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

Aug 2021

Project Reference Number

NIA_NGN_337

Project Registration

Project Title

Biomethane Study

Project Reference Number

NIA_NGN_337

Project Licensee(s)

Northern Gas Networks

Project Start

September 2021

Project Duration

0 years and 5 months

Nominated Project Contact(s)

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Project Budget

£68,611.00

Summary

Many Anaerobic Digestion (AD) facilities are underperforming due to technical, logistical or financial challenges and recent efforts in the industry have led to consideration of new opportunities to maximise heat decarbonisation efforts. Support for AD with CHP projects is weakening; RO (Renewables Obligation) support will start expiring within the next 5 years for the early adopters and under current regulations, FIT (Feed-In Tarriffs) supported projects are unable to replace ageing CHP engines without compromising their FIT accreditation. Furthermore, capacity in the distribution networks is an issue, limiting opportunities for new biomethane connections in certain areas whilst at the same time waste feedstock is becoming constrained.

This research-based project will identify areas for potential growth in biomethane production, by reviewing both feedstock potential and gas grid capacity, to identify suitable clusters or key target plants than could convert from CHP to biomethane injection, with minimal effort for maximum economic, environmental and social benefit.

Third Party Collaborators

CNG Services Ltd

Energy Innovation Centre

Nominated Contact Email Address(es)

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Problem Being Solved

Many Anaerobic Digestion (AD) facilities are underperforming due to technical, logistical or financial challenges and recent efforts in the industry have led to consideration of new opportunities to maximise heat decarbonisation efforts. Support for AD with Combined

Heat Power (CHP) projects is weakening; RO (Renewables Obligation) support will start expiring within the next 5 years for the early adopters and under current regulations, FIT (Feed-In Tarriffs) supported projects are unable to replace ageing CHP engines without compromising their FIT accreditation. Furthermore, capacity in the distribution networks is an issue, limiting opportunities for new biomethane connections in certain areas whilst at the same time waste feedstock is becoming constrained.

The two main issues the project will look to assess are:

1. Uncertainty in support for biomethane post March 2022 due to the end of the RHI (Renewable heat incentive)
2. Cost of getting biomethane to market caused by GDN MP/IP grid capacity being taken in many areas due to the 110 biomethane projects completed to date

Method(s)

The project team will undertake a review of number of biogas CHP plants on Renewable Obligation Certification in each gas network and across GB, the remaining length of tariff, remaining asset life of biogas consumption assets, and typical conversion costs for gas grid entry – looking at both on-site gas grid entry and shared biomethane upgrade and injection hub approaches.

In order to address the problem outlined above, it is necessary to adopt a series of innovative approaches, as follows:

- To address capacity constraints, the use of within grid compression will be compared with moving biomethane by road to Central Decanting Stations. This has not been done in UK but appears to be a potential solution to specific issues faced by the biomethane industry at present.
- To address technical constraints, conversion of a reciprocating engine from biogas (typically 55% methane) to natural gas (90% CH4) presents challenges and risk. Whilst there have been projects converting from biogas to natural gas, there is very little information in the public domain and this report will be very helpful in moving this activity forward and overcoming technical challenges.
- To address economic and social constraints, it is important to understand the scale and nature of the biomethane opportunity, and to develop a strategic oversight of how developments may evolve. The market research into feedstock and grid capacity is something that has not been done before, but it is clearly fundamental to establishing a robust business model for this type of development going forward.
- Considering viable means of better valorising existing assets and resources provides a significant opportunity for the sector, to prolong the life of ageing developments and to strengthen existing activities. This work will consider such opportunities and could impact on a significant proportion of the AD industry if successful in the future.

The study will focus on the 3 following areas:

1. Central Injection Hub
2. Conversion of Biogas to CHP plants to Biomethane Injection
3. Cost of getting biomethane to market

Key Project outputs are in the form of 3 reports:

Review Central Injection Hub Model and Associated Economics
Review sewage biogas conversion of utilisation from electricity generation to biomethane injection (as per Gas Goes Green (GGG) Workstream 4 , Deliverable 4.2)
Report on all mandatory requirements:
a. Include all Biogas to Electricity plants
b. Identify areas with highest potential for new AD
c. Identify commercial barriers and opportunities

The reports will identify the following opportunities and benefits:
Green House Gas saving from biomethane
Investment in the economy (capex, opex, jobs)
Reduction in gas imports to UK
Allows renewable electricity from wind/solar on sewage treatment sites as the biogas CHP will no longer operate
Data Quality Statement: CNG Services have clear policies in place for data management and quality assurance, that all employees sign up to when employed by the company. All such policies are reviewed on an annual basis by the Board, with implementation monitored by Directors throughout the year.
Measurement Quality Statement: CNG Services have clear policies in place for data management and quality assurance, that all employees sign up to when employed by the company. All such policies are reviewed on an annual basis by the Board, with implementation monitored by Directors throughout the year.

