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 2018

### Project Reference Number

NIA SSEN_0032

## Project Registration

### Project Title

Phase Identification Unit to Assist in Underground Fault Location

### Project Reference Number

NIA SSEN_0032

### Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

### Project Start

February 2018

### Project Duration

1 year and 4 months

### Nominated Project Contact(s)

NIA Programme Delivery Manager –Joe McNeil

### Project Budget

£153,000.00

### Summary

This innovation project will issue a number of depot fault location teams with Phase Identification Units. The HAYSYS phase identification unit, is set to reference the phase at the appropriate secondary substation and by approaching the household the unit can identify if power is present and to which phase the house is connected. This functionality is the basis of the trial in assessing whether the unit can reduce fault restoration times. It is recognised that for many faults where the LV fuse is blown this unit will not be of assistance but for other faults and in conjunction with other technologies it will be of assistance to the local fault location teams. The HAYSYS phase identification unit can be used to identify if the power is on and what phase it is on without entering the property which is critical when we cannot get access to the property at night or when people are at work during the day.

### Third Party Collaborators

HAYSYS Limited

ACUTEST

Academii

Energy Innovation Centre

### Nominated Contact Email Address(es)

fnp.pmo@sse.com

### Problem Being Solved

Rapid and accurate pinpointing of underground cable faults is a key factor in minimising supply interruption time and repair costs. Methods exist for locating underground cable faults with varying degrees of precision but ways of improving accuracy and confidence are constantly being sought.

However, at night times or holiday periods when large numbers of customers are not available assessing whether the premises still have their supply connected can be difficult. If there are no lights showing in the house it could be due to holiday absence or loss of supply.
The conventional method of the fault operative visiting the house to question the customer regarding their supply availability is not possible in that situation particularly with non-accessible cut out locations.
Using a HAYSYS phase identification unit, which by electro-magnetic coupling can identify which houses remain connected and which have their supply interrupted,can assist in locating the fault location.
In conjunction with other technologies, e.g. sniffer and/or Bidyong, this phase identification unit could play a part in reducing fault location identification times.

## Method(s)

While the primary use of Phase Identification equipment is not for fault-finding there is the potential to utilise the unit in a novel operational method and investigate its potential assistance in reducing fault restoration times.

This project investigates the value of equipping fault location teams with hand held phase identification units as complementary tools in the context of locating underground cable faults in the power distribution network.
In a scenario where there are customers on holiday, night times where no lights are showing in houses and where cut-out locations are inaccessible the phase identification unit can assist in narrowing down the location of the fault and create an accurate area of Interest.
Additionally repair of faults where a fuse link within a link box has restored supplies to customers after a phase/phases going open circuit the unit will assist in deciding the first excavation location.
The thermal camera/cable sniffer can then be used to further confirm the area of first dig.
The main application of the HAYSYS unit is envisaged as being on sustained L V faults with no automatic reclose facility and where a thermal scan has been negative
The aim is to reduce both the time and costs involved in restoring power to consumers in the event of an outage caused by an underground cable fault. Previous work has identified the HAYSYS Phase Identification Unit as the preferred equipment from the range of Phase Identification units available for equipping repair operatives and depot staff

## Scope

Phase identification has traditionally been targeted at connections teams to accurately identify the loading/imbalance on low voltage feeders emanating from secondary sub-stations allowing the preferred phase to be identified for new connections. Similarly, the checking the accuracy of historical records in terms of phase connections has been a primary application of this technology. A very limited trial on site has identified the units as accurately identifying the phase to which suburban housing is connected without entering the households. The unit is set to a reference phase at the appropriate secondary substation and by approaching households the unit can identify if power is present and to which phase the house is connected. This functionality will be the basis of the trial in assessing whether the unit can reduce fault restoration times. It is recognised that for many faults where the L V fuse is blown this unit will not be of assistance but for other faults and in conjunction with other technologies it is hoped to be of assistance to the depot fault location teams.

## Objective(s)

Issue a select number of depot fault location teams with Phase Identification Units.
Initiate training for the teams, then develop formal Training, process and procedure.
Evaluate equipment performance over a period of around 9 months in assisting fault locationincluding reinforcing further learning.
Create a robust methodology for attributing benefits to Phase Identification Units
Acquire data and develop a detailedcost benefits analysis
Document all results, conclusions and recommendations
Evaluate project outcomes for possible adoption by BAU

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

## Success Criteria

A number of existing fault location technologies have been developed to substantially improve the reconnection of customers to the network at times of interruption due to faults. However, none of them are 100% accurate in identifying the preferred location for the primary excavation point.

Geographical Area
Trials will be conducted in 4 regions in England (SEPD North East, South East, Thames Valley and Wessex). The project

management and administration team will be located in Perth, Scotland.
Revenue Allowed for in the RIIO Settlement
None

Indicative Total NIA Project Expenditure Total (2017/19 NIA)expenditure= £153,000 of which 90% (£137,700) is allowable NIA Expenditure. The costs include 9 months of field trials in order to capture sufficient results.
There are two criterion of success, either being achieved will result in a successful project.
1. Records of CI/CML performance improvement
2. Where specific cut-outs are inaccessible success shall be measured as avoiding direct disturbance to customers to identify the fault location.
If the Phase Identification Unit can assist in the appropriate type of fault to narrow this excavation point to an area between two properties without overtly disturbing the householders or in situations where customers are absent from properties this is hoped to lead to continuing improvement in customer service and reconnection times.

