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Strategic Innovation Fund (SIF)

Round 1 Innovation Challenges – Beta Phase

Expert Assessors' Recommendations Report

Contents

1. Introduction

Innovation will play a crucial role in delivering best value to energy consumers in the delivery of Net-Zero while maintaining word-class levels of system reliability and customer service, and ensuring no consumer is left behind. The Strategic Innovation Fund (SIF) is a £450m funding programme which aims to facilitate the UK's transition to Net-Zero at lowest cost to the consumer and to position the UK as the 'Silicon Valley' of energy, making it the best place for high potential business to grow and scale in the energy market. It was launched in July 2021 within the RIIO-2 price control for the Electricity System Operator (ESO), Electricity Transmission, Gas Transmission and Gas Distribution licence holders[1] to drive innovation and transformation in energy networks. It is delivered in partnership with Innovate UK (part of UKRI), who are working to coordinate innovation activities funded by network consumers with other innovation funded programmes, and draws on Innovate UK's established expertise in managing innovation programmes, convening partners, and fostering entrepreneurship.

Innovate UK's and Ofgem's strategy in delivering the SIF focuses on:

- Encouraging innovation alignment – between different funders, across different industry sectors, and in line with regulatory change
- Being response – making sure that Projects are targeted at challenges and can develop in an agile way
- Enabling commercialisation – helping innovative ideas find markets across the UK energy system and internationally

The SIF adopts a multi-round format with Innovation Challenges launched at each round and a multi-phase Project format within each round to mitigate the risk associated with innovation. For the round 1 Innovation Challenges, the Project Phases consist of the Discovery Phase, Alpha Phase and Beta Phase. The Discovery Phase focuses on feasibility, the Alpha Phase on experimental development, and the Beta Phase on deployment and demonstration.

As part of round 1 of the SIF, four Innovation Challenges were launched focusing on strategic issues currently facing networks – whole system integration, data and digitalisation, heat and zero emissions transport. Projects progress through each of

[1] Electricity distribution licensees were eligible to submit Applications once RIIO-ED2 started on 1 April 2023.

the SIF's Phases focusing on one of these Innovation Challenges. For the round 1 Beta Phase, the requirements with regards to scope, partners etc. has not changed from the original round 1 Innovation Challenge briefs[2].

In March 2022, over £4.5m was awarded to 40 Projects for the Discovery Phase of round 1[3]. In July 2022, over £8m was awarded to 18 Projects for the Alpha Phase of round 1[4]. This report offers recommendations on which of the completed round 1 Discovery Phase and Alpha Phase Projects should continue to be funded in the Beta Phase. All Projects which completed the Alpha Phase had the option of submitting an Application for the Beta Phase, merging with another SIF Project and submitting an Application, or not submitting an Application for the Beta Phase. It should therefore be noted that 14 eligible Applications were received for the Beta Phase across the four Innovation Challenges, from the 18 Alpha Phase Projects.

Unlike the Discovery Phase and the Alpha Phase, the Beta Phase is focused on deployment and demonstration activities which results in more SIF Funding and longer timelines being available to Projects. For the round 1 Beta Phase, Projects start from 1 July 2023, can last up to 5 five years, and can request SIF Funding greater than £500,000. Prospective Beta Applications seeking more than £10,000,000 were required to provide justification to Innovate UK and Ofgem prior to the Beta Phase Application period close of 22 March 2023.

For the avoidance of doubt, round 1 of the SIF is open to all network licence holders except electricity distribution licensees. It is therefore open to:

- Scottish Hydro Electric (SHE) Transmission Plc
- SP Transmission Plc (SPT)
- National Grid Electricity Transmission Plc (NGET)
- National Grid Electricity System Operator Limited (NGESO)
- National Gas Plc (NGT)
- Scotland Gas Networks Plc and Southern Gas Networks Plc (SGN)
- Northern Gas Networks Limited (NGN)
- Cadent Gas Limited (Cadent)

[2] For more information on the round 1 Innovation Challenges, please see: https://www.ofgem.gov.uk/publications/strategic-innovation-fund-innovation-challenges
[3] For more information on the round 1 Discovery Phase Projects please see: https://www.ofgem.gov.uk/publications/strategic-innovation-fund-discovery-projects-approved-funding
[4] For more information on the round 1 Alpha Phase Projects please see: https://www.ofgem.gov.uk/publications/strategic-innovation-fund-round-1-alpha-projects-approved-funding

- Wales & West Utilities Limited (WWU)

2. Assessment process

At each Project Phase in round 1 of the SIF, Applications have been assessed by Expert Assessors. The Expert Assessors are experts who together provide relevant knowledge and expertise on the respective Innovation Challenges and/or the energy sector, including areas such as policy and regulatory, commercial, financial and technical. They are appointed to inform Ofgem's decision-making on the selection of Projects for SIF Funding. Ofgem is the decision-maker for the SIF.

Consistent with the requirements of the SIF Governance Document, the Expert Assessors have assessed each Application with reference to:

a) Its compatibility with the Eligibility Criteria in chapter 2 of the SIF Governance Document, as demonstrated by responses to the Application questions in paragraph 4.11 of the SIF Governance Document, in line with the methodology for evidencing net benefits to energy consumers described in paragraphs 4.25-4.30 of the SIF Governance Document[5]

b) The progress report from the Projects in Alpha as per paragraph 6.9 and the show and tell presentations referred to in paragraph 6.13 of the SIF Governance Document

c) The assessment interviews conducted with each Project which submitted a Beta Phase Application as set out in paragraphs 5.2 – 5.23 of the SIF Governance Document, and

d) any additional and relevant information available.

As per paragraph 5.6, the Expert Assessors' assessment and feedback has been consolidated into this one written report.

As part of each Application assessment, the Expert Assessors also considered whether Projects should receive all the SIF Funding requested for the Beta Phase, partial funding, or no funding at all. Where Expert Assessors considered appropriate, recommendations of partial funding have been made. The Expert Assessors have also provided recommendations on Project-specific conditions that the Project must comply with to address or mitigate any risks they identified in their review of the Projects. These have been included below for each of the Projects but may differ from what is included in the Project Directions for each of these successful Projects as the Project-

[5] For the SIF Governance Document, please see: https://www.ofgem.gov.uk/publications/updated-sif-governance-document

specific conditions are further reviewed by Ofgem. For the avoidance of doubt, the final Project-specific conditions are included in each of the Project Directions.

The overall funding recommendation summarised in this report is based upon a balance of considerations taking into account whether a Project has met each of the SIF Eligibility Criteria, suitability of the Project for SIF Funding or partial SIF Funding, any Project-specific conditions and stage-gates recommended by Expert Assessors, and wider concerns or opportunities identified by the Expert Assessors during the assessment process outlined above.

For more information on the Innovation Challenges and their requirements, the assessment process, and the Projects assessed for the Discovery Phase and Alpha Phase, please see the recommendations report issued for the round 1 Discovery Phase[6] and the Alpha Phase[7].

[6] For more information on the round 1 Discovery Phase, please see: https://www.ofgem.gov.uk/publications/strategic-innovation-fund-discovery-projects-approved-funding
[7] For more information on the round 1 Alpha Phase, please see: https://www.ofgem.gov.uk/publications/strategic-innovation-fund-discovery-projects-approved-funding

3. SIF Round 1 Alpha Phase portfolio Gas Sector Projects - Summary

In summary, based on these assessments, the following tables present the gas sector Projects that are recommended to Ofgem for funding under the SIF Round 1 Alpha Phase, subject to the various conditions outlined above, and the gas Projects that are not recommended for funding.

3.1 Gas Sector Projects recommended for SIF Funding

Whole system integration

Project Name	Funding Licensee	Initial Net Funding Requested (£)
HyNTS Compression	National Grid Gas Plc	£33,303,556

Data and digitalisation

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Intelligent Gas Grid	Southern Gas Networks Plc	£6,072,524
Predictive Safety Interventions	Southern Gas Networks Plc	£1,078,258
Digital Platform for Leakage Analytics	Cadent Gas Limited	£9,496,476

Heat

Project Name	Funding Licensee	Initial Net Funding Requested (£)

Velocity Design with Hydrogen	Southern Gas Networks	£5,912,144

Zero emission transport

Project Name	Funding Licensee	Initial Net Funding Requested (£)
HyNTS Deblending for Transport Applications	National Grid Gas Plc	£9,921,257

Total SIF Funding requested by gas Projects recommended for SIF Funding: £65,784,215

3.2 Gas Projects not recommended for SIF Funding

Whole system integration

All gas Projects which submitted an Application for the Beta Phase whole system integration Innovation Challenge were recommended for SIF Funding.

Data and digitalisation

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Energy System of the Future – Digital Twin	Southern Gas Networks Plc	£11,880,338
Thermal Imagery Analysis	Northern Gas Networks Ltd	£9,942,045

Heat

All gas Projects which submitted an Application for the Beta Phase heat Innovation Challenge were recommended for SIF Funding.

Zero emission transport

All gas Projects which submitted an Application for the Beta Phase zero emission transport Innovation Challenge were approved for SIF Funding.

4. SIF Round 1 Beta Phase Portfolio Electricity Sector Projects - Summary

In summary, based on these assessments, the following tables present the electricity sector Projects that are recommended to Ofgem for funding under the SIF Round 1 Beta Phase, subject to the various conditions outlined above, and the electricity Projects that are not recommended for funding.

4.1 Electricity Projects recommended for SIF Funding

Whole system integration

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Network-DC	Scottish Hydro Electric Transmission Plc	£5,486,794
INCENTIVE – Innovative Control and Energy Storage for Ancillary Services in Offshore Wind	Scottish Hydro Electric Transmission Plc	£922,333
Crowdflex	National Grid Electricity System Operator	£18,610,355

Data and digitalisation

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Predict4Resilience	SP Transmission Plc	£4,518,605

Heat

No electricity Projects were submitted for the Beta Phase heat Innovation Challenge.

Zero emission transport

No electricity Projects submitted for the Beta Phase zero emission transport Innovation Challenge were recommended for SIF Funding.

Total SIF Funding requested by electricity Projects recommended for SIF Funding: £29,538,086

4.2 Electricity Projects not recommended for funding

Whole system integration

Project Name	Funding Licensee	Initial Net Funding Requested (£)
SCADENT – SuperConductor Applications for Dense Energy Transmission	National Grid Electricity Transmission Plc	£8,327,220

Data and digitalisation

All electricity Projects which submitted an Application to the Beta Phase data and digitalisation Innovation Challenge were recommended for SIF Funding.

Heat

No electricity Projects were submitted for the Beta Phase heat Innovation Challenge.

Zero emission transport

Project Name	Funding Licensee	Initial Net Funding Requested (£)
A Holistic Hydrogen Approach to Heavy Duty Transport (H2H)	SP Transmission Plc	£4,864,487

5.1 SIF Beta Phase – Whole system integration – Summary

This section covers the assessment of round 1 Beta Phase Applications received into the 'Whole system integration' Innovation Challenge[8].

