

## NIA Project Registration and PEA Document

### Date of Submission

Jun 2021

### Project Reference Number

NIA\_NGGT0174

## Project Registration

### Project Title

CH4RGE – Methane Reduction from Gas Equipment (Stage 2)

### Project Reference Number

NIA\_NGGT0174

### Project Licensee(s)

National Gas Transmission PLC

### Project Start

May 2021

### Project Duration

0 years and 11 months

### Nominated Project Contact(s)

Steven Johnstone (NGGT), Neil Billingham (NGGT)  
Box.GT.Innovation@nationalgrid.com

### Project Budget

£82,098.00

## Summary

Emissions Reduction - Capture and re-utilisation of vented gas. CH4RGE Phase 2 development, incl preparation of FEED for site trials of chosen technology for emissions capture solutions

### Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

## Problem Being Solved

Gas losses occur across the entire UK gas National Transmission System (NTS) through direct gas emissions (principal areas being planned and emergency venting, compressor seal gas losses, valve losses and leaks). Such emissions are increasingly becoming a focus; requirements are likely to go beyond current controls (Best Available Technique (BAT) and licence conditions) driving NG to make significant emissions reductions to avoid financial, environmental and reputational harm. These emissions occur as methane leaked directly to the atmosphere – methane has a Global Warming Potential (GWP) 25 times higher than carbon dioxide. For National Grid (NG) to achieve the stated corporate goal of Net Zero GHG emissions by 2050, in line with the UK Government's target, significant reductions in methane emissions will be required in the short and medium term. Reducing emissions through innovation and technology are key to achieving these goals and a central tenet of the RIIO-T2 innovation settlement.

In the 12 months since commencing the first phase of CH4RGE, further policy drivers have aligned to increase focus on methane emissions. Specifically, the European Union has progressed with developing policy controls on methane emissions, sector bodies (such as Marcogaz) have increased their activities in this area, and Ofgem has put Net Zero transition for the NTS at the heart of the RIIO-T2 settlement. The landscape and regulatory direction now aligns even more closely with the CH4RGE objective than when the project was conceptualised in 2019/2020.

The first 12 months of the CH4RGE project has delivered key learnings including confirmation of a strong need case and opportunity to deliver environmental, financial and reputational gain, confirmation that viable innovation solutions exist (that sit outside of Business As Usual (BAU)) and a clear line of sight to one or even two pilot projects. Funding channels, up to and including the RIIO-T2 Year 3 Reopener have been identified for pilot and potentially network roll out of a number of projects under CH4RGE as an internal brand banner.

However, if the opportunity to maximise potential success is to be realised, several key problems remain to be resolved before a technology solution can be proven and readied for rollout:

- Obtaining fixed delivery costs for one (or more) pilot solutions via a formal RFP
- Confirming the exact mechanism for how the programme will map to the Innovation ND500 model
- Confirmation of pilot site(s) and investigation of integration requirements and condition surveys
- Compliance reviews against NG Policies, Procedures and Specifications (PPSs)
- Formal Environmental Assessment (FEA), Formal Process Safety Assessment (FPSA) and engineering challenge and review
- Environmental regulator engagement
- Detailed design, building, commissioning an undertaking active pilot phase

The proposed CH4RGE second stage will not provide resolution to all of these problems, however, it will act as an enabler to move the project forward through the period May 2021 to September 2021, to a subsequent site-based pilot. This will also allow key decisions to be made on how exactly to apply the ND500 hybrid innovation model and accommodate a review of available and suitable funding mechanisms which could support future phases.

## Method(s)

The scope and deliverables which form this PEA application comprise '4.2 Options Selection', progressing into early '4.3 Conceptual Design Development'; these are the next incremental stages of what is planned to be a long-term engineering project programme aligned to the ND 500 delivery model. The overall programme will assess the feasibility, conceptual and detailed design requirements of prospective BAU emissions capture solutions, leading to a pilot on the NTS, allowing full evaluation of effectiveness/costs and development of a roll out plan. This second stage will apply a continuation of the successful first stage methodology and utilise the same delivery team. The stage 2 funding will enable all elements commenced in stage one to be developed further and allow work to start on key new tasks which will enable continuation of the overall objective.

