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

Mar 2017

Project Reference Number

NIA_SGN0112

Project Registration

Project Title

Forged Carbon Fiber Products (FCFP) - Stage 1

Project Reference Number

NIA_SGN0112

Project Licensee(s)

SGN

Project Start

March 2017

Project Duration

3 years and 6 months

Nominated Project Contact(s)

Oliver Machan, Innovation Project Manager

Project Budget

£359,092.00

Summary

The scope of this research and development project is to mature the FCF technology whereby SGN, the manufacturer and the technical service provider can gain confidence in the project's success in its entirety. The project will facilitate the development of the basic products and includes additional conceptual design to refine the FCF products given the unique material properties. Further evaluation of the preliminary tools and moulds will enable final selection of products/product components. This evaluation will facilitate product design and integration in to the distribution network following successful completion of the Stage 2 field trials.

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

Until the early 1970's, metals were the default material when creating new, and adding to the gas distribution networks. Due to their corrosive nature of metals and risk that poses, over the last 35 years various iron mains replacement programmes have been in place. The favoured replacement pipe material is Polyethylene or 'PE' which is light weight, non-corrosive and offers an up to 80 year life. Until now, the intermediary fittings between differing pipe materials along with any complex parts like valves and the repair fittings for existing pipes have continued to be made of metals to fulfil strength and pressure requirements. This makes them heavy, prone to the same corrosion mechanisms and leaves potential weak spots in otherwise remediated networks. Making these products from metals also has a large carbon footprint due to smelting and working methods.

SGN are now looking to develop an initial selection of 5 complex products made from Forged Carbon Fibre (FCF) which is light weight, non-corrosive and is as strong if not stronger than the metals used. Their production can also incorporate recycled carbon materials and is a much less energy intensive process.

Method(s)

Under this project the following research and development tasks will be undertaken in collaboration with the manufacture and the

appointed technical consultant:

Task 1: Design & Engineering of the Products

- CAD design along with basic finite element analysis of the systems
- Design of all vacuum and compression moulding tools
- Technical review of conceptual design of the products to relevant industry standards and legislation
- Gap analysis and risk assessment again GB an EU standards

Task 2: Tooling and Fixtures Manufacture

- Machining, finishing and assembly of aluminium compression/vacuum moulds
- Printing and finishing of DMLS compression moulding tool
- Construction of machining fixtures to be used for manufacturing

Task 3: Manufacturing of the Products

- Compression moulding of 3 products along with assembly
- Vacuum and compression moulding and water cutting of 1 product along with assembly
- Vacuum moulding of 1 products along with assembly

Task 4: Testing

- Basic In-house testing following manufacture
- Laboratory testing to simulate the environment the products will be required to operate in

Task 5: Review

- Review and appraisal of design, development, engineering and testing reports
- Creation of an offsite testing report which details the performance of the products in a non-gas environment and makes an assessment on suitability for field trial
- Recommendation for Stage 2 field trials

Scope

The scope of this research and development project is to mature the FCF technology whereby SGN, the manufacturer and the technical service provider can gain confidence in the project's success in its entirety. The project will facilitate the development of the basic products and includes additional conceptual design to refine the FCF products given the unique material properties. Further evaluation of the preliminary tools and moulds will enable final selection of products/product components. This evaluation will facilitate product design and integration in to the distribution network following successful completion of the Stage 2 field trials.

Objective(s)

The objective of this project is to give assurance that Forged Carbon Fibre can be used to manufacture a range of complex products that are used on the gas distribution network.

To do this, the project will redesign and manufacture 5 products maximising the material properties and then test those products against the existing metal based product standards and specifications.

Assurance gained through testing will be used to support an ongoing Stage 2 which will incorporate field trials of the products.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project are:

1. Technical review of product conceptual design of the products to relevant industry standards and legislation
2. Gap analysis and risk assessment against industry standards and specifications
3. Review and appraisal of design, development, engineering and testing reports
4. Laboratory testing to simulate the environment the products will be required to operate in
5. Creation of an offsite testing report which details the performance of the products in a non-gas environment and makes an

assessment on suitability for field trial
6. Recommendation for Stage 2 field trials

Project Partners and External Funding

The technical services cost and 50% of the manufacturing cost of the project is being funded under NIA by SGN. The remaining 50% of the manufacturing cost is being contributed by the manufacturer in return for joint ownership of the IPR.

Potential for New Learning

This project is expected to provide all Network Licensees with a fundamental understanding of whether it is viable to introduce complex FCF components into the distribution networks, which will be light weight, non-corrosive and is as strong if not stronger than the metal components used. The project should also allow an early assessment of whether FCF components could be used on local transmission networks subject to further analysis and testing which would bring further financial benefits.

Scale of Project

This project has been designed to be the first stage of a larger project developing and testing FCF products. Adopting a stepwise approach allows the costs and risks to be managed whilst at the same time gauging the engineering viability for the following stage. The range of products selected allows different areas of design complexity to be assessed which should lead to a further, wider range of products being made available in the future.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL6 Large Scale

Geographical Area

Manufacture and in-house testing on the products will be undertake in the USA and laboratory testing will be undertaken in the UK and Ireland. No field trials are anticipated during this stage.

Revenue Allowed for the RIIO Settlement

There are no direct saving benefits anticipated.

Indicative Total NIA Project Expenditure

The total project expenditure is £330,247, 90% of which is allowable NIA expenditure (£297,222).

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 cost benefit calculation varies for the different products based on safety, base product cost, environmental and installation time factors. As a general output across the range of 5 products being designed, produced and tested, if the Stage 2 field trials prove successful then a saving of around 20% compared to base method is anticipated.

Please provide a calculation of the expected benefits the Solution

Based on just the 5 products being developed and aggregating the cost and volume information available from a number of years shows an average yearly base cost of £1.006m. Applying the new method across the aggregated product range produces a method cost of £702.250k, a saving of £289.350k annually once fully implemented.

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

If the same principal is applied to the other GDNs and assuming similar volume use then the annual saving across all the network licensees would be £1.157m. It should be noted though that this does not account for procurement agreements that may be in place covering a range of products and sizes where high or low volume products have been discounted or used as loss leaders.

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

No additional cost is anticipated as incorporation of the products would be managed under normal procurement activities.

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

By undertaking this development work the gas industry as a whole can share the overall cost, knowledge, risk and subsequent benefit from development and testing.

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.

Although FCF is being used in the 'CIPP - Stage 3' project (NIA_SGN0086), this is in conjunction with the use of Cured in Place Pipe and no other materials. It is also for connection fittings which are much more basic in their design and manufacturing complexity. This project will develop new and additional learning regarding the FCF material and its potential uses in the gas industry.

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

Using FCF as the material for the products mentioned in the project scope; is unproven and requires testing of such things like strength to determine if FCF could be used within the gas industry.

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

Due to the high degree of risk and uncertainty associated with the project, SGN would be unable to fund the project as part of its business as usual activities.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

The NIA funding is sought to address these uncertainties and to reduce the risks associated with using FCF as the material for the complex products.

This project has been approved by a senior member of staff

☑ Yes