Scottish & Southern Electricity Networks

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

Jun 2026

Project Reference Number

NIA_SSEN_0084

Project Registration

Project Title

AI-ID: AI Identification of service cable location

Project Reference Number

NIA_SSEN_0084

Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

Project Start

June 2026

Project Duration

2 years and 7 months

Nominated Project Contact(s)

Brian Wann, Innovation Delivery Manager

Project Budget

£193,074.00

Summary

Significant increases in domestic electricity demand means that many service cables feeding individual properties will need to be changed to accommodate higher loads. Many of these cables have been in place for decades and network companies do not have good enough records to understand the location of these assets or their replacement requirements. This project will develop a novel AI-enabled system using Google Maps Street View images (street view) and LiDAR maps to locate service-cables between the street and the property. Where service-cables are underground/visually obscured between properties, machine learning models will infer cable locations, either directly between the mains and identified service point, or from the adjacent property and automatically populate GIS maps with vectors representing identified service-cable position so allowing efficient replacement/upgrade.

Third Party Collaborators

Aston University

Nominated Contact Email Address(es)

fnp.pmo@sse.com

Problem Being Solved

To meet the UK's decarbonisation ambitions, it is crucial that electricity distribution networks act as enablers not constraints to this significant change. National electrical cable infrastructure has largely not been upgraded since the 1950s-70s, whilst electricity demand has increased significantly. Hundreds of kilometres of primary low-voltage network needs strengthening to accommodate increasing electricity usage and network connections.

Significant increases in domestic electricity demand means that many service cables feeding individual properties will need to be changed to accommodate higher loads. The low voltage networks that feed domestic properties have, for many years, been at the far end of a one-way power flow network. This “tail-end” network often had gaps in the way it was recorded. Many of these cables have been in place for decades and network companies do not have good enough records to understand the location of these assets or the work that replacing them would entail.

Whilst current industry practise is to record both main and service data with GIS this was not always the case and historically service information was often captured individually by using a paper “service record” card which were stored locally. This means that there are areas of the network where GIS systems do not include full details of the service cables to individual properties. Whilst efforts have been made to digitalise these service cards, this has proven to be a slow laborious and inefficient process. As we move to decarbonise having good information on the location, cable type and termination equipment will be vital to allow DNOs to plan appropriate network interventions.

Historically, electrical demand was predictable and grew slowly with time. With the advent and uptake of Low Carbon Technology such as EV and heat pumps this demand is rising and we are on the cusp of a steep upswing which will mean the need to upgrade service cables. This will mean an increase in work needed to upgrade these cables which is currently done on an individual property basis and often includes a site survey and typically costs between £3,000 and £6,000. With approximately 3.2m domestic properties in SSEN, many of which will require upgrades, any reduction in this cost is welcome. If we know where the cables are located and what material overlays them, planning and sourcing contractors becomes cheaper and easier, and could allow for more than one property to be upgraded at a time.

The ready availability of new data sources such as LiDAR, Google Maps etc offers the possibility to explore new options for identifying DNO service equipment at scale and at lower cost than existing options. For example, using LiDAR we can directly identify where an overhead service is from a pole to the house. When, however, if the service is looped between properties, under eaves or an underground cable goes from the main to a property to a service box, these cannot be readily visualised and additional analysis is required.

This project will use image data sources, such as Google Maps, to identify SSEN electricity apparatus between the mains and properties. Multimodal image analysis combines data from different imaging sources to improve accuracy, in this case to identify objects, and AI will be used to detect or predict electrical apparatus and identify them on maps in the correct place.

SSEN currently do not have the knowledge to carry out this project. This project will be a Knowledge Transfer Partnership (KTP) between SEPD and Aston University. Funding will be sought through the KTP route to cover 50% of the project cost, the other 50% will be supported through NIA.

