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NIA Project Registration and PEA Document

Date of Submission

Mar 2024

Project Reference Number

NIA_NGN_448

Project Registration

Project Title

APEX (Alternative Power for Equitable Communities)

Project Reference Number

NIA_NGN_448

Project Licensee(s)

Northern Gas Networks

Project Start

March 2024

Project Duration

0 years and 6 months

Nominated Project Contact(s)

Innovation@northerngas.co.uk

Project Budget

£177,000.00

Summary

The APEX (Alternative Power for Equitable Communities) project will introduce an innovative method for localised and community-centred energy systems. It aims to leverage the capabilities of power-to-hydrogen (PtH2) technology within community settings while exploring forthcoming whole systems future energy scenarios that optimise the utilisation of current gas infrastructure.

This concept revolves around harnessing excess, local renewable energy to produce hydrogen through electrolysis, strategically integrated to amplify energy flexibility and lower energy costs. The innovation will incorporate green hydrogen into the existing infrastructure, thus contributing significantly to sustainable development and the transition to low-carbon, place-based community heating schemes. The project will help with shaping the future of how hydrogen can integrate with community energy systems in line with the UK's vision of a Just Transition to Net Zero.

Nominated Contact Email Address(es)

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Problem Being Solved

The APEX project offers a new approach to community-centred energy systems, aiming to leverage power-to-hydrogen (PtH2) technology and understand how gas infrastructure can be utilised in different future energy scenarios. However, several challenges and complexities underlie this innovative solution.

The core challenge is centred around optimising the integration hydrogen derived from green energy sources within a community setting, whilst ensuring practical and sustainable use of existing gas network infrastructure. While strategically integrating hydrogen into existing infrastructure holds promise for amplifying energy flexibility and reducing costs, the practical execution faces hurdles. There exists a critical need to align these initiatives with diverse community characteristics, including geographical, infrastructural, and

demographic aspects. The task of identifying and assessing 3 diverse model communities in partnership with NGN demands a comprehensive understanding of the intricate variations within these communities.

Moreover, modelling the APEX solution under different future scenarios outlined in NGN's strategy presents another layer of complexity. Varying hydrogen applications, such as a community entirely reliant on 100% hydrogen or scenarios with primarily industrial and/or transport-specific use cases, necessitate distinct gas infrastructure utilisation. Balancing these scenarios while ensuring seamless integration and optimal utilisation of existing infrastructure poses a significant challenge.

Furthermore, the process of selecting and prioritising scenarios for future demonstration phases requires meticulous alignment with NGN's strategic vision and the potential for economically successful PtH2 integration. This involves assessing the feasibility, economic viability, and technical intricacies of each scenario, adding to the complexity of decision-making.

In summary, the challenge lies in navigating the complexities of integrating PtH2 technology into diverse community settings, aligning with varying energy scenarios, and ensuring effective integration within existing gas infrastructure. Addressing these challenges will be crucial in shaping the future of hydrogen integration with community energy systems and aligning with the UK's vision of a Just Transition to Net Zero.

Method(s)

The following statements will outline how the project will meet the measurement and data quality objectives set out. This will include the mechanisms put in place to ensure the accuracy, integrity, relevance, reliability, and timeliness of the projects results.

Stage 1: Preparation and Community Selection- In this work package various data sets from previous projects will inform the initial planning, stakeholder engagement, and evaluation of diverse model communities (rural, urban, industrial) based on geographical, infrastructural, and demographic characteristics. The models will be compared with areas across NGN's geographical area in order to produce replicable work across GB.

- Define project scope, engage stakeholders, and select representative communities for comprehensive evaluation and suitability for hydrogen integration.

Stage 2: Scenario Development and Feasibility Analysis- Development of multiple future scenarios depicting green hydrogen integration across various energy demands within selected community types. Conduct feasibility and viability analysis considering cost-effectiveness, minimal disruption, and consumer affordability.

- Create adaptable models for hydrogen integration outcomes and assess the practicality and economic feasibility of integration plans.

