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NIA Project Registration and PEA Document

Date of Submission

Jun 2018

Project Reference Number

NIA_UKPN0039

Project Registration

Project Title

Engineered Poles Products

Project Reference Number

NIA_UKPN0039

Project Licensee(s)

UK Power Networks

Project Start

July 2018

Project Duration

2 years and 7 months

Nominated Project Contact(s)

Peter Lang

Project Budget

£249,815.00

Summary

This project has produced new specification for Engineered Poles and the second phase of this project will demonstrate whether they are fit for procurement activities.

Nominated Contact Email Address(es)

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Problem Being Solved

The GB Electricity Distribution Operators rely on a tried and tested timber material to support distribution overhead lines, however, the sustainability of the forests these trees grow in, is shrinking. These trees rely on a slow growing environment and take around 120 years to grow to ensure they are of a suitable strength.

The material specification for wood poles (ENATS 43-85) standardises poles according to length and grade, with their strengths for use in line design calculations being derived from these dimensional standards and an assumed fibre strength. This is appropriate for a natural material such as wood, where the material properties are not under the control of the manufacturer. Poles constructed with alternative materials, in contrast, are entirely engineered, providing the opportunity to specify both the dimensions and the mechanical strength. For pole lines in GB, this represents a major change in design philosophy and also an opportunity for many different approaches to line design.

While poles fabricated from engineered materials meet the current requirements of the national wood pole design standards they are cost prohibitive; one preferred material for example is composite which is currently in the region of 5 to 7 times more expensive than the equivalent wood pole variant. It can be justified to assume their cost would reduce should they be used in high volumes, but with the size of the GB market compared with continental markets being quite small, volume-related cost efficiencies would only be met if GB as a whole adopted common standards for both pole specification and line design.

When we factor in the life of a wood pole as around 60 years it is becoming apparent that at some time in the future an alternative support material will be needed for the GB market, this awareness to the restricted availability of suitable timber is already being felt by our suppliers.

Furthermore, the use of traditional timber preservatives on wood poles is becoming more restrictive and treated wood poles are now classed as hazardous waste, increasing their disposal cost. As creosote is harmful and with the possibility of it being banned by 2021 or at least allowed to be used in limited applications wood pole alternatives are required to ensure economic continuation of overhead lines. Supports that are significantly visually different may require planning permission, resulting in significant delays in any OHL refurbishment work and additional costs.

Method(s)

In order to overcome these challenges we will:

- Develop a draft specification from first principles for alternative engineered pole products. This will be reviewed by the whole industry through the Collaborative Energy Portfolio (CEP).
- Test one type of engineered poles against the draft specification within the identified product manufacturing facility, in order to test the suitability of the specification.
- Install/trial the new engineered poles on the network.
- Develop the installation & operation manuals for utilising these alternative poles in future, revise the specification as required following learning from first use.

Scope

This project is formed of two phases:

Phase 1: A collaborative development of a draft specification and recommended revisions to standards through the CEP for engineered poles. This includes:

Feasibility Study Report : Publish a feasibility study report on historical design standards to establish a technical basis for justifying the continued use of empirical design methods detailed in ENA TS 43-40 and TS 43-50 when utilising engineered pole products.

Factor of Safety Report : Determine an appropriate factor of safety that can be used for the range of engineered pole products.

Draft specification circulated within the industry for review : Draft a new specification based on empirical methods that could potentially be used to revise existing design standards (ENA TS 43-40 and TS 43-50). Following this project the ENA Overhead Line Working Group will decide whether to amend the standards and what amendments to make based on this learning.

Life Cycle Analysis Report : Publish a report which looks at the whole life cycle of different types of pole material available in terms of the possible future environmental benefits, costs of production, transportation and construction of each.

As part of the final phase 1 report the consultancy contract will provide indicative costs of one or more of the proposed potential products to replace wooden poles (and this will consider potential mass scale production/location/different sizes etc.).

Phase 2: Procurement, testing and trialling the new proposed engineered poles. This includes:

Procurement, Manufacturing & Factory Acceptance Tests (FATs) : Following the draft specification creation and based on the required characteristics a tender will be released for supplying poles and poles will be manufactured and tested through agreed Factory Acceptance Tests.

Poles Delivered to site : Delivery of poles to the nominated site.

Successful Installation : Installation of Engineered Poles on distribution overhead line networks.