Method(s)

The project will develop an AI-facilitated process that will accurately estimate the location of underground or visually obscured cables between the service and the property. Methods will involve multimodal image analytics alongside AI techniques to accurately detect or predict the accurate location of assets and deliver a vectorised representation (directed line segment or arrow from a tail to a head), of these locations on GIS maps. This will push the state of the art in AI powered multimodal image analytics (i.e. RGB an image where each pixel is defined by the amount of red, green, and blue colours and Lidar) and make innovative contributions to the field of multimodal image analysis, while delivering a solution to the energy sector.

Because this project is jointly funded by a Knowledge Transfer Partnership, an ‘associate’ will be hired. The associate will be embedded at SSEN to carry out the project work and will act as a conduit between the university academic and SSEN to ensure knowledge transfer.

During a short phase 1 of the project:

- Associate will be hired to work in the SEPD area
- They will undertake the following:
  - Understanding user requirements and acquisition analysis
  - Defining evaluation metrics for algorithmic performance (detection accuracy, speed of execution, complexity etc)
  - Creating a preliminary version of the graphical user interface (GUI)

Longer phase 2:
During this phase,

- RGB regions of interest will be identified. RGB image analysis will be carried out to detect regions of interest including: property type, candidate ‘cable’ regions using street view and digital service cards will be created.
- Overhead cable locations will be identified from each property along with LiDAR regions of interest and candidate cable regions

from LiDAR scans.

- Highlight the estimated service cable on the corresponding street view image/LiDAR scan

Phase 3

- A vectorised GIS map featuring cable location for each property will be created
- Integration into SSEN existing workflows. Training and implementation will take place during this phase as well as workshops with other DNOs.

Data Quality Statement (DQS):

The project will be delivered under the NIA framework in line with OFGEM, ENA and SSEN internal policies. Data produced as part of this project will be subject to quality assurance to ensure that the information produced with each deliverable is accurate to the best of our knowledge and sources of information are appropriately documented. All deliverables and project outputs will be stored in our internal systems with appropriate backup and version management. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

AI-ID will be shared with other networks via regular updates to the ENA Data and Digitalisation working group.

Measurement Quality Statement (MQS):

The methodology used in this project will be subject to the supplier's own quality assurance regime and the source of data, measurement process and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and assessments will also be clearly documented in the relevant deliverables and final project report made available for review.

The project is an early-stage proof of concept to establish if this method is viable, further work will follow to fully implement findings if this stage is successful

Scope

The successful conclusion of this project will result in the inclusion of vectors representing the identified cable position of each property in a selected GIS sub-section of the SEPD area. It is envisaged that at the end of this project, the AI-enabled mechanism for automating the process of locating power cables will be implemented on SSEN's GIS for further testing and expansion through a follow-on pilot project.

The estimated cost of upgrading a service cable (cable that runs from the pavement or similar to the meter), is currently estimated at between £3,000 and £6,000 per property. The cost includes planning, materials and carrying out the work. If the cable position is unknown an in-person survey will be required and possibly a risk assessment. If we know not only the position of the cable, but the surface type that requires digging and the position of the meter cupboard planning for replacement or upgrade and costs involved can be reduced.

Making a conservative estimate that accurate mapping will reduce costs by £400 per service cable replacement or upgrade and we will replace an estimated 97,000 service cables in the next price control, a saving of £38.8m. This is expected to deliver an approximate saving of £54m over SSEN's network by 2040 and £326m over the whole of GB.

There are two further cost related considerations:

1. Digitising records: As much of the current infrastructure dates to the 1960/70s recording positions of cables was done manually using cards that are currently being digitised at a significant cost to the business. With an accurate map of service cables created using visual tools and AI techniques, this cost could be avoided.
2. Streetworks: Streetworks refer to the activities involved in the construction, maintenance, and repair of the public highways and roads. SSEN works closely with local authorities, regulatory bodies, and other stakeholders to ensure that streetworks are carried out in compliance with regulations, minimize disruption to the public, and maintain the integrity of the electricity distribution network. In some cases, if amendments need to be made to the excavation plan due to inaccurate location data then there is the potential for a fine to be issued. Streetworks fines may vary based on the specific regulations and local authority requirements. With accurate mapping these fines can be minimised.