Stage 3: Pilot Testing, Evaluation, and Scaling Recommendations- Evaluate outcomes and provide recommendations for future trials and potential scalability of successful integration approaches to broader community networks.

- Gather insights for scaling successful approaches and provide guidelines for potential broader implementation. Make recommendations for future project phases.

Scope

In Scope:

- **Community Evaluation and Analysis:** Evaluation of three diverse model communities (rural, urban, industrial) considering geographical, infrastructural, and demographic characteristics.
- **Scenario-Based Modelling:** Development and analysis of multiple future scenarios outlining the integration of green hydrogen across different energy demands within selected community types.
- **Strategic Recommendations:** Formulation of recommendations for future demonstration phases and identification of potential trial locations aligning with network development plans.
- **Socio-Economic Impact Assessment:** Analysis of socio-economic impacts related to the scenarios modelled including economic effects, and consumer behaviour.
- **Feasibility and Viability Assessments:** Assessment of the feasibility and viability of integrating of the scenarios in the context of existing gas networks considering cost-effectiveness, minimal disruption, and consumer affordability.

Out of Scope:

- **Detailed Engineering Design:** Detailed engineering plans or designs for infrastructure modifications beyond initial trial locations.
- **Direct Technology Development:** Research and development of new hydrogen production or storage technologies beyond evaluating their integration feasibility into existing networks.

Objective(s)

- Develop tailored strategies for the effective integration of network scenario models into three diverse model communities (rural, urban, industrial) considering geographical, infrastructural, and demographic characteristics.
- Create and analyse multiple future scenarios outlining the integration of green hydrogen across different energy demands within selected community types.
- Formulate informed recommendations for future demonstration phases and identify potential trial locations aligning with network development plans.
- Assess the feasibility and viability of integrating green hydrogen into existing gas networks, considering cost-effectiveness, minimal disruption, and consumer affordability.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Integrating power to hydrogen technology into community heat networks, allows for the project to explore optimal approaches to reducing reliance on conventional energy sources, with the aim of reducing pressure on energy bills for consumers.

By exploring the efficient use of surplus local renewable energy for hydrogen production, the project will aim to reduce pressure on costs for heating and hot water with, with potential cost savings.

Success Criteria

Minimum Criteria Description:

- **Must** produce a feasibility report validating the practicality and viability of hydrogen integration into existing gas networks.
- **Must** provide actionable recommendations aligned with network development plans.
- **Should** report outlining impacts on job creation, economic growth, and consumer behaviour.
- **Must** demonstrate the adaptability of existing gas networks.
- **Must** produce verification of the project outcomes aligning with NGN's vision.

Desireable Criteria:

- **Could** provide an indication of likely acceptability of various different options based on research.

Project Partners and External Funding

Funded via Northern Gas Networks RIIO2-NIA

Centre for Energy equality: £63,793.00

LCP Delta: £83,708.00

Total forecasted external spend: £147,501.00

Potential for New Learning

The project will create the following insights:

- **Community-Specific Integration:** Insights into how gas network integration can be tailored and effectively implemented across diverse community types (rural, urban, industrial), will provide a blueprint for future energy transitions in different settings.
- **Scalability and Adaptability:** Understanding the scalability of hydrogen integration scenarios across various energy demands and infrastructure settings, will develop adaptable models for wider energy system transitions.
- **Socio-Economic Impacts:** Analysis of the socio-economic impacts of hydrogen integration in different scenarios, including its effects on job creation, local economies, and consumer behaviour, will provide valuable insights.