For the Beta Phase, 4 Applications were submitted to Innovate UK through the Innovation Funding Service (IFS) portal by the closing deadline of 22 March 2023 and are listed below.

Project reference number	Project name	Funding licensee	Total Project costs (£) (excl. in-kind cont)	Total Project contribut-ion (£)	Total SIF Funding request-ed (£)	Recom-mended for funding (Yes/No)
10062040	HyNTS Compressi on	NGT PLC	37,003,556	3,700,000	33,303,356	Yes
10064387	SCADENT - Super Conductor Applications for Dense Energy Transmission	NGET	9,374,218	1,046,998 (73,999 in-kind)	8,327,220	No
10067854	Network-DC	SHE	6,097,127	610,333	5,486,794	Yes
10067856	Incentive	SHE	1,122,973	200,640 (365,710 in-kind)	922,333	Yes
10070764	Crowdflex	NGESO	22,530,136	3,919,781	18,610,355	Yes

[8] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-innovation-challenges

5.2 Evaluation of Applications

5.2.1 10062040, HyNTS Compression, Initial Net Funding Requested £33,303,556

Project Partner name	Eligible costs (£) (excl. in-kind contr)	Project contribution (£)	SIF Funding Requested (£)
NATIONAL GRID GAS PLC	4,199,542	3,700,000 (1,240,880 in-kind)	499,542
CARDIFF UNIVERSITY	677,937	0 (85,000 in-kind)	677,937
SIEMENS INDUSTRIAL TURBOMACHINERY LIMITED	9,943,113	0 (2,472,000 in-kind)	9,943,113
NORTHERN GAS NETWORKS LIMITED	24,200	0	24,200
SOUTHERN GAS NETWORKS PLC	12,640	0	12,640
DNV SERVICES UK LTD	19,458,824	0 (2,455,000 in-kind)	19,458,824
PREMTECH LTD	680,155	0 (54,420 in-kind)	680,155
CULLUM DETUNERS LIMITED	2,007,145	0 (378,000 in-kind)	2,007,145

Submitted Project description
The National Transmission System (NTS) is a network of high pressure natural gas pipelines, that supply gas to power stations, large industrial and domestic users, from natural gas terminals situated on the coast, to gas distribution companies and

direct connects. In order to move gas from supply to demand, the system utilises several compressor stations located strategically across the country.

In order to achieve the UK's Net Zero targets by 2050, the gas networks will play an important part through the delivery of net zero gases such as hydrogen and biogas to users. These gases have different properties to natural gas and therefore need different control and management systems. Modelling of the energy system and interaction with our network through Discovery and Alpha has shown the need for compression and that our current systems are capable of meeting the current future scenarios, this work will continue in the Beta Phase.

The HyNTS Compression project directly impacts the cost of transitioning the NTS to Hydrogen by targeting our highest cost asset and providing technical and commercial feasibility for repurposing vs replacement. The associated costs for replacement are ~£60m per unit which can be dramatically decreased by upgrading key components. The project will provide the technical and safety evidence for our first transition activity; Project Union. This project is creating an 100% hydrogen backbone linking industrial clusters and terminals, which will commence construction in 2026. If this project proves that the current compression systems are able to function with hydrogen we plan to implement the solutions into the project delivery.

The HyNTS Compression project will provide a technical demonstration and create a strategy for UK NTS Compression System transition linked to our implementation projects and wider business plan. The technical demonstration will be conducted initially on an offline facility, to enable gas turbine modifications in a clean room environment whilst gathering evidence on hydrogen capability, followed by the full compression system test at the DNV Spadeadam site as part of the FutureGrid facility.

The demonstration will provide the technical and safety evidence for the re-purposing ~65% of the NTS compressor units and provide insight into repurposing others on the network. The project will modify an existing unit to run on hydrogen and then test it at both blends of hydrogen and 100% hydrogen. Demonstrating not only the rotating machinery package capability but how the full system would operate on a hydrogen network.

Eligibility Criterion 1: Projects must address the Innovation Challenge set by Ofgem.
Eligibility Criterion met
The Expert Assessors considered the Project to have addressed the Innovation Challenge as it focusses on innovation in the gas transmission system to support its decarbonisation by using various blends of natural gas and hydrogen, including a use case of exclusively hydrogen. The Project is contributing to understanding and evidence building of the feasibility and costs of repurposing compressors in the gas transmission system. In the short term, the Project is also contributing evidence for National Grid Gas Transmission and UK government on the compression requirements for Project Union (beyond its initial phase) which seeks to build a hydrogen backbone connecting producers and users of hydrogen, particularly for industrial clusters and power generation. The Project was considered to be directly related to one the aims of the Innovation Challenge, which is to improve coordination of emerging innovations across networks, generators and market participations, and one of the central scopes of the Innovation Challenge, which is to evaluate the costs and opportunities of repurposing existing infrastructure assets.

Eligibility Criterion 2: Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers
Eligibility Criterion met
The Project in its entirety has not demonstrated a clear net benefit to gas or electricity consumers. However, the Expert Assessors considered some of the Project's activities, up to the Project's first proposed stage-gate, to have clearly identified potential to deliver a net benefit to gas consumers, and therefore have recommended the Project only receiving SIF Funding up the first stage-gate in the Project. While the business case developed for the Beta Phase indicates a net benefit to a subset of gas consumers through the potential to reduce the cost of transitioning the National Transmission System (NTS) to hydrogen, by repurposing compressor

systems rather than outright replacement, the Expert Assessors considered these benefits to be conditional on several significant assumptions.

Should the Project be successful in its entirety, and 100% hydrogen be required in the NTS, the Expert Assessors considered this to most likely benefit Project Union firstly, which is a project operated outside of the SIF led by National Gas Transmission to create a UK hydrogen backbone, transporting 100% hydrogen and connecting production and storage facilities with end users. The Expert Assessors therefore considered the primary beneficiaries of the Project in its entirety to therefore be some industrial clusters using hydrogen, some power generators and potentially, some users of hydrogen vehicles refuelling at stations integrated with the NTS.

The Expert Assessors also considered there to be several major underpinning assumptions made in the benefits case which would need to materialise to allow this benefits case of the Project in its entirety to be realised. These include the continuous increase in the blending of hydrogen into the gas network ultimately moving to 100% hydrogen across the UK and Project Union going ahead to full build. These assumptions have significant uncertainty and depend on future policy decisions, which the Expert Assessors considered to materially diminish the benefits case for this Project if these situations were delayed or do not happen as assumed. While the Expert Assessors noted this uncertainty in the benefits case, relevant hydrogen subject matter experts in Ofgem highlighted the important evidence potential of this Project to feed into regulatory considerations in the short-medium term. This value is considered to address the concerns raised by the Expert Panel in this regard.

The Expert Assessor's primary concern was that these uncertainties have not been taken into account sufficiently from a cost and risk-sharing perspective to warrant consumers paying for this innovation Project in its entirety at this time. As a result, the Expert Assessors have recommended that the Project proactively identify opportunities to reprofile costs prior to or as part of reaching stage-gate 1, and as part of this, provide an update on how the Project's overall costs can be reduced and/or contributions be increased from the Project's commercial partners, while also taking into consideration any wider and relevant hydrogen decisions.. The Expert Assessors recognised there is potential for a net benefit to be delivered to gas consumers but, as part of its partial funding recommendation, want the

Project to more clearly articulate the minimum viable scope for the Project and its potential benefit for consumers. As such, the Expert Assessors have considered the Project to have met this Eligibility Criteria, so long as it is only funded up to its first stage gate at which point the Project's costs are revisited.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Project was considered by the Expert Assessors to demonstrate network innovation as it seeks to establish upgrade and refurbishment options for existing compression station equipment deployed on the NTS. Although new equipment is available which can operate on high hydrogen blends or 100% hydrogen, there is currently no proven option to refurbish and upgrade existing assets. Hydrogen compression in the network at high concentrations has not yet been proven in the UK or elsewhere globally and, as a result, this was considered to clearly involve gas network innovation.

Given the relative density of hydrogen compared with natural gas, the existing compression equipment will we unable to meet the network performance needs for high hydrogen blends. This existing equipment will therefore require either replacement or refurbishment. The Project involves network innovation because it is examining how its existing asset base and the National Transmission System (NTS) could be repurposed for hydrogen or where refurbishments will be required to function with hydrogen and hydrogen blends. Any compressor upgrades which come as a result of this Project will need to be developed and tested and proven to be safe and reliable prior to be deployable, another key consideration for why the Project involves network innovation.

The Expert Assessors also considered the Project to involve network innovation because there are also important environmental aspects with operating a hydrogen network which need to be addressed and tested as part of this Project. Specifically around the managing of NOx emissions in a hydrogen rich fuel blend used by the gas turbine used to power the compressor.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors considered the Project to have both positive and potentially negative implications for the development of competitive markets in the future. As there is no current market for compressor upgrades or retrofit for use with hydrogen, this project is creating knowledge and providing a signal to the well-established compressor supply chain, which could lead to increased competition in the future. This could support lowering of prices in the future and deliver value to consumers.

However, this Project has only one OEM (Siemens) in its consortium who will gain significant insight on the technical and commercial feasibility of upgrading and modifying its compressors. This OEM already has a large market position in the UK, having supplied 65% of the existing compressor equipment. The Project could therefore lead to further consolidating the position of a single OEM and protecting its already strong market position in the sector and hence reduce the competitiveness of the market in the future. However, the Expert Assessors positively viewed the wider OEM engagement the Project has started engagement with Solar and Baker Hughes and their growing interest in re-purposing legacy compressor assets. This could help diversify the market for repurposing and potentially reduce risk of increased consolidation of market by Siemens.

The Expert Assessors have recommended a Project-specific condition that the Project Partner Siemens increases their contribution towards the Project to help ensure the Project is delivering value for money and does not result in one OEM having a dominant position in the supply of compressors. Additionally, as mentioned above in Eligibility Criteria 2, the Expert Assessors have also recommended a Project-specific condition for the contribution amount from Siemens be assessed and reprofiled prior to or as part of the Project reaching stage-gate 1, and as part of this, to ensure the Project reflects the Project's risks and commercial value.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met
The Expert Assessors considered the Project to be innovative, novel and risky as there is no evidence that refurbishment of existing compression assets to work with high hydrogen blends has been attempted elsewhere. The Project is seeking to demonstrate and validate desk studies conducted in the Alpha Phase around the gas turbine capability to run on blends or 100% hydrogen fuel with minor modifications and progressive modifications and upgrades required for the compressor to run blends and 100% hydrogen. The Expert Assessors considered this aspect of the Project to be innovative and novel because it could be a first of its kind type of demonstration. The innovation is aimed at reducing net zero transition costs and maintaining network design flexibility as the role of hydrogen in the energy mix evolves. Working with hydrogen mixes requires equipment development as well as rigorous testing and the collection of safety, environmental and performance evidence to inform standards, network codes and operational philosophies. This aspect of the Project was considered to be risky by the Expert Assessors as there are unknowns and uncertainties with this type of innovative and novel testing which is proposing a first of its kind demonstration.