Other considerations:

- A recently published National Infrastructure Commission[1] (NIC) study points out challenges with supply chain and workforce resilience. NIC recommendation 14 suggests current skills gaps be recognised along with the large workforce needed to deliver energy transition. With better information during planning, we can secure the services required in advance.
- Currently a lot of cable upgrade is done reactively. With all cables mapped and needs for contractors understood, there is potential for a larger number of customers to be upgraded at one time.

- This will also reduce disruption to customers as, rather than address replacements or upgrades on a reactive basis, work can be planned and carried out on a greater number of properties at one time.

[1]National Infrastructure Commission, Electricity distribution networks: Creating capacity for the future, 21 Feb 2025 (https://webarchive.nationalarchives.gov.uk/ukgwa/20250327100350/https:/nic.org.uk/studies-reports/electricity-distribution-networks-report/)

Objective(s)

This project aims to deliver the following objectives:

1. Use multiple sources to identify candidate cable regions
2. Create a method of identifying where service cables run into domestic properties using visual cues
3. Use LiDAR to identify overhead cable locations
4. Design and train a purpose-built AI model to estimate location of underground and looped services within defined area of SEPD
5. Create a vectorised GIS map featuring cable location for each property and test with users within a defined area of SEPD
6. Create plan to integrate the tool with existing workflows
7. Embed new knowledge into SSEN and share with other DNOs

Consumer Vulnerability Impact Assessment

See figure 1 - the Consumer Vulnerability Impact Assessment indicates the project will not result in negative impact on vulnerable customers. The impact assessment only indicates a positive impact.

Success Criteria

The successful conclusion of this project will result in the inclusion of vectors representing the identified cable position of each property in a selected GIS sub-section the SEPD area. It is envisaged that at the end of this project, the AI-enabled mechanism for automating the process of locating power cables will be implemented on SSEN's GIS for further testing and expansion through a pilot project.

Project Partners and External Funding

The skills and expertise to build the solution and carry out this project in its entirety, do not currently exist within SSEN and will require a mix of expertise drawn from the external partner Aston University and SSEN. This project will create a new post within Aston University. This person will be hosted at the SEPD site at Thatcham and transfer knowledge from the academics at Aston directly to the team working on the project.

Aston University (https://www.aston.ac.uk/) is a new partner for SSEN. This project will require close working with the Aston University academics over 30 months. It is hoped that a new and productive relationship will be developed bringing new expertise to SSEN and all other DNOs.

This project has been co-created with Prof. Sadka, the Director of the Sir Peter Rigby Digital Futures Institute. Professor Sadka has a long track record of leading contributions and innovations in the field of AI-enabled visual media. This project will enable him to apply his wide-ranging experience in AI and multimodal image analytics for developing bespoke solutions for the accurate detection and/or prediction of electric apparatus and deliver a vectorised representation thereof on GIS maps. The challenges faced will empower him and his team to further push the boundary of the state of the art in AI-powered multimodal image analytics (i.e. RGB and LIDAR) and hence make vital innovative contributions to the field while also delivering bespoke solutions to the business partner.

Aston University will be the only project partner. The university will be the employer of the research associate and will provide 5% FTE of Prof. Sadka's time to oversee the project.

Funding for 50% of the project will be sought through the UKRI Knowledge Transfer Partnership funding scheme.

Potential for New Learning

The aim of the KTP is to embed knowledge into the company that does not already exist. Currently with SSEN we do not have the skills or knowledge on how to use multimodal image analytics as well as AI techniques to detect or predict the location of underground or looped cables. The project will also explore potential business models for wider deployment to establish this new capability across the industry.

Scale of Project

The project will be carried out in three phases over 30 months. A detailed timetable of work was created to deliver the project and through discussion between SSEN and Aston University, the duration of 30 months was agreed. During Phase 1, the associate will be hired and tasked with understanding user requirements and creating a preliminary GUI. Phase 2 is when cable locations will be identified and during Phase 3 the tool will be finalised, tested and integrated into workflows.

At the end of each phase a project meeting will be held with all partners to understand next steps and ensure that the project is delivering on its objectives.