Scale of Project

This project is a desktop research based project and not seeking to undertake capital build.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project will be limited to the North and North East of England within the Northern Gas Networks geographical area.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

NGN External Costs: £147,401.00

NGN Internal Costs: £29,499.00

NGN Total Forecasted Project Costs: £177,000.00

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:

- **Cost-effectiveness:** APEX aims to integrate green hydrogen strategically into existing gas networks, potentially reducing pressure on energy costs for consumers by leveraging the flexibility and efficiency of hydrogen within community energy systems.
- **Minimising Disruption for Consumers most at Risk:** By conducting comprehensive evaluations and scenario-based modelling, the project intends to minimise disruptions to existing energy infrastructures and communities, ensuring a smooth transition towards hydrogen integration without compromising reliability or stability.
- **Accessibility for Vulnerable Consumers:** The project considers the impact on vulnerable consumers, aiming to ensure that the transition to hydrogen remains affordable and accessible, potentially benefitting consumers in vulnerable situations by offering cleaner, more affordable energy options.

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

- **Cost Savings:** Integration future network capability into existing gas networks may result in cost savings for customers by enhancing energy flexibility and potentially reducing overall energy costs.
- **Enhanced Energy Accessibility:** The project aims to explore options for more accessible and reliable energy solutions, potentially improving service reliability, and expanding access to cleaner energy sources for customers.
- **Environmental:** Transitioning gas grids to alternative use in different scenarios in different geographies could lead to reduced carbon emissions, offering environmental benefits that contribute to a healthier and sustainable energy future for customers.

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

Low TRL Research Project

At the current stage of the project there are no immediate quantifiable projected benefits, as the project progresses there will be greater insight how the project can produce tangible benefits.

Potential benefits have been documented under RIIO2-NIA Governance Requirement 1, earlier in this document.

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

The project will be replicable across GB, when the project is producing scenario based modelling these archetypes chosen will be identified to fit in line with various locations across GB.

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

The cost of rolling out the method across GB is currently unknown, to outline a cost there will need to be further development of the 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 learnings and outcomes of the project will hope to produce a blueprint outlining how gas network scenarios can be effectively integrated into diverse community settings, considering geographical, infrastructural and demographic characteristics.

Providing insight into the socio-economic implications of hydrogen integration including its effects on job creation, local economies and consumer behaviour within the targeted communities.

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.

There has been no identified project that overlaps with the APEX projects outcomes, this has been looked at through the other various funding streams.

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

Overall, the APEX project's innovative nature stems from its holistic approach to community selection, scenario-based modelling, strategic recommendations, and alignment with broader goals, making it a unique endeavour in the field of hydrogen integration within community energy systems.

Hydrogen Integration Approach:

- Strategic integration of green hydrogen into existing Gas Networks' infrastructure reflects a novel approach, leveraging infrastructure to enhance energy flexibility and reduce costs in a way that hasn't been extensively explored previously.
- Utilising gas network infrastructure in diverse community settings (rural, urban, industrial) showcases a comprehensive application that hasn't been systematically attempted before.

Comprehensive Community Evaluation:

- The selection and evaluation of diverse model communities (rural, urban, industrial) based on geographical, infrastructural, and demographic characteristics is a unique approach. Previous projects have focused on broader geographical regions.

Scenario-based Modelling:

- Tailoring future scenarios across various hydrogen applications in different community settings demonstrates hasn't been extensively explored previously.
- The focus on modelling of gas infrastructure utilisation across scenarios is innovative, as past projects might not have integrated such diverse and detailed scenario planning.

Recommendations for Advancement:

- The approach of making informed recommendations for future demonstration phases and identifying potential trial locations that align with most recent policy hasn't been commonly seen in previous hydrogen integration projects.

Whole Systems:

- The emphasis on aligning trial scenario selection with NGN's strategic network development plans showcases strategic innovation, ensuring applicability and scalability.
- The project's alignment with the UK's vision of a Just Transition to Net Zero signifies an innovative perspective, combining both local and national objectives in P2G integration projects.

Relevant Foreground IPR

The 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 part of its business and usual activities

The project's low TRL and no other previous applications advancing to a suitable level makes this project beyond the scope of Northern Gas Networks business as usual activities.

As GDNs move closer to the energy systems transition and the targets for net zero, further investigation on the future power to hydrogen infrastructure needs to be explored.

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 project is highly innovative and future facing for the GB energy system. The project doesn't seek any capital build reducing the potential risks associated.

This project has been approved by a senior member of staff

Yes