The project is rated low in the common assessment framework detailed in the ENIP document after assessing the total project value, the progression through the TRL levels, the number of project delivery partners and the low level of data assumptions. No additional peer review is required for the project.

Scope

This project feeds into additional work being undertaken on decarbonisation, which is cheaper than alternative forms of decarbonisation.

Stage 1

1.1 Review Central Injection Hub Model and Associated Econometrics

1.2 Model additional options, with additional GDN funding of the assets associated with Options 3 and 4 (as described above)

1.3 Consider commercial barriers and opportunities

Stage 2

2.1 Review sewage biogas conversion of utilisation from electricity generation to biomethane injection

2.2 Identify existing quantum – total installed capacity and operational capacity across the sector

2.3 Review and benchmark current performance

2.4 Identify the engine population and distribution by manufacturer, then determine the most likely alterations required to achieve conversion to run on natural gas.

2.5 Determine the most likely operational pattern and the range of operational scenarios which may be required – identify the key issues which may arise as a result of the run pattern.

2.6 Estimate cost ranges for the various works, and any differences in cost which may occur as a result of varying operational practices.

2.7 Undertake high level cost benefit analysis of ROC's V RHI/GGSS/RTFC

2.8 Consider the carbon benefits of redirecting the Biogas for alternative use.

Stage 3 - Report on all mandatory requirements:

- Must include all Biogas to Electricity plants
- Must identify areas with highest potential for new AD
- Must identify commercial barriers and opportunities

3.1 Extract the sub-set of operation and consented AV CHWP facilities from NNFCC's AD Deployment database. Analyse the dataset by capacity and commissioning date to determine their likely RO/FIT rates and accreditation date and to identify sites with ageing CHP's, to assess the likelihood of each site switching to biomethane at the end of their tariff or CHP lifetime

3.2 Obtain performance data for each site to determine their current energy production, utilisation and wastage.

3.3 Map all identified facilities to illustrate geographical spread across the UK

3.4 Identify for all sites deemed likely to consider switching within the next 5-7years, their distance from the gas grid

3.5 Identify key clusters of AD plants with CHPs deemed to have a high or medium likelihood of considering a switch to biomethane production within the next 5-7 years

3.6 Produce more granular, local scale maps, clearly illustrating each potential cluster in more detail, annotated with basic site details.

3.7 Produce a smart infographic showing potential target clusters, the scale of opportunity and current energy wastage, by GDN to illustrate the potential contribution this model could make to greening of the gas network between now and 2030.

3.8 Part 2 – Complete cost assessment

3.9 Considering the CHP scale brackets considered in the previous task, for those plants deemed most likely to consider switching to biomethane, we will use internal datasets to determine the likely cost of converting large AD plants to biomethane injection facilities, where they are in reach of a suitable grid connection point.

3.10 The costs of establishing a strategic injection point will be determined for each GDN.

3.11 Learning curves will be developed for each cost scenario.

3.12 Where possible, granular costs will be obtained and presented, and P50/P90 values considered for each component, to identify key sensitivities and to validate costs for future developments.

3.13 The team will consider current and potential future funding.

Objective(s)

Stage 1 objective - To present a comparative assessment of all options, specific to the GB regime.

Stage 2 objective - To quantify the scale and cost of the opportunity at site-level, in both economic and environmental terms

Stage 3 objective – Assess GB AD Biogas Sites & Complete Cost Assessment

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

This project will have a low impact on consumers in vulnerable situations as it will not directly impact or benefit them in financial or well-being terms. However, the project outputs will provide insight into the scale and nature of biomethane opportunity across GB and if more opportunity for green gas connection is identified, it will further support a lower carbon, safe and reliable network.

Success Criteria

A successful project will see the delivery of reports to the participating networks, that will help us understand the ways in which Biomethane production can be maintained or increased in the future.

Minimum criteria:

- Establish options for addressing capacity constraints on the grid
- Explore opportunities for market growth in key areas, focusing on conversion of existing CHP facilities to biomethane.
- Determine the landscape for future market development, addressing feedstock and grid capacity constraints.
- Quantify the additional biomethane that could be produced for grid distribution, should the options explored be pursued.

Project Partners and External Funding

Project partners are CNG Services and EIC. The project is wholly funded via NIA.