Eligibility Criterion 6: Projects must include participation from a range of stakeholders.
Eligibility Criterion met
The Expert Assessors considered the Project to have participation from an appropriate range of stakeholders for the activities set out for the Beta Phase including the network operator, a significant equipment OEM (Siemens), specialist support consultancies, and DNV GL, the owner of the target demonstration site at Spadeadam as part of the FutureGrid facility. The Expert Assessors also noted positively the involvement and engagement of gas distribution companies in the Project to help inform a whole systems approach to hydrogen. The Expert Assessors also noted positively the participation from HSE, the UK's Health and Safety Executive, in the Project. They were considered to be key stakeholder to process and validate the evidence from a hydrogen safety perspective and provide input to the demonstration proposed.

While the Expert Assessors considered the Project to have met this Eligibility Criteria, they also noted that the Application could have been strengthened with the addition of a more diverse stakeholder group, for example with the inclusion of likely hydrogen off-takers such as industrial users. However, the Expert Assessors still considered the Project to have met this Eligibility Criteria as the range of stakeholders and their participation was considered sufficient for the Beta Phase activities set out.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion met

The Expert Assessors noted several concerns relating to the Project's value for money and underlying costings including relatively high administrative costs through the project lifetime, high day rates for consulting partners (DNV), its dependency with and additionality to Project Union and the potential uncertainty in benefits for GB consumers beyond select industrial and power generators to warrant the large amount of SIF funding requested. In addition, the lack of specific details on how the management and administrative costs were planned to be deployed added to these concerns.

However, the Project stated in its interview that the learnings from its proposed activities with compression units would also be relevant to domestic power consumers through power system support applications and hydrogen town trials.

Furthermore, as previously mentioned in Eligibility Criteria 2, the Expert Assessors also noted that the value for money provided by the Project is contingent on uncertain external factors and assumptions such as the rate and extent of hydrogen blending into the gas transmission network and development of Project Union. The Expert Assessors also noted that the Project will provide outputs in terms of learning and usable data, which will be valuable whether or not the approach of compressor repurposing is deployed in practice.

The Expert Assessors also noted a potential risk to the Project, should high hydrogen blends become a widespread requirement and a growing market for new compressors be established. They considered that this could result in new product

innovation and competition that may deliver new products which could result in the upgrading of existing compressors being less attractive and riskier.

As such, the Expert Assessors have recommended that the Project proactively identify opportunities to reprofile costs prior to or as part of reaching stage-gate 1, and as part of this, provide an update on how the Project's overall costs can be reduced or contributions increased, while also taking into consideration any wider and relevant hydrogen decisions which may impact the Project's risk and commercial value profile. . The Expert Assessors also recognised that the independent financial audits could be an approach utilised to help drive efficiencies in the Project's overall spending. The Expert Assessors considered the Project to have the potential to provide value for money to consumers and noted that a focus on reprofiling costs or reducing costs would help in mitigating some of the risk associated with the external factors and assumptions. As a result, the Expert Assessors considered the Project to have met this Eligibility Criteria while also recommending that cost reduction activities (such as audits, increased contributions, lower costs) be examined at or prior to stage-gate 1 to ensure spend reflects the policy and commercial risks.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion met

The Expert Assessors considered the Project to have a robust methodology, Project management and risk mitigation structure which gives confidence that the Project will be capable of progressing in a timely manner. The Expert Assessors considered the Alpha Phase's activities to have informed the Beta Phase's plan and methodology, which was viewed positively.

The Expert Assessors however did note that the Project has interdependencies across businesses, test sites, contracting and technologies which are complex and could pose as a risk and delay the Project. The Expert Assessors did note the risk register and mitigation strategies appear to be comprehensive and there is a clear allocation of responsibilities between Project Partners.

As the Expert Assessors have recommended the Project proactively identify opportunities to reprofile costs prior to reaching or at stage gate 1 and that it provide an update on how the Project's overall costs can be reduced or contributions adjusted, while also taking into consideration any wider and relevant hydrogen decisions the Expert Assessors considered this approach to mitigate some of the risks associated with the interdependencies of the Project. As such, the Expert Assessors considered the Project to have met this Eligibility Criteria because it has robust methodology and a well-developed and comprehensive risk register with mitigation strategies with opportunity to review the applicability of the Project's proposed solution and its overall benefit. The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Regulatory barriers identified for the Project Phase
NO
The Project has not identified any regulatory barriers which would prevent the delivery of the Project through the Beta Phase. The Expert Assessors also did not consider there to be regulatory barriers which would impact the delivery of the Project through its Beta Phase. The Project has recognised long term deployment of its proposed solution would depend on policy decisions related to the implementation of National Gas Transmission's Project Union and a future government decision on the role of hydrogen in the future energy system. However, the Project also recognises the potential role it could play in informing these decisions specifically and on wider decisions related to the use of hydrogen.

Recommendation to the Gas & Electricity Markets Authority
FUND
The Project overall was considered to be a well put together project with a strong consortium consistent with delivering the proposed scope of work. It was also considered to be clearly an innovative project focussing on retrofitting NTS assets (compressor system) to enable them to run on blended and pure hydrogen. This has not been analysed and demonstrated elsewhere globally.

If approved, the Expert Assessors considered the Project and its proposed scope of work to require significant funding. The Expert Assessors, however, had several areas of concern regarding the uncertainties relating to the expected benefits and the strength of the argument to undertake this work now, ahead of clearer policy drivers on the use cases for hydrogen. It was noted that Project Union will be the first step on this potential path for the use cases of hydrogen, but at the moment, the future role of hydrogen within the NTS is unclear.

As such, it is currently unclear the extent to which (low carbon) high hydrogen blends will be required in the NTS, at what concentrations, to which end uses and over what time frame. The widespread production, transportation of 100% hydrogen blends nationally was considered by the Expert Assessors to have a longer time horizon. The early phases of Project Union are likely to be the pathfinder for 100% hydrogen transportation and the first phase of it does not require compression.

Nonetheless, against this challenging policy context and interdependency with Project Union, the Expert Assessors recognised the potential option value of high hydrogen blends and 100% hydrogen to future energy system policy decisions. Coping with these high hydrogen levels will certainly require investment to upgrade or replace compression equipment. The value offered from elements of this Project, specifically its ability to inform early decision points in Project Union and wider hydrogen policy decisions, is recognised and it is therefore recommended that the Project proactively identify opportunities to reprofile costs at or prior to reaching stage gate 1 and that the Project provide an update on how its overall costs can be reduced or contributions adjusted, while also taking into consideration any wider and relevant hydrogen decisions.

Furthermore, the Expert Assessors considered that the potential benefits to the Project Partners warranted a higher funding contribution than proposed in the Application as the benefits to gas consumers from the initial Project Union use case will be limited to industrial and power users.

As such, the Expert Assessors in consultation with hydrogen subject matter experts at Ofgem have recommended the Project be approved for SIF Funding, but that the Project proactively identify opportunities to reprofile costs ahead of reaching or as part of stage gate 1 and that it provide as part of this an update on how the

Project's overall costs can be reduced or contributions adjusted, while also taking into consideration any wider and relevant hydrogen decisions.

Recommended Project specific conditions

1. Before the Project starts, the Funding Party must submit a minimum viable scope of work up to Stage Gate 1 that helps to inform decisions related to the Front End Engineering Design of Project Union. This scope of work should not exceed an overall cost of £5m.

2. A maximum of 50% of the cost of this rescoped and smaller project should be drawn from SIF funds. The remainder from the Project Partners.

3. The project scope should explicitly describe its success criteria and how it supports the development and sanctioning of Project Union and the schedules of the two projects interact.

4. A detailed breakdown of costs of any rescoped project will be required, including clarifying the exact use of project management time, outlining deliverables, share of costs between partners.

5. The source of any funding of the currently proposed project scope beyond this shorter, rescoped project should be assessed by OFGEM and DESNZ and should be contingent on policy decisions concerning the desired future role of hydrogen in the NTS.

5.2.2 10064387, SCADENT - Super Conductor Applications for Dense Energy Transmission, Initial Net Funding Requested £8,327,220

Project Partner name	Eligible costs (£)(excl. in-kind contr)	Project contribution (£)	SIF Funding Requested (£)
National Grid Electricity Transmission PLC	4,450,012	933,000	3,517,012
University of Strathclyde	1,367,018	0	1,367,018
The University of Manchester	509,216	0	509,316
Nexans France	2,933,972	0	2,933,972
AMSC	40,000	39,999	1
Orsted Wind Power A/S	74,000	0 (73,999 in-kind)	1

Submitted Project description

The SCADENT project proposes the innovative deployment of High Temperature Superconductor (HTS) cable technology in urban environments, to provide the increased network capacity required to allow widescale electrification of heat and transport.

HTS cables can have 3-10 times the power density of equivalent conventional cables, meaning they deliver higher capacity at lower voltage levels and via fewer cable routes. Deploying them enables faster network capacity increase, delivering time, cost, and carbon savings.

The Scadent Beta project intends to build a demonstrator 275kV HTS cable to prove the technology to be ready for use on the GB transmission network.

Eligibility Criterion 1:
Projects must address the Innovation Challenge set by Ofgem.

Eligibility Criterion met

The Expert Assessors considered this Project to have addressed the Innovation Challenge because it aims to develop and demonstrate a novel High Temperature Semiconductor (HTS) cabling option, which is particularly relevant for increasing network capacity in dense urban areas, especially where tunnelling is required. This solution was considered to offer value to consumers where it is a cheaper and less intrusive method to provide the required increased capacity at lower cost than

conventional cable solutions. The Project's Alpha Phase explored counterfactuals and found there to be a clear application for the technology over the near and medium term. This is a novel technology, not deployed elsewhere in GB. This project is therefore aligned with several of the aims of the Innovation Challenge, which is to improve coordination of emerging innovations across networks, generators, market participants etc. as well as reducing complexity in the system.

While the Expert Assessors considered the Project to have met the aims of the Innovation Challenge it was noted that this Project could have more clearly set out the potential scalability of this technology.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion not met

The Expert Assessors did not consider this Project to have identified a clear benefit for electricity consumers and therefore do not consider the Project to have met this Eligibility Criteria.

While the Expert Assessors acknowledged the Project's potential to reduce the future costs of transmission (275kV) cable installations and network reinforcement in certain circumstances, they considered the Project's and technology's pathway to business as usual (BAU) beyond the Beta Phase to be unclear, noting specifically the lack of clarity around the potential applications for the GB electricity network. The Expert Assessors also noted that circumstances are possible where the Project's use case could be less cost-effective against traditional cable systems, thereby demonstrating a limited potential benefit to electricity consumers.

To strengthen the potential use cases, the Expert Assessors noted that the Project would have benefited from exploring other use cases, such as the potential uses for this technology should 400kV cables become a requirement in new urban areas. The Expert Assessors noted that, should this occur, the Project's use of 275kV cables could represent a cost saving over 400kV cables. However, this approach was not sufficiently set out by the Project as an activity in the Beta Phase.

