.

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

A key tangible benefit of this project for the TO will be a reduction in time spent by staff across the various teams involved in the connections process – including engineers, project managers and contracts managers – preparing and hosting pre-application calls. This could save a minimum of 5 hours a week across the various departments. Based on the assumption all people usually participating in the call have jobs at a similar job level, we believe the tool could create a saving of £0.028M per annum.

This time saving can increase depending on the volume of sites discussed/calls held a week so we have chosen to be conservative here. It will also be dependent on the changes implemented under TM04+.

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

We believe it could be replicated across all TO networks. Due to the nature of Transmission Contracts, it is unlikely this could be replicated for networks below 33kV. This is due to the variables related to distribution GSPs and the difference in detail required between T and D connections.

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

As this would depend on the availability of data gathering within each network area, it is not possible to provide an accurate outline at present.

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

- Key Learnings about how a holistic connection exploration tool can effectively be used during the pre-connection application process will be documented and shared.
- Tested assumptions which enable simplified network capacity estimates, timelines and costs will be documented and shared.
- Both of these can be adopted by other Network Licenses either independently or with support from SPT or DScience LTD.

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.

We have engaged with the other TOs and the NESO to ensure another project like this isn't being carried out. We ensured this was clearly different from the Connections 360 tool as our proposal focuses on producing an estimated connections solution rather than a network overview. We are continuing to engage and ask for feedback from the other TOs and the NESO to ensure they can take our learnings on board from this project.

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 ICE project is innovative because it addresses longstanding inefficiencies in the new connections process by uniquely integrating the automation of substation capacity, connection cost and timeline estimation, data centralisation, data visualisation, and advanced geospatial analysis. The dynamic route planner for optimal OHL selection provides a tool to address social and environmental impact earlier in the route planning process.

By interacting with dynamic data and visualising network conditions, ICE provides a holistic view of grid capacities and project impacts, enabling informed decision-making at the earliest stage of the connection process—something that is currently unavailable.

This project is innovative in several ways:

- Holding a suitably abstracted graph model of the current, planned and proposed substation and OHL network. This graph model is used to run a power flow determining the feasibility of taking a new connection at a particular node.
- Using various geospatial layers and a graph-based optimisation algorithm to generate the likely route an OHL connection would take from a developer's site to a target substation. The constraints considered will include such things as avoiding built up areas, waterways, wind farms amongst others while minimising the length of a transmission line.
- Using historical connection costs and timelines to provide more accurate forecasts of the likely cost of a connection and the proposed energisation dates.
- Finally, ICE brings together all the aspects described above into a single user-friendly view enabling all of them to be considered and discussed when embarking on a new connection.

Relevant Foreground IPR

N/A

Data Access Details

The provision of data is subject to anonymisation and/or redaction for reasons of commercial confidentiality or other sensitivity.

Access to this data must be requested by contacting SPInnovation@spenergynetworks.co.uk. Please provide the following information in your request:

- Affiliation, position and contact details of requesting party
- Relevant project and type of data required
- Reasons for requesting this data and evidence that this data will be used in the interest of the UK network electricity customers
- How data will be shared internally and externally by the requesting party

Any data request deemed unsuitable for sharing will be highlighted to the appropriate requesting party. After receiving the request we will provide the estimated date for completing the data provision based on other requests and our team workload at that time. All requested data remains the property of SP Energy Networks.

https://www.spenergynetworks.co.uk/pages/data_sharing_policy.aspx

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

Customers within our area are about to undergo a massive change to the connections world with the implementation of TM04+ coming quick and fast with updates to the policy coming daily. Therefore, we need the ability and skills of an external party to produce and manage this as quickly as possible, which would not be a possibility if funded through BAU. Funding the development of this project through innovation methods alleviates the risk of development taking longer through BAU funding methods and ultimately minimising efforts in supporting our customers through a time of real change.

This project is unable to be fufilled under BAU as it uses technology that SPT do not currently already use and will involve methods of trial and error in the development approach. Additionally, it uses different cloud technology meaning we have an opportunity to trial non-standard approaches.

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

This project is required using the support of NIA funding given the significant changes to the connections process coming to our industry. Doing nothing would mean customers not receiving the best detail of our network as possible given we wouldn't be able to pull all the data into the one tool.

Additionally, the customer would suffer by increased wait times to speak with engineers, given they will be reassessing the whole queue under TM04+. Fundamentally, not funding this under NIA creates the risk of negative customer impact.

This project has been approved by a senior member of staff

- [x] Yes