Scope elements (divided into Work Packages):

1. Project management and Stage 2 launch / engagement workshop, including refresh of steering group membership and terms of reference.
2. Final FEED (Front End Engineering Design) scoping workshop (with Design Assurance Engineers), including management of the process to completion, launch and evaluate the FEED call-off tender and subsequently working with the identified FEED partner organisation to support their PEA application.
3. Ongoing programme management, including holding an 'ND 500 Process Workshop', to conclude the required alignment and governance of the project under the hybrid ND 500 innovation model; this being the first innovation project to target delivery under this approach. This will also be a key stage to secure buy-in from the necessary stakeholder groups including the project delivery team.
4. Continued refinement and development of the Project Scope Document for issue as part of the Original Equipment Manufacturer (OEM) call-off. This will be updated with Stage 2 learning and the detailed outputs of the ND500 mapping workshop.
5. Development and launch of the OEM Request For Proposal (RFP), which will be focused on a gap analysis of the Request For Information (RFI) returns received to date to minimise time required to prepare and also reduce the input requirements for the participants. Global Procurement have advised a framework call-off as being the most efficient way to do this; we will manage the steering group inputs to review and evaluate the return and collate and present recommendations for approval. The potential impact of hydrogen, and the future transition of the NTS, on the equipment proposed will be considered and a high-level evaluation undertaken.
6. Engagement with NG's digital team to commence corporate and social media messaging around the CH4RGE project, including external CH4RGE sub-pages on the gas website. This will support corporate messaging around the journey towards Net

Zero and help CH4RGE to achieve 'brand presence' as a key part of NG's Net Zero roadmap.

7. Continued development of venting calculator 'public beta' including further site data gathering, analysis and service support in preparation of embedding the new tool as BAU.
8. Consideration of how a potential transition to a hydrogen based NTS could impact on supplier equipment and how CH4RGE solutions can be future-proofed against such a transition.
9. Review of potential future funding mechanisms which could be deployed to ensure a successful pilot of one or more technologies, and any future wider roll out as BAU.
10. Preparation of NIA Project Summary Report (Stage 2).
11. Project stage close-out and review of lessons learnt.
12. Production of dissemination materials.

Regular engagement and decision workshoping with NGG project teams at key stages to determine the direction of the project and its ongoing viability. N.B. the desk-based nature of the work minimises the risk of any continuing COVID-19 delays or programme impact.

## Scope

The scope of this study is to continue to develop the successful CH4RGE programme through feasibility and into conceptual design, as part of a programme to deliver innovative technologies designed to reduce methane emissions from gas compressor machinery trains (CMTs) (and associated ancillary systems).

As the UK progresses towards Net Zero by 2050, NG must minimise methane emissions. The energy sector at a European and international level is also taking the transition to low carbon energy networks seriously and are holding producers and gas transporters to account, this direction of travel has strengthened since the initial CH4RGE sanction in April 2020. NGG are seeking to demonstrate Net Zero commitments as customers and shareholders will demand to see where efforts are being made, and to see greater transparency in the dissemination of any associated financial savings. This has been evidenced by the priority which has been placed on Net Zero / transitional network solutions by Ofgem within the RIIO-T2 framework.