Installation Procedures and BAU adoption Report : Developing the new Installation Procedures for future utilisation of the engineered poles through Asset Management.

Objective(s)

Phase 1: Develop a draft specification for alternative engineered poles. The draft specifications developed will be agreed by the whole industry through the ENA/CEP.

Phase 2 : Completed Trial and completed Business as Usual standards will focus on testing the engineered poles against this draft specification within the manufacturing facility and installing(trialing) the new engineered poles on a UKPN 33kV line. The current proposed trial will require 6-10 poles in total.

Furthermore following the completion of the trial UKPN will work on the BAU documentation to enable the use of engineered poles in UK Power Networks and other DNOs complying with the specifications developed on phase 1 of this project.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be deemed successful if the following are achieved:

- A draft industry specification for engineered poles is developed;
- One type of new engineered pole is developed and tested against the new specification; and
- Poles of this type are safely installed on UK Power Networks' network.

Project Partners and External Funding

Phase 1 of the project (specification development) will be run under the CEP, the vendor (a preferred supplier is currently identified) will be contracted by the ENA and the cost of the project recharged to the participating DNOs.

The project is dependent on all participating networks signing up to provide finance.

The following networks have confirmed their participation:

- 1) UK Power Networks (Lead DNO group)
- 2) Western Power Distribution
- 3) SP Energy Networks
- 4) Scottish and Southern Electricity Networks
- 5) Electricity North West Limited
- 6) Northern Powergrid

Potential for New Learning

Phase 1 of this project will specifically look into a specification that can be used across all UK Networks for engineered pole products.

Scale of Project

The projects costs are mainly during Phase 1 (70%) which will allow every DNO to contribute to the development of the specification and feasibility study for engineered poles alternatives. A tender was progressed through the ENA CEP and the most complete technical/commercial proposal was selected.

The phase 1 costs will be shared between several DNOs which are composed of the consultancy contract to the selected bidder and the time spent to manage/review the deliverables from this contract by each DNO representative.

There was a delay of nine months in getting the Phase 1 deliverables agreed by the members of the ENA Overhead line forum. Now that the specifications are available UK Power Networks will test the specifications are fit for purpose in a procurement tendering event as part of Phase 2.

The second phase of the project will include only a limited number of poles (currently proposed at 6-10) to trial them on a UK Power Networks overhead line to enable the creation of the installation manuals and check any issues with the connection of other elements to the poles.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

Phase 1 is a collaboration effort with support from all UK DNOs.

Phase 2 will include a trial engineered poles purchased under the Phase 1 specification.

Revenue Allowed for the RIIO Settlement

The trial that will be performed as part of phase 2 of this project line will not be charged to this project as it is part of the ED1 asset replacement plan. This NIA project will only be charged the additional costs for using the new engineered product compared to the standard wooden poles used as Business as Usual.

Indicative Total NIA Project Expenditure

This project expenditure is comprised of two elements :

Phase 1 : Specification Development (through CEP).

Total CEP Project Order to be issued through ENA : £107,000

In total there are 14 licensees participating and phase 1 costs (the consulting contract costs) will be shared between all 14 licensees.

Total Manpower to support the Phase 1 from DNOs is £54,365 as following :

£20,000 - UK Power Networks (Lead DNO group)

£3,053 - Western Power Distribution

£10,000 - SP Energy Networks

£15,022 - Scottish and Southern Electricity Networks

£4,000 - Electricity North West Limited

£2,290 - Northern PowerGrid

Phase 2 : Procurement, Testing and Trial.

UK Power Networks costs to procure, test and trial up to eight units of engineered poles within UK Power Networks depending on the commercial cost difference with wood poles. The trial that will be performed as part of phase 2 of this project line will not be charged to this project as it is part of the ED1 asset replacement plan. This NIA project will only be charged the additional costs for using the new engineered product compared to the standard wooden poles used as Business as Usual now.

Total Phase 2 Cost : £75,450

Total NIA Expenditure for Phase 1 & 2 : £224,834 (90% the total project expenditure £249,815).

This change request does not involve any increase in project budget.

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)

To have an overview of the benefits of using engineered poles we need to consider a lifetime cost rather than the ED1 cost only and considering the following:

The lifetime for engineered poles is expected to be at least 80-100 years while the wood poles have a lifetime of 50-60 years (and if Creosote was banned the current alternative is using water based preservatives with lifetime 25-30 years).

