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 2015

Project Reference Number

NIA_NGN_118

Project Registration

Project Title

CO2 Capture through mineralisation

Project Reference Number

NIA_NGN_118

Project Licensee(s)

Northern Gas Networks

Project Start

January 2015

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Dan Sadler - Head of Energy Futures (NGN), Michael Evans - Cambridge Carbon Capture, Richard Pomroy, Commercial Manager (WWU)

Project Budget

£52,000.00

Summary

The scope of this 12 month programme of work by CCC is to prove the technical advantage of the CCC process of CO2 mineralisation.

The project will contain two stages run in tandem –

Stage 1: Laboratory based experimental analysis of the CO2 mineralisation process (11 months)

Stage 2: Expert review of results of stage 1 experiments to ascertain competitive advantage (11 months)

Third Party Collaborators

Energy Innovation Centre

Cambridge Carbon Capture

Nominated Contact Email Address(es)

innovation@northerngas.co.uk

Problem Being Solved

To meet environmental and energy security targets, networks need to encourage shale gas and non-fossil fuel sources of gas to be injected into their networks. Use of bio-methane on the gas distribution network will help to reduce the future dependency on fossil fuels thus ensuring security of supply for the future whilst using and sustaining the existing energy infrastructure. However, to meet regulatory & commercial specifications, there is a need for acid gas removal (AGR) from the gas before distribution. The current

upgrading of gas is costly therefore any introduction of more cost effective methods will lower the financial barrier to injecting into the networks.

Existing AGR process equipment is expensive, large and energy intensive, and vents the scrubbed CO2 directly to atmosphere. Venting of 30% CO2 is equivalent to increasing gas combustion emissions by 43%.

Method(s)

In order to demonstrate the technical feasibility of the CCC process the project has been split into two stages: -

Stage 1: This stage is focused on primary experimental analysis. The experimental analysis will pass simulated shale/bio gas through a slurry of magnesium hydroxide in water to determine rates of reaction and mass-balance on the fate of the CO2 that is removed. This experiment will demonstrate the technical feasibility and performance advantage of this technology over existing commercial amine scrubbing technologies. CCC will explore the quantitative dependence of reaction rates, %CO2 removal and %Mg (OH) 2 carbonation on key variable parameters. Product samples will be analysed for phase and magnesium & carbon content.

Stage 2: This stage will analyse the competitive advantage of the CCC process. Analysis of results after each set of experiments and review by expert academic and industrial supply-chain stakeholders to assess and qualify the competitive advantage over existing methods.

Scope

The scope of this 12 month programme of work by CCC is to prove the technical advantage of the CCC process of CO2 mineralisation.

The project will contain two stages run in tandem –

Stage 1: Laboratory based experimental analysis of the CO2 mineralisation process (11 months)

Stage 2: Expert review of results of stage 1 experiments to ascertain competitive advantage (11 months)

Objective(s)

The objective of this project is to –

- Determine rates of reaction and mass-balance on the fate of the CO2 that is removed from simulated shale gas.
- Demonstrate technical feasibility and performance advantage of this technology over existing commercial amine scrubbing technology.
- Qualify the competitive advantage of CCC technology (over amines) for shale gas CO2 scrubbing.
- Assess the scale of the opportunity and the route to market.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project are:

- Demonstration of CO2 stripping of the simulated gas mixture

- Chemical analysis of end products proving desired chemistry; demonstration of good utility of Mg(OH)2 (<20% Mg(OH)2 in product solids)
- Reaction kinetics calculated and validated against available research literature
- Industrial contacts shortlisted & key discussion questions summarised.
- Production of market research report

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project will be conducted at laboratory scale level.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

CCC will be using laboratory facilities at Cambridge University.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

NGN

£20,000External Project expenditure

£6,640 Max Internal Spend

90% of which is Allowable NIA Expenditure (£23,976)

WWU

£20,000External Project expenditure

£6,640 Max Internal Spend

90% of which is Allowable NIA Expenditure (£23,976)

The external costs of this project is £40,000. This will be funded through the allowable NIA incentive and shared equally between WWU & NGN.

Cambridge Carbon Capture will also contribute to the project via a grant fund from Innovate UK of £112,436.00 this will not be recovered via NIA.

Total project expenditure - £165,716

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 potential savings of this technique could be significant both for reduction in 'cleaning operations' for bio methane plants but also for general decarbonisation of UK's energy.

Please provide a calculation of the expected benefits the Solution

Research project

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

This method could be applied across the whole of GB and applies to all network operators.

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

Unknown

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

This project will identify whether the CCC process could be used for CO2 removal from alternative sources of methane. This is a step towards making this technology a commercial reality, a technology that would promote the injection of alternative methane sources into the networks.

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.

n/a

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

n/a

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

n/a

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

n/a

This project has been approved by a senior member of staff

☑ Yes