In addition, the Expert Assessors noted that the Application was unclear on whether the Project would require further testing, should it be successful and completed, for it to be proven in an operational environment. While the Expert Assessors noted that this was addressed by the Project team during the interview, the Expert Assessors did consider it an area where the Application and Project could have more clearly articulated the requirements post Beta Phase.

The Expert Assessors also noted that the Project upon completion would not deliver data and real time system operation and performance. They considered this to limit the potential benefit for electricity consumers. This was also considered to be a key omission by the Project as greater data about system operation will likely be key in a future energy system.

The Expert Assessors also expressed a concern about how the Project would translate into BAU for the Funding Party and other transmission operators, as it was unclear in the Application and interview whether there will be sufficient adoption opportunities for this technology for there to be a benefit to electricity consumers.

Taken together, the Expert Assessors considered these to limit the overall potential benefits which could be delivered to electricity consumers as there were uncertainties about future use cases, additional funding or development which may be required, and adoption possibilities beyond the Beta Phase. The Expert Assessors therefore did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 3: Projects must involve network innovation.
Eligibility Criterion met
The Expert Assessors considered this Project to involve network innovation because there has not been a previous demonstration of this technology in a field trial at the voltage set out by the Project (275 kV) and there is no prior installation or use cases for AC transmission in GB at the distances and voltages envisaged. The Project's aim of testing HTS cabling offline in a first of its kind demonstrating, over a very short distance, indicates some of the challenges of establishing this type of system in practice and why this Project was considered to demonstrate network innovation. For example, in order for this technology to be

incorporated into business as usual, the Project will need to not only prove the core cable and cooling technologies of the HTS cable and its integration with the grid, but also develop the performance and evaluation models, and new standards for testing and maintenance.

The Expert Assessors therefore considered this Project to have met this Eligibility Criteria.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors did not consider this Project to undermine the development of competitive markets because there is currently no market for this technology in the GB electricity network industry. Successful demonstration and deployment of the technology was considered to have the potential to develop this market and thereby increase the competitive options, and potentially the supply chain, for network utilities. This Project has the potential to enable components manufacturers for HTS cables and system service providers to develop competitive solutions. In addition, the Project states that any GB transmission procurement of HTS technology would be subject to competition. The Expert Assessors therefore consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Expert Assessors considered this Project to be innovative, novel and risky because HTS cabling solutions for transmission capacity upgrades are not yet proven for use at the higher voltages and distances necessary for GB Transmission Grid operation.

The Expert Assessors considered the Project to be innovative because the main innovation focuses on jointing and termination at 275kV and building a suitable test facility to support this activity and accelerated aging of assets. It was also noted that the learnings and development of the Project, should it be successful, could also support future projects.

The Expert Assessors also considered the Project to be novel and risky because they noted that considerable research, development, testing and assessment is necessary before the Project's proposed system could viable and useable in a business as usual scenario. For example, the Expert Assessors noted that this Project is only examining one component of the research and development process by testing a novel HTS cabling system for 25 metres at 275kV. The Expert Assessors noted that other uses cases will need to be developed and tested. The Expert Assessors therefore noted the risk of this new technology and its novelty with the first of its kind demonstrator in GB.

The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion not met

The Expert Assessors did not consider the Project to have participation from a sufficient range of stakeholders for the activities set out for the Beta Phase. While the Expert Assessors considered the Project to include participation from a sufficient range of stakeholders to test and examine the technology proposed, as well as potentially develop the supply chain, the Expert Assessors did not consider the Project to include participation from a sufficient range of stakeholders because the Project did not include other GB transmission operators, such as SSEN and/or SPEN in the Project.

These stakeholders were considered to be a crucial missing component of the Project, and the Expert Assessors noted they could have been included in a variety of ways, such as a Project Partner or as part of an advisory panel to the Project. Without their direct participation in the Beta Phase, the Expert Assessors considered the Beta Phase and any developments from it to be proceeding at risk, based on the assumption that the proposed solution can be incorporated across all GB transmission operators. This was considered by the Expert Assessors to be a significant unknown and risk to the Project.

While not crucial to the Beta Phase, the Expert Assessors noted that the participation of distribution network operators (DNO) would have strengthened the consortium and the possibility of scalability after the Beta Phase, should the Project

be successful. It was noted that in particular, there could have been shared learnings between DNOs and TOs, particularly around network installation, use and maintenance in dense urban environments.

Overall, the Expert Assessors did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion not met

The Expert Assessors did not consider the Project to be delivering value for money and be costed competitively. The Application and the interview did not provide sufficient clarity and detail on the breakdown of costs set out for the Beta Phase and some costs were higher than industry norms without sufficient justification. These therefore did not provide the Expert Assessors with a sufficient level of detail to consider whether the Project provides value for money and is costed competitively.

The day-rates set out appeared high in a number of areas relative to industry norm. For example, labour rates across several of the Project Partners and the Funding Partner were considered to be above the industry norm without justification. While these costs may have been justifiable, without details on context for these costs, the Expert Assessors did not consider the Project to be costed competitively. The Expert Assessors noted that the Application would have been strengthened by providing greater details for the subcontractor costs as they may have been justifiable but lacked sufficient justification and detail.

Furthermore, the Expert Assessors did not consider this Project value for money due to the size of the market being unclear. As previously stated, the use cases and scalability of the Project and its innovation were unclear or would likely require additional examination beyond the Beta Phase activities set out, and therefore was not considered to provide value for money. The Expert Assessors noted that the Project would benefit from assessing and including greater details in the Application on the whole system benefit of the Project and wider scalability question as detailed above.

The Expert Assessors therefore did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion not met

The Expert Assessors considered the Project's methodology to not be sufficiently robust and to not provide confidence that it would be capable of progressing in a timely manner because the Application lacked sufficient detail in the Project planning. While the Expert Assessors noted some positive aspects in the Application, they did not consider the Project to have met this Eligibility Criteria.

The Expert Assessors considered the work package descriptions in the Project plan to be limited in their scope and to lack sufficient detail. While the Expert Assessors considered the Gantt chart to be well set out, they noted difficulties in understanding who was accountable for which work package, the resourcing set out for each work package, how the resourcing fit with the Project plan, and considered the milestones overall to be limited. It was also noted that the Project's risk register does not explicitly cover integration risk and it is unclear as to which Project Partner owns which risks, technical sign-offs, as well as which Project Partner is applying what contingencies and how these might relate to the risk register. The Expert Assessors suggested the Application would have benefitted from clearer risk identification and mitigations.

While the Expert Assessors considered the stage-gating methodology to be clear and that the interview provided greater understanding of the Project's activities, they considered the plan for demonstration to be immature and in need of further development.

Regulatory barriers identified for the Project Phase

N/A

The Application nor the Expert Assessors identified any regulatory barriers which would impact the delivery of the Project's Beta Phase.

Recommendation to the Gas & Electricity Markets Authority

DO NOT FUND

All Expert Assessors did not recommend this Project be considered for SIF Funding, as they did not consider the Project to have met all the Eligibility Criteria.

The Project was considered innovative and to have addressed the aims of the Innovation Challenge as it proposes developing and demonstrating a novel high temperature semiconductor (HTS) cabling option which would be particularly relevant for increasing network capacity in dense urban areas. This was considered to be a novel technology which has not be demonstrated in the GB transmission network to date. The Expert Assessors also did not consider this Project to undermine the development of competitive markets because there is currently no market for this technology in the GB network industry and the proposed activities did not undermine the development of competitive markets.

Whilst the Expert Assessors acknowledged that the Project represents a potential benefit to electricity consumers through the reduction of future costs of transmission cable installations and network reinforcement when compared to current approaches and technologies, they did not consider the Project to have demonstrated a clear pathway to incorporation beyond the Beta Phase and considered the potential application or target market for its proposed approach to be limited. Therefore, the Expert Assessors did not consider this Project to have identified a clear benefit for electricity consumers or to provide good value for money.

The Expert Assessors also did not consider this Project to include participation from a sufficient range of stakeholders for the activities set out in the Beta Phase but noted that participation from transmission operators would have strengthened the application. The Expert Assessors considered the role of transmission operators to be key in supporting scalability in GB. The Expert Assessors that either participation in the Project or in an advisory group from transmission operators would have strengthened the Application through more informed scoping of the proposed trials as well as dissemination. Additionally, although the Project acknowledged it had interacted with some distribution network operators, their lack of participations in the Project was also considered to limit the potential scalability of the innovation.

Additionally, the Expert Assessors also noted that the Project would have benefitted from exploring other use cases in the Beta Phase. The Expert Assessors considered the use cases to be limited and therefore did not consider the Project to have sufficiently identified a net potential deliver for electricity consumers.

Recommended Project specific conditions
N/A

5.2.3 10067854, Network-DC, Initial Net Funding Requested £5,486,794

Project Partner name	Eligible costs (£)(excl. in-kind contr)	Project contribution (£)	SIF Funding Requested (£)
SCOTTISH HYDRO ELECTRIC TRANSMISSION PLC	4,408,954	453,000	3,955,954
UNIVERSITY OF EDINBURGH	1,241,391	124,104	1,117,287
CARBON TRUST ADVISORY LIMITED	114,492	0	114,492
NATIONAL GRID ELECTRICITY SYSTEM OPERATOR LIMITED	103,330	10,333	92,997
SUPERGRID INSTITUTE	228,960	22,896	206,064

Submitted Project description

The UK government has set targets to increase offshore wind to 50GW by 2030. The method for connecting offshore wind farms to the grid is to connect each wind farm to an alternating current (AC) converter station with an AC circuit breaker between the converter station and the rest of the onshore AC network, to protect the electricity grid from faults on the offshore direct current (DC) network. This method results in stand-alone assets connected directly to the transmission grid, increasing the total number of required AC converter stations. As the number of wind farms increases, the number of AC convertor stations increases. Without innovative solutions, the growing network of High Voltage Direct Current (HVDC) connections around GB will be less flexible and responsive, resulting in higher assets and system operating costs.

DC circuit breakers (DCCBs) are more than likely to be required to deliver a multi-terminal HVDC hub serving multiple offshore wind generation sites, GB transmission links, and international interconnectors.

Solution

Network-DC will investigate and demonstrate the use of DCCB, an innovative technology untested in the UK and European markets. DCCBs will allow us to bring multiple wind farms into a DC system, containing the impact of any single failure safely and securely.

This Project brings together international partners to accelerate the readiness of DCCBs for installation into the design of the UK HVDC Network, and outline a clear pathway for the installation of the UK's first DCCB.

The use-case selected for DCCBs is based on a DC switching station (DCSS) proposed at Peterhead, that could support HVDC links connecting electricity transmission in NE Scotland to locations in England and international interconnectors. The addition of a DCCB could provide capacity for additional power generation to be connected at the DCSS.

Approach

Our approach uses the state-of-the-art HVDC centre to simulate DCCBs, avoiding overreliance on live fault testing and field trials, that have a high risk for other users of the system.