Should Creosote be banned (a review is to be conducted in March 2021) then the only available alternative is using wood poles treated with water based preservatives which has a lifetime of 25 years which means on a life time analysis the wood poles (with water based preservatives) would cost over double Creosote treated wood poles.

Engineered Poles are expected to last four times as long compared to water based preserved wooden poles and two times as long compared to creosote based preserved wooden poles which mean the installation costs (more than 50% of the replacement costs) will be reduced over its lifetime.

Engineered Poles could initially be used in areas with high potential public access to mitigate any potential safety associated risks with public contact.

Please provide a calculation of the expected benefits the Solution

The demonstration project specifically will not have any monetary benefits as it is focused on creating the specification and feasibility study for alternative engineered poles and having a limited trial on one of UK Power Networks lines.

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

UK Power Networks have the 695,000 pole assets across its network, of which 6000-8000 poles are replaced every year. Similarly this solution can be replicated across all other DNOs.

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

The material cost of a sample of engineered poles is currently 4-5 times the cost of wooden poles but have the similar installation costs which eventually makes the total cost of using engineered poles around 30% higher than wooden poles.

Considering the lifetime of engineered poles the lifetime unit cost of engineered poles is 25% lower than wooden poles (creosote treated) and if creosote was banned then engineered poles are less than 50% of wooden poles (with water based preservatives) saving approximately £500/unit which could save £800,000 – £1,200,000 across GB if fully implemented considering the overall lifetime of the new products.

In the long term (life time analysis) the cost of engineered poles is expected to be lower than wood poles

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

Phase 1 of this project will specifically look into updating the specifications that can be used across all GB networks for engineered pole products.

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

n/a

- 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.

Since 2007 the electricity industry has carried out several projects relating to the assessment of alternative pole materials for overhead line construction, notably using the following materials, concrete, steel and composite. The findings of which can be found in the following reports:

- STP Report No 6090, Project No S2151_1 November 2007, Alternatives to Wood Poles.
- STP Project No S2151_2 August 2010, Mechanical Erection Procedures, Foundation Capabilities, Pull Tests and Fittings for Concrete Poles.
- STP S2162_1 November 2011 Residual Strength of Ageing Wood Poles Stage 1 Obtain and Test First Batch of 25 Poles.
- STP S2162_3 July 2014 Residual Wood Strength of Ageing Wood Poles Stages 1 to 3.

- STP Project No S2151_3 July 2014 Alternatives to wood poles-stage 3 Composite Poles (Mechanical Erection Procedures, Foundation Capabilities, Pull Tests and Fittings).

- NIA_SPEN0019 – 2017 Operational Assessment of Composite Poles.

These projects focussed on the operational practicalities, physical strengths and ability to use existing fittings with the alternative materials; they did not look at the design approach that is currently used for wood poles and producing a new specification for their use against the same design approach, which this project aims to do in its first phase.

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

Previous projects focussed on the operational practicalities, physical strengths and ability to use existing fittings with the alternative materials; they did not look at the design approach that is currently used for wood poles and producing a standard specification for their use against the same design approach, which this project aims to do in its first phase.

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

Through the collaboration of all DNOs the aim of this project is to have a new specification for using innovative engineered solutions to be able to approach the market for alternative innovative solutions. As there is no product in the GB market now or even a specification available, the Asset Management teams cannot use any other products on a large scale deployment. In section 3.2 of the NIA Governance document, the DNOs are encouraged to pursue different types of Methods and Solutions. The development of an engineered alternatives specifications and the associated benefits is an area that has not received a great amount of attention from any Innovation stimulus. Due to the risk involved in the project and not fully knowing whether the benefits can be delivered across our licence areas, these activities would not form part of our business as usual activities. In order to progress an innovative project which carries significant risk in implementation, additional innovation funding is required as a stimulus.

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

At this stage there are no definitive products that can replace wooden poles cost effectively hence the development of this specification with contribution from all DNOs and the feasibility/life cycle assessment for alternatives is crucial to be able to source innovative alternative solutions in future. If the project is successful, it will have proven a technical solution and business processes which will reduce poles replacement costs and increase pole lifetime. It is also noted that the NIA guidance encourages Network Licensees to ensure that projects funded across NIA cover a broad range. To date there have been very few projects which have been looking for alternatives to wood poles and creating a new specification.

This project has been approved by a senior member of staff

Yes