Stage 1 of CH4RGE has validated a clear need case. Planned investment in new Best Available Technology (BAT) Compressor Machinery Trains (CMT) and associated reductions in reliance (plus decommissioning) of legacy assets will lead to lower seal gas losses in particular. However, CH4RGE research has shown that a 'technology floor' will prevail. Regardless of 'hearts and minds' operational practice improvements, a technology solution is unequivocally required to capture residual emissions, achieving a key transitional Net Zero gain ahead of 2050. This equipment will continue to be required until a full shift to a hydrogen based NTS is complete, this is beyond the short / medium term and past the design life of new assets potentially realised as a result of CH4RGE; this is 'no regrets' investment. Our continued reliance on a methane NTS for the foreseeable future requires technological solutions which can be installed easily as new (or retrofitted to existing equipment) and be capable of ready integration with existing systems. Following the OEM RFI it is clear that such systems exist and are being actively taken through TRLs by the suppliers, we must now confirm the integration and compliance requirements in order to prepare for a safe, effective and knowledge building pilot. The pathway to 2050 is as important as the end goal and requires that we reduce emissions as quickly as possible; it is clear now that CH4RGE, if supported on a continuing basis under the NIA, is capable of cost effectively and quickly fulfilling this brief.

The OEM RFI indicates a degree of readiness and willingness to pilot a range of technologies which are in the latter stages of development and could provide solutions to seal gas losses and planned venting losses. For the first time, these solutions bring the prospect of BAU methane capture from suppliers with proven capability in delivering technologies which will not impact on the availability or security of supply of the compressor network. In some cases, these technologies are undergoing pilot trials, although none on the UK NTS. This confirms the market is seeking viable solutions for gas recapture and re-pressurisation for which real life utilisation and success could be demonstrated. It is essential that NGG becomes an early adopter in this field to maintain its global reputational position.

The cost case is explored below. Initial quantification of methane losses indicates that a reduction potential exists across the network of ~700,000 tCO<sub>2</sub>e over a nominal 20 year period, even when applying restrictive assumptions on the potential applicability of sites and equipment (e.g. focusing on existing and planned dry low emission compressors and electric drives, only at higher utilisation sites). Overall, this project has the potential to deliver financial return, but also key environmental, sustainability, reputational and societal benefits aligned to RIIO-T2 objectives.

## Objective(s)

- 1) To deliver the CH4RGE Net Zero programme through feasibility and into conceptual design, during which period a FEED consultant will be onboarded and the formal OEM framework call off will be launched.
- 2) To deliver and maintain project momentum, in order to capitalise on potentially available funding mechanisms to support pilot and full scale roll out.
- 3) To further the high degree of engagement seen to date internally, creating a brand presence for CH4RGE as the leading Net Zero transition toolset in the UK gas transmission and distribution sector.

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

RIIO-1 PEA used as paperwork prepared and project approved prior to RIIO-2 PEA template being available

## Success Criteria

1. Project progression to commencement of conceptual design phase.
2. Developed brand visibility, awareness and engagement on CH4RGE and its key role as part of GT's Net Zero roadmap.
3. Confirmation of delivery mechanism mapped to the ND500 innovation hybrid roadmap.
4. Further refinement, user testing and development of the venting calculator tool (a Net Zero companion tool to CH4RGE).

## Project Partners and External Funding

PESL Consulting (Subsequent project stages, outside of the scope of this PEA would look to bring other partners on board, in addition to PESL, e.g. engineering contractors and OEM suppliers.)

## Potential for New Learning

- Enhanced learning on technology solutions, their limitations, applicability (now and on a future hydrogen based NTS) and confirmation of market readiness and cost.
- Clarity on requirements for FEED stage, including clear scope to determine integration, compliance and FPSA / FEA scope.
- Further identification / refinement of potential sites and the application of these technologies on the NTS
- Operational 'in use' evidence from Venting Calculator tool beta testing.