The Project will use Hardware Testing in the Loop (HIL) and Software Testing in the Loop (SIL) to establish performance standards for DCCBs. Testing and consultation with key stakeholders will establish and demonstrate DCCB performance, resulting in approved specifications that can be used for procurement.

Benefits

A DCCB hub will reduce the need for AC infrastructure and effectively isolate faults in offshore network components. This project will build confidence in DCCBs allowing utilisation across the network.

Eligibility Criterion 1: Projects must address the Innovation Challenge set by Ofgem.
Eligibility Criterion met
The Expert Assessors all agreed that the Project addressed this Eligibility Criteria because they considered the Project to be directly aligned with the Innovation Challenge's key focus areas of improving the coordination of new innovations across key stakeholders. The Project proposes the introduction of a novel technology that could significantly facilitate the deployment of renewable energy, particularly offshore wind generation, on the UK grid. The proposed technology was expected to both enable high voltage direct current (HVDC) circuit breakers and to simplify HVDC networks while preserving their

resilience. The resulting advantages include potentially lower network costs and faster network connections for new offshore generators, which supports the wider Net Zero transition. This relates to several key areas of scope within the Innovation Challenge, such as future policy and regulatory conditions to support whole market system approaches and coordinating approaches to deliver more efficient capital investment on the system.

The Project was also recognised by the Expert Assessors for its potential to enhance coordination between offshore wind generators and the transmission network by isolating faults, thereby reducing their network-wide impact. This is a direct focus area of one of the Innovation Challenge's key aims. The proposed approach by the Project was considered to lead to a potentially more cost-effective grid topology and an optimised whole system design-space. Moreover, the Project is appreciated for its focus on supporting a coordinated approach to asset installation, which could potentially yield more efficient capital investment and cost reductions.

As a result, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion met

The Expert Assessors considered the Project to have met this Eligibility Criteria. While the Expert Assessors note some caution regarding the timeline and certainty of the projected benefits, on balance the uncertainties were considered reasonable for the Project and it was recognised for its clear potential to deliver a net benefit to electricity consumers. This was considered to be primarily due to the Project's enablement of a technical solution that offers operational and cost advantages, and by reducing the costs of network infrastructure for connecting new sources of renewable electricity generation to the grid. This could be achieved by adding capacity to existing infrastructure, minimising the need for additional infrastructure, and maintaining network flexibility and fault tolerance. The Project is also associated with potential environmental benefits, including reduced coastal impacts and simplified, faster grid connections for generators.

The Expert Assessors considered the cost benefit analysis to be robust and to indicate a net present value to the system (and hence to the customers) of approximately £350 million over a lifespan of 35 years. While the Expert Assessors recognise the timelines associated with these benefits exceed the length of the Project, and the caveat that these benefits are contingent upon the long-term deployment of direct current circuit breaker (DCCB) technology, they consider the Project to have clearly identified potential to deliver a net benefit to electricity consumers. As a result, they considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Expert Assessors all considered this Project to involve network innovation because of its focus on the deployment and further development of a novel technology on UK transmission networks, including providing insights to inform the ESO and policymakers on how its proposed solution could be incorporated.

The Project aims to prove the viability of high voltage direct current (HVDC) circuit breakers within UK transmission networks, an endeavour that hasn't been undertaken before due to the absence of existing standards and codes. The Expert Assessors emphasize that this is not incremental innovation but a significant stride forward, thereby representing network innovation. The Project is further deemed innovative as it is developing core technology (circuit breakers) for use in the new direct current offshore network, and providing tools for the ESO to correctly design such systems that include the DCCBs. Lastly, the Project is deemed to involve network innovation as it is examining and de-risking a new approach to the integration of offshore wind farms into the GB energy system that could provide system and consumer benefits with successful deployment. Therefore, the Expert Assessors consider this Project to have met the Eligibility Criteria.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors collectively agreed that the Project is not undermining the development of competitive markets as it includes participation from a diverse

range of stakeholders. They also noted several points as to why they have confidence in the Project not undermining the development of competitive markets.

Firstly, the Project has put forward its plan for broad dissemination of data generated by the Project via the ENA's Smarter Networks Portal and academic models, thereby promoting universal applicability of the technology across the UK grid. Secondly, the Project fosters competition by facilitating the creation of a new market for HVDC circuit breaker supply. This effort is further reinforced by the engagement of multiple potential original equipment manufacturers (OEMs) as suppliers rather than Project Partners, thereby creating a competitive environment between suppliers. Additionally, the Project has ensured participation of at least two OEMs, who will provide replicas for testing and future incorporation. The initiative to develop an open-source model allows multiple parties to undertake future analysis, promoting diversity of stakeholder involvement.

Finally, the Project proposes a more detailed understanding of alternative solutions for offshore wind farm connection through DCCBs. The Expert Assessors considered source model development and insight dissemination to form an integral part of the Project, ensuring the development of competitive markets is not undermined and compliance with SIF participation requirements is maintained.

In light of these points, the Expert Assessors considered this Project to have met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Expert Assessors all considered the Project to be innovative, novel, and risky, thereby meeting this Eligibility Criteria. This conclusion is based on several key factors identified across the Project.

Firstly, the Expert Assessors underscored the innovation and novelty inherent in the Project, given that DCCBs have not been used commercially in the UK or elsewhere in Europe. Further adding to its novelty and innovation is that regulations for the installation and use of DCCBs are still under development and

the Project represents an opportunity for its insight to inform the development of these regulations.

Secondly, the Project introduces a novel network design approach with no existing HVDC circuit breaker qualified for use in UK networks. The inherent difficulties in DC switching at high voltages, combined with the existing network design strategies avoiding HVDC switching where possible, contribute to the Project's riskiness but were not considered to be unsurmountable. The Project was also considered to hold the potential to unlock different network design strategies beneficial to the Net-Zero transition.

Thirdly, the use case of DCCB with marine cables is new, adding to the Project's innovativeness and riskiness. The Project is proposing using largely capacitive cables, in contrast to the inductive overhead lines currently used, which could result in a change to the use of inductive lines.

Finally, the Project's novelty is further reinforced as it provides new insight and de-risking of a potentially crucial technology that may offer significant cost benefits to consumers in the long term. The main risk is linked to uncertainty about the likelihood of a DCCB rollout occurring due to externalities beyond the Project's scope.

As a result of these reasons, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion met

The Expert Assessors all considered the Project to have included participation from a sufficient range of stakeholders for the activities set out. The Project's composition and structure were noted positively, particularly its mix of stakeholders, which includes transmission systems, academic experts, the Electricity System Operator (ESO), and a breadth of engineering expertise.

The leading role of SSEN’s National HVDC Centre, where most of the physical work will be carried out, was noted as a strong point in the Project's organization.

The inclusion of HVDC specialists from the University of Edinburgh and the SuperGrid Institute, alongside the ESO for network design and representation of generators through the Carbon Trust, was considered to have provided a comprehensive set of stakeholders, well-aligned with the Project's objectives and activities. The intention to subcontract multiple HVDC circuit breaker OEMs, with more than one considered essential, was also highlighted as a strength of the Project.

Finally, the Expert Assessors commended the well-constructed consortium for its balanced mix of academics, network operators, OEMs, and the HVDC Centre. They concluded that this balanced stakeholder representation has the necessary skills and is well positioned to deliver the Project's outcomes.

Therefore, the Expert Assessors consider the Project to have met this Eligibility Criteria due to the sufficient and diverse participation from a range of stakeholders.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion met

Three of the four Expert Assessors consider the Project to deliver value for money and be costed competitively. They highlighted that the potential system benefits, as modelled, offer substantial advantages compared to the costs of the Project. The cost-benefit analysis developed through the Alpha Phase gives them confidence that there will be several network scenarios where the network design option to use HVDC connections through HVDC circuit breakers will yield consumer savings when compared to the counterfactual. These savings could be considerable if the technology is adopted at scale and supply-side competitive pressures are maintained.

One Expert Assessor, however, noted that the Project’s costs could have provided a more competitive pricing model and that some work packages' funding allocations weren't supported by the activities set out in the Application. They noted that the funding requested appears excessive given the Project's focus on modelling and simulation, and there were specific concerns about the substantial funding allocated to OEMs for their design work under work package 3 and the nearly £2m requested under work package 5 to develop a replica DCCB in a real

time digital simulator and associated tools. Despite this concern, the majority of the Expert Assessors considered the Project to have demonstrated value for money.

The Expert Assessors also considered the labour rates to provide good value throughout the proposal relative to industry norms, and the project's structure through stage gates was praised for managing uncertainty risk. The scope was also deemed appropriate, and the costs allocated to each Project Partner were viewed as suitable for the sector.

In summary, while the majority of the assessors considered the Project to have offered value for money and to be costed competitively, the Project could have more clearly set out and justified its costs, specifically related to design work.

However, on balance the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion met

The Expert Assessors all expressed confidence in the Project's robust methodology for delivery. They considered the Project to have an appropriate level of detail in a clearly defined plan, fostering confidence in its potential for timely progression in the Beta Phase. The assessors commended the Project's well-developed plans, noting that further detail might be added to the Gantt chart and work package descriptions. Resource allocation was seen as sufficiently clear, and the continuation of the risk register from earlier phases for tracking and managing risk was appreciated and was considered well thought out.

The assessors emphasized the significance of engagement with OEMs, both for the rigour of the Beta Phase and to foster momentum for future business as usual adoption. The Expert Assessors suggested that ensuring ongoing and genuine commitment from OEMs to their product development and testing in parallel with the Project would be crucial.

Moreover, the Project received praise for its positioning in the Beta Phase with OEMs. The methodology for testing, which includes both software and hardware

testing, was highlighted as a positive aspect, and the Project's management of regulatory and commercial risks was seen as competent.

Lastly, the assessors expressed high confidence in timely delivery due to the robust methodology. They commended the Project team for having the right balance of skills and expertise, and the involvement with OEMs was seen as an added assurance of high-quality technical outcomes.

In summary, the Expert Assessors also considered the Project to have a robust methodology that fosters confidence in its capability to progress in a timely manner, and therefore was considered to have met this Eligibility Criteria.

Regulatory barriers identified for the Project Phase
NO
The Project has not identified any regulatory barriers which would prevent the delivery of its Beta Phase activities. The Project and Expert Assessors noted that the current regulatory landscape for the Project's proposed solution would require regulatory development, implementation and change which the Project could help inform. As a result, the Project and Expert Assessors both identified the need for regular engagement by policymakers (specifically DESNZ) and Ofgem in the Beta Phase. As such, the Expert Assessors have recommended a Project-specific condition for the Project to include regular engagement and updates with Ofgem and DESNZ.