## Project Partners and External Funding

There is no external funding nor are there any formal project partners.

## Potential for New Learning

1) The suitability of phase identification units to assist in fault location.
2) Identifying properties where this technology may not be suitable and alternatively properties where the technology will be of assistance.
3) Acquire a better understanding of the types of fault where this technology can be applied.

## Scale of Project

Operations staff from 9 SEPD depots will conduct trials using the HAYSYS Phase Identification Unit. This will continue over around 9 months in order to collect enough statistics to assess the benefits being produced.

## Technology Readiness at Start

TRL7 Inactive Commissioning

## Technology Readiness at End

TRL8 Active Commissioning

## Geographical Area

Trials will be conducted in 4 regions in England (SEPD North East, South East, Thames Valley and Wessex). The project management and administration team will be located in Perth, Scotland.

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

Total (2017/19 NIA) expenditure = £153,000 of which 90% (£137,700) is allowable NIA Expenditure. The costs include 9 months offield trials in order to capture sufficient results.

# Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

## Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

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

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

n/a

## 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 (RIIO-1 projects only)

The project will reduce CIs and CMLs by locating faults more effectively than is currently possible, reducing costly expository works. This creates a more reliable network for our customers. On top of a reductionin CIs and CMLs there will also be a reduction in operation costs as less excavation work needs to take place. It is estimated that this project will save approximately £70k for our customers due to a reduction in operational costs. More details on total savings are detailed in the next section.

## Please provide a calculation of the expected benefits the Solution

Method Case(over 4 years)
HAYSYS –CAPEX = £37,050 Training Costs –OPEX = £18,644 SIMS Integration Cost –OPEX = £1,557 Maintenance –OPEX = £22,230 Total Cost = £79,481
CI CML Saving = £163,800(175 faults located @£936 CML saving per fault) Excavation Saving = £218,750 (175 faults located @ £1,250 saving per fault) Note: these savings are split between SSE and customer once cost deductions have been made. Approximately £70k will go to the customer. Savings Attributed to Bidoyng = £48,030
Method Case Savings =£255,039
Base Case (over 4 years) CI CML Cost = £163,800 Excavation Cost = £218,750 Total Cost = £382,550
Base Cost (£382,550) –Method Cost (£79,481) = Total Saving of £255,039

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

Developed methods will bebased on off the shelf solutions and will befully transferable to all DNO's who want to acquire them. The method would have the potential to be deployed by all field teams working on underground cable fault repair or condition monitoring.

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

The goal is to establish a methodology which is easy to use, can be deployed rapidly and has minimal equipment costs. Worst case equipment costs will be around £1,500. If the project proves that a low cost phase identification unit is fit for purpose,then roll out costs will reduce. To equip the field teams of SSEPD approximately 64 units are needed for BaU rollout and it is hoped to reduce the cost to around £1,275. Other DNO's can expect similar costs and benefits experienced by SSEN

## Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project 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

RIIO-2 Projects

☐ 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

Knowledge acquired from testing and trials will be made available for dissemination among distribution network operators. If the project proves that phase identification equipment can help to locate underground cable faults, then the developed methods and processes will be transferable to all network operators and their subcontractors. If appropriate, knowledge can be transferred to equipment manufacturers for enhanced diagnostics tool development and to cable manufacturers foruse in future underground cable design.

### Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

SSEN has a planned EV and link LV strategy. This outlines the strategic approach to EVs on the SSEN network. As such this project is in accordance with the EV/LV strategy to ensure a holistic approach to fault management in the future.

☑ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

### 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.

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

Based on published IFI and NIA information there are no known projects being undertaken by other network licensees to develop fault location technologies using phase identification units.

### 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

PIU is normally used for connection projects to identify suitable cable phases to make customer connections. This alternative use is an innovation in the field of Fault findingusing PIUs. Working in harmony with Thermal Imaging cameras;this dual approach should minimize disturbance of customersand IIS losses though limiting exploratory excavations by early fault location identification

## Relevant Foreground IPR

n/a

## Data Access Details

n/a

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

This project is outside of the Normal BAU activates as it is not yet proven that use of PIU for Fault location is viableGiven that this technology in the proposed use is unproved this does not meet the criterion required to be adopted as BAU presently. Given the benefits which may be achieved for Distribution customers across the UK this project is suitable for NIA funding. Similarly as this is a trial it is not being deployed equally across the Distribution Networks business and thus cannot be considered BAU.

## 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

Do to the associated commercial and operations risks this project cannot be undertaken without NIA support. • Commercial –The cost of equipment,procurement, training and use of PIU for fault identification would be a significant undertaking for a novel use of thistechnology. • Operational –The use of this device during trial may at times incur additional Operationaltime requirements with additional work requiredto ensure proof of concept for the PIU being used as a fault identification unit. 2 With the two key risk areas ultimately being associated with IIS this has a direct effect on consumers. As such the use of NIA funding is required to mitigate the consumer risk as far as practicable.

## This project has been approved by a senior member of staff

☑ Yes