## Scale of Project

Desk based / market engagement / operational engagement

## Technology Readiness at Start

TRL4 Bench Scale Research

## Technology Readiness at End

TRL5 Pilot Scale

## Geographical Area

UK wide

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

£73,598.00

## 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:

RIIO-1 PEA used as paperwork prepared and project approved prior to RIIO-2 PEA template being available

#### How the Project has potential to benefit consumer in vulnerable situations:

RIIO-1 PEA used as paperwork prepared and project approved prior to RIIO-2 PEA template being available

### 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)

Whilst the financial cost benefit of this project can be measured it is important to note that this is not the sole rationale for undertaking this work. In order to achieve progress against critical objectives such as Net Zero, investment must be made where there is a real prospect of achieving environmental, sustainability, reputational and societal gain, even if the financial aspects of these metrics cannot be quantified. A high-level cost benefit model is summarised below:

- CH4RGE stage one estimates indicate that 3,700 tonnes of methane emission per annum could be in scope with an annual cost of carbon of over £4m per annum.
- Initial calculations suggest an investment of up to £10million could deploy a technology solution at 10 key high running sites where modern dry seal gas turbines are already in use or in flight.
- This could result in a reduction to ~280 tonnes per annum of in-scope gas losses. This represents a reduction of ~80% from 2030 project figures (i.e. in addition to gains achieved from CECS investments). This equates to over 550,000 tCO<sub>2</sub>e over a 20 year period, potentially reducing the business financial exposure by over £24 million.

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

Not applicable

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

Following the successful pilot phase, there is clear potential for roll out at up to 10 NTS compressor stations, which would allow for a methane reductions of c. 1,100 tonnes per annum, which would provide major inroads to Net Zero.

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

A preliminary estimate of the roll out cost at 10 key sites would up to £10million (excluding the pilot NIA project).

### 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 primary learnings will be applicable to NG as the UK gas transmission licence holder. Other network licensees, such as the gas distribution networks, could benefit from venting recapture solutions on AGI sites, and reciprocating compressors are now being trialled on UK gas distribution network sites. There are also potential benefits for European TNOs and other UK market participants and licence holders with gas compression equipment e.g. operators of interconnectors and terminals.

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

RIIO-1 PEA used as paperwork prepared and project approved prior to RIIO-2 PEA template being available

### 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.

NG initiated the 'Alternatives to Venting' project with GL Noble Denton through the IFI scheme to assess and demonstrate technologies that could help reduce the amount of natural gas vented. The report (Alternatives to Venting', A. Varma and CY. Law, GL Report 9415, Issue 1.0, September 2009.) identified several emission reduction technologies, including: Recompression, Adsorbed Natural Gas (ANG) and Flaring. However, none of these could readily transition to BAU on network critical plant and sites, with an acceptable risk profile. No investment in these solutions has been carried out in the intervening years.

Initial approaches to OEMs in 2019 indicated that this topic has become very current and that a new range of technical applications are in the latter stages of development which could provide solutions to capture seal gas losses and planned venting losses in particular. For the first time, these solutions bring the prospect of a ready transition to BAU methane capture from suppliers with proven capability in delivering technologies which will not impact on the availability or security of supply of the compressor network.

On this basis the drivers and market readiness have changed materially since the original Alternatives to Venting Project, such that the proposed work represents no duplication. Previous learnings will provide a key reference for the review phase of the proposed NIA project. There is no duplication of effort between CH4RGE stage 1 and proposed stage 2.

**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**

Project aligns to RIIO T2 innovation objectives, in particular the transition to Net Zero. Changing drivers around impact and importance of methane emission control are encouraging development of the market; only since 2019 have compressor OEM supported technologies been progressed, which provides far greater confidence in the potential for integration with existing systems. For the first time, a combined seal and vent capture technology is considered feasible. At present there are no online applications of these technologies on the UK NTS. The candidate technologies are currently at low TRL but could be readily developed by this project and provide the first opportunity to apply the BAT approach (ENV21/22) to such. Development of the venting calculator offers an understanding of the counterfactual position to technology solutions, and current barriers to optimisation.

**Relevant Foreground IPR**

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**Data Access Details**

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

Unproven in the UK context and technology not available for direct purchase without trials and operational viability assessment.

**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**

No RIIO T2 funding available for this programme, considerable commercial and technical risk to adopting a direct roll out. Wider review of potential funding mechanisms to be undertaken.

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

Yes