Recommendation to the Gas & Electricity Markets Authority
FUND
Network DC was considered to be an important Project addressing the whole systems challenge by enabling the development of high voltage direct current (HVDC) circuit breakers specifications. This has the potential to de-risk and enable the supply chain to deliver effectively and specifically to GB system needs. This scope of work is considered to go beyond incremental innovation as DCCBs have not been used commercially in GB or for this specific use case (under sea and faster fault rise times) anywhere globally. The availability of DCCBs to network designers include potentially lower network costs and faster network connections for new offshore generators post 2030, which

supports the wider Net-Zero transition. The project is also recognised for its potential to enhance coordination between offshore wind generators and the transmission network by isolating faults, thereby reducing their network-wide impact and improving resilience. This approach could lead to a more cost-effective grid topology and an optimised whole system design-space in the future. The Project has identified a robust business case of c. £350m over a 35 year lifespan, which has been scaled down since the previous phases owing to more granular analysis and pragmatism.

Overall, the Expert Panel felt the Project offered a route to providing an important proposed solution for system designers to consider when planning for a high offshore wind future. It also noted that, there is no certainty that this proposed solution would actually be taken up given the significant additional dependency of the development of HVDC networks and DCCBs on wider policy and regulatory direction, which is beyond the control of the Project. Thus, the Project needs to continuously monitor ongoing and future developments in this sector and reassess the risks to having an enabling environment to roll this technology out commercially. Additionally, it is critical that this Project engages and primes the supply chain to be ready and willing to move forward to deployment, including securing commitment to carry out a real life demonstration on the back of this Project.

Recommended Project specific conditions

1. Ahead of the Project kick-off, the Funding Party should submit a plan to improve the competition between OEMs wishing to participate in the project and beyond to improve the value for money for SIF. This plan should address the level of co-contribution the OEMs will make to the project. In addition, the successful OEMs should provide a statement of their intent to participate in a physical demo/deployment [e.g. Peterhead] after the SIF project completion should the SIF project be successful. Such statement must be in place by SG1 and is a necessary condition for the project to progress beyond this point.

2. The Funding Party should outline how its project governance will ensure the project will react appropriately in the event of change of assumptions (e.g. policy

or regulatory changes) which call into question the value for the project, for example calling an extraordinary stage gate or similar.

3. During the project, the Funding Party needs to include greater consideration as to how the work would feed into and influence global HVDC and DCCB standards. There should be a short report submitted at the end of the project that summarises these efforts and the outcomes as well as updates at each SG.

4. The Funding Party needs to include considerations of policy and regulatory risks and opportunities as an ongoing activity through the project. It also must provide a short summary on these aspects at every stage gate.

5. Ahead of the Project kick-off, the Funding Party should secure support from stakeholders in Ofgem and DESNZ working on offshore transmission networks and offshore wind to engage closely and secure input on the project findings at key milestones.

6. Project should consider how to influence EU standards on DCCBs and networks and also consider how, if previous work on standards has happened in EU, to align with this EU work – this will help access EU market and support UK PLC benefit from leading on DCCB specs development to avoid a scenario where there is a UK-bespoke specification.

7. Need discussion with SSE and consideration of IP management and other aspects if HVDC centre changes ownership from SSE to the ESO as part of next price controls.

5.2.4 10067856, INCENTIVE, Initial Net Funding Requested £922,333

Project Partner name	Eligible costs (£)(excl. in-kind contr)	Project contribution (£)	SIF Funding Requested (£)
SCOTTISH HYDRO ELECTRIC TRANSMISSION PLC	557,678	0	557,678
UNIVERSITY OF STRATHCLYDE	220,508	11,425	209,083
NATIONAL GRID ELECTRICITY SYSTEM OPERATOR LIMITED	42,117	4,215	37,902
THE CARBON TRUST	302,670	185,000 (365,710 in-kind)	117,670

Submitted Project description

Problem

The energy contained in generators at power stations and industrial facilities provides inertia as they rotate at the same frequency as the electricity grid.

Inertia in the GB electricity network is falling. Without novel solutions, adding additional renewable generation capacity will become increasingly challenging and could increase the operating cost of the GB network system and consumer bills. Historically, renewable generators have not treated system inertia as their problem as it has been high. However, we are already seeing renewable generation curtailed due to low system inertia.

Solution

INCENTIVE will investigate and demonstrate how offshore wind farms (OWF) can provide inertia to the onshore networks. This will provide grid stability and reliability at a lower cost, and reduce the need for additional infrastructure by co-developing and co-locating inertia services with OWFs. OWFs providing inertia to the onshore network is not an incremental innovation, but a step-change in thinking that could be replicated globally.

INCENTIVE will investigate OWFs with:

1. STATCOM with supercapacitor energy storage and grid forming converter.
2. Battery energy storage system (BESS) with overrated grid forming converter.

3. Synchronous condenser with flywheel.

These solutions have never been trialled in conjunction with an offshore wind farm before, making this a first-of-its-kind project.

The Project brings together OWF developers, technology suppliers, NGESO, and Ofgem, to help build a cross-industry understanding of the INCENTIVE solutions.

Approach

As agreed with UKRI, INCENTIVE will be delivered over two stages:

- Stage 1 (this application) - build on the Alpha Phase to deliver concept selection and a site selection for the installation of a pilot project.
- Stage 2 (subject to site and technology selection) - take the project through Front End Engineering Design and the Financial Investment Decision to install the pilot project. Stage 2 will be applied for under Beta Round 2.

This approach will deliver better value for GB consumers by reducing the potential of project failure and ensuring consumers' money is spent confidently.

Benefits

INCENTIVE will deliver benefits over and above those achievable through existing programmes (i.e. The Stability Pathfinder). These include:

Introduction of design alterations to requisite or already-planned assets to provide inertia.

Capturing cost savings by building inertia provision alongside building OWFs. For example, sharing network, access, and planning considerations.

Accelerating the connection of renewable assets by proactively addressing inertia at the outset.

Driving down market prices by creating a liquid market for inertia services.

Eligibility Criterion 1: Projects must address the Innovation Challenge set by Ofgem.
Eligibility Criterion met

The Project was considered by the Expert Assessors to have addressed the Innovation Challenge because it aims to improve coordination between transmission networks and offshore wind developers by adapting wind farm equipment such that it can supply inertia and short circuit services to the grid. In addition, the Project aims to identify optimal business models and any market design or regulatory changes that may be needed to ensure optimum arrangements for all stakeholders. The Project could lead to a change in the role offshore wind farms play in the network and the degree and nature of their cooperation with the ESO. The proposed solution could also potentially allow for a cheaper grid topology.

The Expert Assessors considered this to be aligned with the Innovation Challenge's aim of improving coordination of emerging innovations across networks, generators and other key stakeholders, because the Project could result in new opportunities for these stakeholders to coordinate in ensuring the grid has sufficient inertia. This was also considered to be an important consideration for the transition to Net Zero, as ensuring the electricity network has sufficient inertia will be key in ensuring grid stability. The Project's activities are also aligned with several of primary areas of focus within the Innovation Challenge, including the current and future needs for energy provision, and integrated network planning and whole system operation, because the use of inertia from renewable generation could be key in ensuring grid stability with an increase in electricity demand in the future.

The Expert Assessors therefore consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 2: Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers
Eligibility Criterion met
The Project was considered to have clearly evidenced the potential for delivering a net benefit to electricity consumers by introducing an innovative route to reducing the costs of maintaining system inertia. The proposed new approach would compete alongside existing balancing solutions and could directly help reduce the cost of balancing the system and hence the operating cost for the ESO. The Project has identified potential savings of up to £1bn to deliver 5% of GB inertia

needs over a 30-year period. The Expert Assessors considered a central part of the Project's ability to deliver net benefit to electricity consumers to be through lower energy bills.

The Project is proposing that for a relatively small increase in capital expenditure at the on-shore connection point of an off-shore wind farm, significant benefit could be created when compared to a counterfactual case of procuring inertia services via the Stability Pathfinder programme. The Project is also demonstrating benefit to all GB consumers by bringing forward a lower carbon alternative to meet energy system stability requirements and potentially accelerating the connection times of offshore wind farms to support meeting Net Zero goals in a timely manner.

The Expert Assessors therefore considered the Project to have met this Eligibility Criteria as it represents the potential to deliver a net benefit to electricity consumers through lower energy bills and through the use of lower carbon alternatives to deliver grid stability, thereby resulting in environmental benefits.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Project was considered by the Expert Assessors to involve network innovation because it seeks to open up alternative mechanisms to maintain system inertia as renewable generation increases. Currently this inertia is (usually) provided by gas turbine generators and by paying for curtailment of renewable generators. This Project could result in assets such as static synchronous compensators (STATCOMs) with supercapacitor energy storage, battery energy storage with uprated converters and synchronous condensers with flywheels, being built within new offshore wind farm substations and farms providing a competitive service.

While the Expert Assessors noted that these assets would be required to be deployed within each windfarm in any case, but by uprating them it is likely to also provide the additional stability services targeted. This was considered to involve network innovation because it would require a change in approach beyond current practice to how inertia and system stability are provided and could result in greater system stability as electricity demand and generation increases.

The Expert Assessors also noted that potential takeaways from the Project could lead to the Project's proposed solution, or a similar solution being deployed elsewhere in the network where new STATCOM, battery energy storage systems, and synchronous condensers are being installed. The Expert Assessors therefore considered the Project's proposed activities to involve network innovation as it is focusing on new approaches to providing inertia and system stability, which could also be incorporated beyond offshore windfarms.

As a result, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors did not consider the Project to undermine the development of competitive markets, because it aims to increase the sources of and competition between providers of inertia services in electricity system stability markets. It would achieve this by demonstrating technical solutions, such as STATCOMs, for offshore wind farms to be developed with integrated inertia mechanisms, extending the options for offshore wind developer revenues and bringing in new suppliers for inertia provision. The Expert Assessors considered this approach to represent the potential to stimulate or further the development of competitive markets for inertia providers.

The Expert Assessors also noted positively the Project working with 10 wind farm developers via the Offshore Wind Accelerator (OWA) convened by the Carbon Trust to whom the project learnings are disseminated. The Expert Assessors considered this approach to provide confidence that the Project and its proposed solution would stimulate and support competition across the offshore wind developers to apply these solutions, thereby further increasing future competition in provision of inertia services.

As a result, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met
The Project was considered innovative, novel and risky by the Expert Assessors because the Project's proposed focus of providing inertia services is not currently provided by offshore wind farms, or other renewable power generators. The Project also aims to investigate three technical (STATCOM with supercapacitor energy storage and grid forming converter; battery with overrated grid forming converter; synchronous condenser with flywheel) options for evaluation before trial of one in a future project. This approach of investing and testing new technologies for the provision of inertia services was considered by the Expert Assessors to be both innovative and novel. Furthermore, the Expert Assessors considered there to be considerable risks associated with the proposed approach, as there remain policy and regulatory uncertainties over ownership and operation of assets supplying such system stability services which presents a commercial risk to the Project progressing beyond the Beta Phase. The Expert Assessors noted positively that the Project aims to address the technical-economic and regulatory challenges through engagement with renewables' developers, technology suppliers, ESO and Ofgem. Overall, the Expert Assessors considered the Project's proposed solution to both an integration and commercial innovation that is novel and risky. Therefore, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 6: Projects must include participation from a range of stakeholders.
Eligibility Criterion met
The Expert Assessors considered the Project to have included participation from the appropriate range of stakeholders needed for the scope of work set out and considered the Project to have assembled a very robust consortium. The Expert Assessors also considered the roles and responsibilities of the Funding Party and the Project Partners to be clearly set out, where SHE is the Funding Party and will manage the technical assessments; the ESO provides the grid code and market expertise; the University of Strathclyde has expertise to design and test the control solutions; Fraser Nash provides the business model and economic analysis expertise and; Carbon Trust represents the offshore wind developer community who will take on-board the finds and ultimately adopt the solution.