A detailed budget was jointly developed by Aston University and SSEN based on the work plan. The cost of £193,074 to fund 50% of the project with the other half supported through the KTP funding mechanism, this represents good value for money.

The size of this project is intended to produce a proof of concept before further phases to pilot and test the solution at a wider scale are undertaken. This project represents the first step in creating a solution that will benefit all DNOs. Making a conservative estimate that accurate mapping will reduce costs by £400 per service cable replacement or upgrade and we will replace an estimated 97,000 service cables in the next price control, a saving of £38.8m. This is expected to deliver an approximate saving of £54m over SSEN's network by 2040 and £326m over the whole of GB.

£193k is required for the successful conclusion of this project. Any less would not meet the objectives of the project allowing subsequent phases and eventual roll out to other DNOs.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The project will take place in the SEPD region of SSEN.

Revenue Allowed for the RIIO Settlement

This is not included in our current RIIO settlement. As this is an innovative project setting out to create a new way of identifying service cables it is not possible to use BaU funding. NIA funding is required to de-risk future development and ensure capacity is embedded into SSEN to support further development.

Indicative Total NIA Project Expenditure

The total project expenditure is expected to be £193,074

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:

This project aims to map service cables from LV mains to property. The position of many underground or under eave assets are currently unknown. Having an accurate picture of cable location will provide data to inform decision making about future network investment so creating a more efficient and reliable energy system.

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

The estimated cost of upgrading a service cable (cable that runs from the pavement or similar to the meter), is currently estimated at between £3,000 and £6,000 per property. The cost includes planning, materials and carrying out the work. If the cable position is unknown an in-person survey will be required and possibly a risk assessment. If we know not only the position of the cable, but the surface type that requires digging and the position of the meter cupboard, planning for replacement and costs involved can be reduced.

Making a conservative estimate that accurate mapping will reduce costs by £400 per service cable replacement or upgrade and we will replace an estimated 97,000 service cables in the next price control, a saving of £38.8m. This is expected to deliver an approximate saving of £54m over SSEN's network by 2040 and £326m over the whole of GB.

There are two further cost related considerations:

- Digitising records: As much of the current infrastructure dates to the 1960/70s recording positions of cables was done manually using cards that are currently being digitised at a cost to the business. With an accurate map of service cables created using visual tools and AI techniques, this cost will be avoided.
- Streetworks: Streetworks refer to the activities involved in the construction, maintenance, and repair of the public highways and roads. SSEN D works closely with local authorities, regulatory bodies, and other stakeholders to ensure that streetworks are carried out in compliance with regulations, minimize disruption to the public, and maintain the integrity of the electricity distribution network. In some cases, if accurate information about the site is not know there may be a fine associated with streetworks. Streetworks fines may vary based on the specific regulations and local authority requirements. With accurate mapping these fines can be minimised.

Other considerations:

- A recently published document NIC1 (see Section 2.4. for reference detail), points out challenges with supply chain and workforce resilience. NIC recommendation 14 recognises there are and will be challenges ensuring the workforce needed to upgrade the country to reach 2050 goals. If we have better information during planning, we can secure the services required in advance.
- Currently a lot of cable upgrade is done reactively. With all cables mapped and needs for contractors understood, a large number of customers could be upgraded at one time.

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

The end solution will be applicable to all DNOs. It is intended that the outputs of the project will be able to be used by all DNOs either directly or with minor modifications depending on differences in the network and network users. There will be considerations regarding integration with systems used across GB. A proposed roll-out plan in integration with SSEN systems is a deliverable of this project. This could be used as a blueprint for other DNOs to map the solution to their system.

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

Rolling the solution out amongst all DNOs will require us to understand if it is directly applicable and if not, what changes are required to meet other DNO needs. It is anticipated that roll out costs will be minimal.

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 will generate a solution to map the position of cables to properties that are currently not mapped. It is directly applicable to all DNOs and should be interoperable with most systems with minimal tailoring.

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.

No other project on the ENA website can be found that duplicates the outcomes of this project.