Potential for New Learning

There are a number of opportunities for new learning from this work during and following project completion:

- To address economic and social constraints, it is important to understand the scale and nature of the biomethane opportunity, and to develop a strategic oversight of how developments may evolve
- The market research into feedstock and grid capacity is something that has not been done before, but it is clearly fundamental to establishing a robust business model for this type of development going forward
- Considering viable means of better valorising existing assets and resources provides a significant opportunity for the sector, to prolong the life of ageing developments and to strengthen existing activities. This work will consider such opportunities and could impact on a significant proportion of the AD industry if successful in the future.
- The within grid compression option is important for the development of biomethane and possibly H2 which may also have capacity issues. Knowledge gained here is inherently valuable and transferable across a vast number of stakeholders, such as:

- GDNs
- Biomethane producers
- Biomethane investors

- Wider AD industry
- NNFCC - The Bioeconomy Consultants
- Water companies

Scale of Project

Delivered as detailed, the project will bring significant advances in knowledge relating to biomethane opportunity.

Carried out in any other way, including a lessened scope would significantly reduce the benefit received from the project. Identifying the opportunities, but not understanding exactly which sites would benefit from them would be less useful and bring less societal/environmental benefit.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project is research based and is GB wide.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

NGN External costs: £26,000
NGN Internal costs: £11,411
NGN total costs: £37,411

WWU External costs: £26,000
WWU Internal costs: £8,666
WWU total costs: £31,200

Total NIA Project Expenditure: £68,611

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:

Increased biomethane injection supports green gas objectives and facilitates a reduction in methane and carbon emissions.

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)

N/A

Please provide a calculation of the expected benefits the Solution

This is for Development or Demonstration Projects, not required for Research Projects. It should be (Base Cost – Method Cost, Against Agreed Baseline) and include a description of the recipients of the benefits.

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

A report produced at Stage 2 of the project will quantify the scale and cost of the opportunity at site-level, in both economic and environmental terms. At present there are 110 biomethane projects GB wide.

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

This is a research project and roll out costs are not within scope, as the project finishes at TRL 3

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

The comparative assessment of all feasibility options, specific to the GB regime, will help networks understand the scale of biomethane opportunity for their network.

To quantify the scale and cost of the opportunity at site-level for converting CHP engines to natural gas CHP, in both economic and environmental terms, will help remove barriers to this conversion taking place by other water companies. There are currently 481 operational CHP facilities with a further 187 consented but not yet developed, all of which would be considered in the analysis. This will identify to GDNs where the opportunities lie.

The within grid compression option is important for the development of biomethane and possibly H2 which may also have capacity issues

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

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.

A thorough check has been completed and no similar projects identified on the smarter networks portal. All networks were informed of the project and no issues of duplication were raised.

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

To address capacity constraints, the use of within grid compression will be compared with moving biomethane by road to Central Decanting Stations. This has not been done in UK but appears to be a potential solution to specific issues faced by the biomethane industry at present.

To address technical constraints, conversion of a reciprocating engine from biogas (typically 55% methane) to natural gas (90% CH4) presents challenges and risk. Whilst there have been projects converting from biogas to natural gas, there is very little information in

the public domain and this report will be very helpful in moving this activity forward and overcoming technical challenges.

To address economic and social constraints, it is important to understand the scale and nature of the biomethane opportunity, and to develop a strategic oversight of how developments may evolve. The market research into feedstock and grid capacity is something that has not been done before, but it is clearly fundamental to establishing a robust business model for this type of development going forward.

Considering viable means of better valorising existing assets and resources provides a significant opportunity for the sector, to prolong the life of ageing developments and to strengthen existing activities. This work will consider such opportunities and could impact on a significant proportion of the AD industry if successful in the future.

Relevant Foreground IPR

This project and the resultant outcomes/deliverables will conform to the default treatment of IPR as set out under the agreed NIA Governance (where the default requirements address two types of IPR: Background IPR and Foreground IPR).

Data Access Details

For all data access requests, please follow the guidance set out in Northern Gas Networks Innovation Data Sharing Policy.
https://www.northerngasnetworks.co.uk/ngn-you/the-future/our-funding/

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

The scale of the issues at hand is unknown and therefore there is a high level of uncertainty associated with the project which would be beyond the network licensees' risk appetites. This piece of work is to better understand the opportunities for improvement and alternative methods

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 high level of risk associated to a low TRL research project is beyond the current risk appetites of networks, the NIA will allow us to complete this project to better inform future decisions and opportunities. The use of NIA funding means learning will be shared with all networks, as biomethane is connected to all gas networks.

This project has been approved by a senior member of staff

☑ Yes