The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion met

The Project was considered by the Expert Assessors to be delivering value for money, because the Beta Phase Application represents a relatively short (16 month) Project to refine technical and commercial options and establish potential for subsequent Beta Phase site- and solution-specific demonstration. This approach to the Project was viewed positively by the Expert Assessors because it enables initial scoping to occur prior to any demonstration activities. Furthermore, the Expert Assessors recognise the potential benefits (a lowest potential NPV of over £30 million (lower bound of potential benefit)) the Project could demonstrate in ensuring system stability and consider it, as a result, to demonstrate value for money.

The Expert Assessors also considered the Project's costs to be appropriate for the activities set out and includes a formal breakpoint at the end of the detailed design/site selection phase, which will give much more clarity of both the finances and construction plans. The Application also includes a high proportion (~40%) of the costs provided in cash and in-kind by the participants, which lowers the overall amount of SIF Funding requested and provides assurance that it is costed competitively.

The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion met

The Project was considered by the Expert Assessors to have a robust methodology, which gives confidence that it will be capable of progressing in a timely manner. It has an explicit logic, staged work plan and appropriate division of tasks between consortium members. The approach taken to having a pre-Front End Engineering

Design (pre-FEED) was considered robust, recognising the significant uncertainty after the Alpha Phase that creates challenges to move straight to a full demonstration in Beta phase. The work packages outlined cover the major tasks, and funding requests are broken down against corresponding milestones; multiple deliverables are also identified against the work programme. The risk management approach was also considered well thought out and provides confidence that the regulatory and commercial risks will be managed well.

Overall, the Expert Assessors considered the Project to have met this Eligibility Criteria because the Project's materials, plans, and risks were clear, and the Project has a robust methodology which gives them confidence that it will be capable of progressing in a timely manner in the Beta Phase.

Regulatory barriers identified for the Project Phase
NO
The Project nor the Expert Assessors have not identified any regulatory barriers which would impact the delivery of the Project in the Beta Phase. As the Project is examining how offshore windfarms can provide inertia to the onshore networks, it recognises that there several regulatory uncertainties. For example, the position on ownership and operation of assets providing stability services and how they interact with current grid codes and system operator transmission owner codes. As part of its Beta Phase the Project aims to examine, trial and demonstrate potential regulatory and market arrangements, which could deliver insights into the development of policy and regulation.

Recommendation to the Gas & Electricity Markets Authority
FUND
The INCENTIVE project focuses on what the Expert Assessors consider to be a key issue in the net zero transition, which is provision of reliable, low cost and low carbon system stability services. The Project approach is to target relatively low cost upgrades of technology solutions that are likely to be installed with offshore wind farms. This Project and its proposed solution were considered highly aligned to the SIF's focal area and has evidenced its technical and commercial novelty and associated risks. The Expert Assessors considered it to be directly aligned with the Innovation Challenge's aims and scope and considered it to have the potential to

unlock large cost savings for system operation and subsequently to the GB electricity consumers.

The Project was considered to have demonstrated a good understanding of the technical, regulatory and commercial risks, and has a robust plan to address and manage these. To ensure ongoing viability and inform any future demonstration application, the Expert Assessors noted the importance for Ofgem and DESNZ to stay engaged throughout the Project, if funded.

The Expert Assessors considered the Project to have brought together a strong consortium and to include participation from sufficient range of stakeholders with the right range of skills sets and agency to be able to deliver the Project and the activities set out, and ultimately progress the proposed solution into business as usual deployment in the future.

The Project was also considered to have taken a pragmatic approach to staging its Application to enable greater certainty, confidence and support to move to a demonstration phase which may seek future funding or be funded privately as appropriate. This approach combined with offshore wind developer support and contribution, resulted in the Expert Assessors considering the Project to provide value for money relative to the funding requested from SIF and to be costed competitively overall.

As a result, the Expert Assessors have recommended this Project be considered for SIF Funding.

Recommended Project specific conditions

1. Before the start of the project, the Funding Party should provide a list of key criteria that the offshore wind farm ""champions"" would want to see developed from the project to commit to hosting and co-funding a future demonstration.

2. The Funding Party must by end of the project develop insights around potential high frequency interactions between the STATCOM controllers and the wind farms and any implications for the provision of system services.

3. It is essential that the viability or otherwise of regulatory changes and the business models being developed is clear by the end of this project. The Funding

Party must therefore develop an on-going project engagement strategy with key stakeholders within Ofgem and DESNZ with support from Innovate UK and submit this ahead of the project kick-off

4. The Funding Party must submit a summary report outlining if and how INCENTIVE solutions that are deployed outside wind farms on other parts of the network could benefit from upgrades to provide inertia services. In this report, it must also highlight particular assets and related stakeholders who would benefit from the learnings emerging from the INCENTIVE Project.

5.2.5 10070764, Crowdflex, Initial Net Funding Requested £18,610,355

Project Partner name	Eligible costs (£)(excl. in-kind contr)	Project contribution (£)	SIF Funding Requested (£)
NATIONAL GRID ELECTRICITY SYSTEM OPERATOR LIMITED	10,632,804	1,918,761	8,714,043
ELEMENT ENERGY LIMITED	498,809	62,351	436,458
NATIONAL GRID ELECTRICITY DISTRIBUTION PLC	42,372	4,237	38,135
OCTOPUS ENERGY LIMITED	2,235,875	447,175	1,788,700
OVO ENERGY LTD	3,266,460	653,292	2,613,168
SOUTHERN ELECTRIC POWER DISTRIBUTION PLC	181,194	18,119	163,075
CENTRE FOR NET ZERO LIMITED	1,940,680	194,068	1,746,612
OHME OPERATIONS UK LIMITED	2,498,050	375,000	2,123,050
AMAZON WEB SERVICES	1,233,892	246,778	987,114

Submitted Project description
CrowdFlex aims to establish domestic flexibility as a novel, reliable flexibility resource of national significance, competing alongside BAU alternatives and accelerating decarbonisation. As more Variable Renewable Energy (VRE) and Low Carbon Technologies (LCTs) are added to the network, it will become increasingly difficult to balance supply and demand. Domestic flexibility provides a huge opportunity during this transition to build a smart flexible energy system by enabling consumers to act as a new source of flexibility. CrowdFlex explores how domestic flexibility can be utilised to align demand to generation, improve coordination across the network and reduce stress on the system, while reducing consumer energy bills via incentives. The objective of the Beta Project is to build a forecasting model of domestic demand and flexibility, informed by large-scale consumer trials, to establish domestic flexibility as a firm resource and inform new product design. CrowdFlex is the first use case for the ESO's Virtual Energy System (VirtualES). The VirtualES aims to develop an ecosystem of interoperable digital twins representing the entire GB energy system, for a flexible energy system with increased visibility and more accurate forecasting, and ultimately optimising costs for the end user.

Domestic flexibility is inherently statistical in nature. To fully understand and reliably quantify domestic flexibility, CrowdFlex: Beta will:

- Develop probabilistic modelling of domestic demand and flexibility to improve forecasting of baseline domestic demand and flexibility.
- Conduct large-scale consumer trials to enable the model development and a greater understanding of domestic flexibility's potential and technical capabilities.
- Establish a pathway to rapidly accelerate domestic flexibility to Business as Usual (BAU), following the project's completion.

If successful, CrowdFlex has the potential to deliver value across the energy system. Enabling ESO and DSOs to utilise domestic flexibility to reduce operational costs (namely constraints and energy balancing) and capacity and network reinforcement investments. This will lower consumer bills and support the deployment of VRE and uptake of LCTs, accelerating whole system decarbonisation.

Eligibility Criterion 1:
Projects must address the Innovation Challenge set by Ofgem.

Eligibility Criterion met

The Expert Assessors considered this Project to have addressed the Innovation Challenge because it attempts to unlock the potential of domestic demand flexibility. This could alleviate pressures on the electricity grid arising as a result of the transition to Net-Zero. Harnessing domestic flexibility has the potential to reduce grid reinforcement and constraint management costs at a time of increasing consumer demand and renewable generation penetration. In addition, it has the potential to improve coordination between networks and other system participants, specifically end users. The Project will also explore consumers' preferences to provide flexibility services, which can inform future market designs. It also has the potential to reduce complexity, bureaucracy and barriers to entry. It will involve a broad range of stakeholders across the value chain, and focusses on the development of new approaches to maximise the value of network and consumer data. The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion met

The Expert Assessors considered this Project to have clearly identified potential to deliver a net benefit to electricity consumers through the opportunity to participate in providing flexibility services to the network. Participation would result in direct payments to consumers. In addition, the Project creates the potential of reducing operational network costs and future asset investment costs through better demand forecasting and demand side response. Enhanced flexibility should also provide increased network resilience. Although all Expert Assessors have raised concerns that only consumers with heat pumps or EV chargers could benefit directly from flexibility payments, it is acknowledged that everyone benefits from reduced network costs. An indirect benefit for all customers is the increased participation in the flexibility market which ultimately could drive down prices.

The Expert Assessors acknowledge the value in the sharing of raw data from trials for future implementation or use by other innovators. However, one Expert Assessor did question the level of benefit versus value for money of the Project should the data collected not be made openly available to support future innovations. As a minimum, the trial data, especially the anonymised time sequence data of the flexibility requests and responses (from the meter) should be made publicly available. It was acknowledged that the General Data Protection (GDPR) will prohibit any data being shared for feeders with less than 5 meters, but the Project is encouraged to support open data processes. As a result, the Expert Assessors have recommended a Project-specific condition for the Funding Party to outline early in the Project its approach to sharing the data gathered by the Project, while also aligning with GDPR and licence condition requirements, and Ofgem's Data Best Practice Guidance. This could be achieved through API or a licensed access method. An example of best practice was provided in the form of SSENs 'My Electric Avenue' project who provided granular detail which has since support many follow up projects. GDPR should not be used as a reason not to find ways of sharing as much raw data as possible. The Expert Assessors recommended that Ofgem should assist by providing clear guidelines to the Project on data sharing.

Overall, the Expert Assessors considered this Project to have met this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Expert Assessors considered this Project to involve network innovation because it will demonstrate local provision of flexibility services to both minimise the costs of grid constraints (transmission and distribution) and balancing the mismatch in generation and demand therefore enabling novel methods of achieving system operator obligations. In addition, the Project links consumers through Flexibility Service Providers (FSPs) to the network operator to enhance whole system operation and to enhance the efficient use of assets. The Project spans the network from transmission, through distribution to consumption and seeks to balance operation, whilst meeting consumer demand. The Project is a pathway to a virtual energy system and could unlock 3GW to 10GW of flexibility in BAU operation.