A number of projects can be found on the ENA project portal that use imagery to assess asset condition and include:

1. Foundation Source Model 10168330, which went on to be productionised by a third-party collaborator in the project Detecting high risk distribution poles with AI. This tool uses Google imagery and AI to map and assess the condition of wooden poles.
2. Visual inspection and condition assessment platform (VICAP3) NIA_NGET0009. This project looked at assessing asset condition using imagery captured from drones.
3. Satelline. NIA_UKPN0091. Explored the use of satellite imagery as an alternative to LiDAR to measure vegetation proximity to overhead lines.

This project will use AI and multimodal image analytics to develop a solution for the accurate detection and/or prediction of electric cables and deliver a vectorized representation on GIS maps. To do this, a deep learning model will be created to accurately estimate the location of the cable to the property, either directly from the mains to the identified service card, or from the adjacent property. The project will finally automatically populate the GIS map with vectors representing the identified cable positions for each property within the defined area of SEPD. To our knowledge and evidenced by lack of duplication in the ENA project list, a project like this has not been undertaken in the GB energy network.

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

A method to locate DNO service equipment at scale does not exist. This project will use visualisation techniques such as LiDAR and Google Maps, but these methods are unproven for the distribution network. This project will be the first-time multimodal image analysis, and AI will be used to detect or predict the locations of electrical apparatus and identify them on maps. The novel nature of this project means ingesting new data sources we do not currently have access to. Additionally, a new business model will be developed as none currently exists.

There are no other projects looking to address this gap that can be found. There is inherent risk with a TRL level between 4 and 6 – the solution has not been fully developed and so still has the potential to not meet the brief or to fail.

Relevant Foreground IPR

The project will generate IP related to the development of a novel AI-enabled system using images and LiDAR maps to locate service-cables between the street and the property. Details of the IPR arrangements are as follows:

All Background IPR is and shall remain the exclusive property of the party owning it (or, where applicable, the third party from whom its right to use the Background IPR has derived). Neither party shall obtain or have any rights under this Agreement in respect of any Background IPR of the other party, other than as expressly set out herein.

Each party hereby grants to the other party a non-exclusive, non-transferable, royalty free licence to use its Background IPR for the Term strictly to the extent required and for the sole purpose of carrying out the Research Project.

SSEN will own the Resulting IPR generated by the Research Project.

Aston hereby assigns to the Company, including by way of present assignment of future rights, all existing and future rights, title and interest in and to the Resulting IPR and all materials embodying such rights to the fullest extent permitted by law.

Aston grants to the Company a non-exclusive, royalty-free, perpetual, irrevocable, worldwide, transferable licence, with the right to sub-license, to use, reproduce, modify and exploit Aston’s Background IPR strictly to the extent necessary for the purpose of the Company using and/or exploiting the Resulting IPR.

The Company grants to Aston:

- a non-exclusive, royalty-free, perpetual, irrevocable, worldwide, transferable licence to use the Resulting IPR for research, academic and teaching purposes, and (subject always to clause 14) to publish, and permit others to publish, the results of that research;
- a non-exclusive, royalty-free, perpetual, irrevocable, worldwide, transferable licence to use the Company’s Background IPR to the extent necessary to enjoy the benefits of the licence granted by the Company to Aston under clause 9.6.1.

Will comply with standard NIA and KTP IPR.

Data Access Details

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

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

This project cannot be funded under business as usual (BaU) activities as it is an untested methodology, so BaU funding is not appropriate for this type of R&D. The methods and technology used within this project has yet to be fully proven and demonstrated within energy networks. NIA funding will de-risk the use of advanced data techniques to create this AI enabled mechanism and to embed capacity with SSEN to allow further development and subsequent roll out to other DNOs.

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

While this methodology has been trialled by the academic supporting the KTP, it has not been applied to this use case and with high numbers of data points required and involving advanced AI techniques the development is out with our RIIO-ED2 business plan. The project is suitable for NIA funding due it it's inherent risk and potential to benefit DNOs and customers.

This project has been approved by a senior member of staff

☑ Yes