The Expert Assessors recognise that this Project is underpinning a model for future flexibility markets. It is acknowledged that this Project compliments other work in this space for example Local Constraint Managed Zones, or the Demand Flexibility Service.

The Expert Assessors considered this Project to have met the Eligibility Criteria.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors did not consider this Project to be undermining the development of competitive markets because it will demonstrate the feasibility of commercial flexibility services at domestic level and therefore create new competitive solutions to grid services. The Project also includes 3 FSPs and has a stated objective to engage with others to ensure a competitive market for the provision of aggregated domestic flexibility services is created. All Expert Assessors acknowledged that it is essential that this Project shares sufficient knowledge with the non-participating FSPs to allow them to participate in any future markets. The

Expert Assessors like that the Project will seek to engage industry wide for the API specification.

As noted above, it is unclear if and what data from the trials will not be made publicly available. The Expert Assessors had a concern that the proposed solution could have the potential to distort the market in not supporting other suppliers and aggregators in developing their own models of flexibility. Clearer articulation of this would have strengthened the Application and, as noted above, the Expert Assessors have recommended a Project-specific condition for the Funding Party to outline early in the Project its approach to sharing data and adhering to data sharing requirements and guidelines . Overall, however, the Expert Assessors did not consider this lack of detail in the Application to represent a risk to the development of competitive markets and therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Expert Assessors considered the Project to be innovative and risky because this would be the first large scale consumer trial of probabilistic energy demand modelling and consumer participation to provide flexibility services through aggregators. The Project will also explore consumer price elasticity in response to incentives. The modelling approach is novel for this application, as is the market engagement mechanism with consumers for the first large scale consumer trial of its kind. This is because the Project proposes an approach which links ESO models, through APIs to multiple FSP models, to inform commercial engagement with consumers. In addition, taking network decisions based on these models, and on the probabilistic response of an aggregated body of consumers is innovative and risky.

The Expert Assessors consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion met

The Expert Assessors considered this Project to include participation from a sufficient range of stakeholders for this Eligibility Criteria met as it includes service providers, system operators and technical expertise across the entire value chain. The engagement of consumers via their energy suppliers, and the involvement of network operators and organisations means the Project team are in a position to implement the findings of the Project and maximise the successful delivery of the Project in the Beta Phase.

The Expert Assessor were concerned about the breadth of consumer segments to be engaged and the equitability of the offering to all consumers rather than just users of EVs and heat pumps. Expert Assessors noted that it was unclear how the levels of rewards will be tested in the trials and how these relate to the value unlocked by the flexibility created. However, the Expert Assessors did note that the Project has engagement with organisations, such as Citizens Advice, which could help inform wider consumer considerations beyond those participating in the trials. This was considered to have the potential, for example, to enable different consumer market segmentation. The Expert Assessors also encourage the Project to consider adopting an ongoing perception of "fairness" for long term consumer participation, which might require some transparency in the value created and how this is shared.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion met

All Expert Assessors agree that this Project will deliver value for money and to be costed competitively should the Project satisfy the concerns for open data as detailed above. The largest cost is the consumer incentive payments as rewards to provide flexibility services. Further value for money could be provided by offsetting any value created to the energy system from the provision of flexibility services within the trial. It was noted however that this is expected to be relatively small, and that the Project team have accounted for this within their contribution to the Project costs. Expert Assessors noted that the project management cost for the whole Project was particularly high. In addition, it was also noted that the day rates from Element Energy and Centre for Net Zero were higher than expected. The Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 8: Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.
Eligibility Criterion met
The Expert Assessors considered the Project to have a robust methodology which gives confidence that it will be capable of progressing in a timely manner because the trials and modelling methodology has been well thought through in the Alpha Phase. The workstreams and associated work packages appear appropriate in terms of technical focus to provide confidence in delivering the Project's outcomes, although it was noted that Project management costs were higher than expected. Expert Assessors have expressed concerns on the need to have at least two winters worth of data. It was also a concern, if the Project missed the first winter or its start was substantially delayed, whether this would adversely impact the value of the Project. Although during the interviews, it was acknowledged that it should be easier for FSPs to recruit participants (as both Ovo and Octopus have the existing customer base and have done this successfully before). Nonetheless, it is recommended that the Project track these early deliverables very closely. The Expert Assessors liked the agile approach to Project management and considered the Project to have met this Eligibility Criteria.

Regulatory barriers identified for the Project Phase
YES
The Project has recognised the potential need for a derogation during its Beta Phase Project. The primary potential barrier identified which may require a derogation was associated with the settlement in the balancing mechanism, which is currently settled half-hourly. However, as the Project focuses on domestic flexibility, many houses are not currently settled half-hourly. The Project has set out dedicated activities to explore shifting trial participants to elective half-hourly settlements to overcome this barrier, and the Project believes this approach will be sufficient to satisfy the balancing mechanism settlement requirements. The Expert Assessors noted positively that the Project in its Alpha Phase held discussions with DESNZ (formerly BEIS), Ofgem and Elexon to explore derogation options for its Beta Phase. The Expert Assessors also noted positively that where

an alternative approach may be required, the work packages would not start until mid-2024.

Recommendation to the Gas & Electricity Markets Authority
FUND
All Expert Assessors have recommended this Project be considered for SIF Funding because it has met all the Eligibility Criteria. The Project was considered to have addressed the Innovation Challenge by taking a holistic whole systems approach to assessing the potential value of probabilistic demand flexibility informed by real trial data from many thousands of consumers. This Project was considered to have the potential to underpin the model for future flexibility markets. It is acknowledged that this project compliments other work in this space such as Local Constraint Managed Zones or the Demand Flexibility Service. The Expert Assessors agreed that this Project has demonstrated a potential value for money to electricity consumers should the open data from the trials be made available at a suitable level of granularity that could support future innovation and supports the future FSP market. The Expert Assessors did note that the level of benefit versus value for money of the Project would be limited if the data collected from trials is not made openly available to support future innovations, and have recommended Project-specific conditions to avoid such a situation. As a minimum, the trial data, especially the anonymised time sequence data of the flexibility requests and responses (from the MPAN) should be made openly available. It is understood that the project must comply with GDPR and Ofgem's data best practices and the Expert Assessors have recommend a Project specific-condition for the Project develop a data sharing plan early in the Project delivery phase. The Expert Assessors also recommended the Project also consider all consumer segments and the equitability of the offering to all consumers rather than just users of EVs and heat pumps. The Expert Assessors noted that it was unclear how the levels of rewards will be tested in the trials and how these relate to the value unlocked by the flexibility created. It is crucial that the Project offer just and fair offerings to embed equitable long-term consumer participation.

The Project is not considered to undermine the development of competitive markets as it seeks to introduce an alternative source of flexibility services to compete alongside existing methods.

The Expert Assessors liked the agile approach to project management although the Project management costs were considered on the higher end of what was anticipated. Overall, however, the Project delivery was considered reasonable with a large amount of the cost going towards customer incentives. The Project plan, workstreams and associated work packages appear appropriate in terms of technical focus to provide confidence in delivering the Project's outcomes.

Recommended Project specific conditions

FSPs should have to develop insights on consumer demographics.

Required for early in the Delivery stage. It's imperative that the Project does not distort or restrict access to other FSPs to enter the market beyond. Data sharing of raw data needs to include market segmentation, demographics and/or assets. The Project must develop and resolve arrangements for which the raw data gathered in the Project can be made available in a useful way but comply with Ofgem's Data Best Practise and remains GDPR compliant. This needs to be sufficient for other market participants and innovators in the future. This plan should be approved by Ofgem. The Expert Assessors could be available to support review if required.

ESO to provide a presentation at stage gate ahead of trial kick-off illustrating clearly how the CrowdFlex market will interact with complement or effect existing markets. Both during the trial delivery and also the scenarios that may emerge on project completion. This should have representation from senior ESO representatives, ESO markets and control room teams – in which they should explain the potential impacts on their business operations of CrowdFlex and why/how they will look to own and integrate Crowdflex approaches and markets in to their business operations. This presentation should also cover how the CrowdFlex incentives will impact other markets and any potential market distortion effects.

CrowdFlex to illustrate how they will fulfil this condition (in detail) at the first initial stage gate in September ahead of trial kick-off.

An initial communication of how this will be developed and tested throughout trial delivery should be presented at the early stage gate ahead of trial commencement. This should then be executed in parallel to the Project delivery with reporting of stakeholder feedback, options analysis, and updated strategy6 presented at one of the later stage gates.

6.1 SIF Beta Phase – Zero emission transport - Summary

This section covers the assessment of round 1 Beta Phase Applications received into the 'Zero Emission Transport' Innovation Challenge[9].

For the Beta Phase of round 1, 2 Applications were submitted to Innovate UK through the Innovation Funding Service (IFS) portal by the closing deadline of 22 March 2023 and are listed below.

Project reference number	Project name	Funding licensee	Total Project costs (£) (excl. in-kind cont)	Total Project contribu t-ion (£)	Total SIF Funding request-ed (£)	Recom-mended for funding (Yes/No)
10061711	A Holistic Hydrogen Approach to Heavy Duty Transport (H2H)	SPT	5,599,966	735,479	4,864,487	No
10062041	HyNTS Deblending for Transport Applications	NGT	11,021,257	2,474,127 (1,374,127)	9,921,257	Yes

[9] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-innovation-challenges

6.2 Evaluation of Applications

6.2.1 10061711, A Holistic Hydrogen Approach to Heavy Duty Transport (H2H), Initial Net Funding Requested £4,864,487

Project Partner name	Eligible costs (£) (excl. contri in-kind)	Project contribution (£)	SIF Funding Requested (£)
SP TRANSMISSION PLC	1,453,945	260,545	1,193,400
IMPERIAL COLLEGE LONDON	462,602	92,520	370,082
RICARDO-AEA LIMITED	1,274,800	140,894	1,133,906
H2GO POWER LTD	1,924,674	193,000	1,731,674
SCOTTISHPOWER ENERGY RETAIL LIMITED	483,945	48,520	435,425

Submitted Project description

The solutions developed within A Holistic Approach to Hydrogen for Heavy Duty Transport (H2H) Beta are essential for a reliable and cost-effective roll-out of grid-connected hydrogen production, which is required to decarbonise the heavy transport sector. Using a conventional approach, such developments are susceptible to connection delays and prohibitive costs, which will hinder the adoption of this critical technology. Conversely, by fully leveraging the benefits of flexible connection and operational solutions, together with data-driven decision-making, H2H will deliver tangible benefits to:

- Power sector and its customers.
- Hydrogen producers.
- Hydrogen transport users.

H2H presents a de-risked innovation investment case with significant impacts in the order of £2.7bn for existing and future electricity customers up to 2070 and saving 5.7MtCO2e in direct carbon emissions.

Specifically, H2H Beta will develop first-of-a-kind, cross-sector and multi-vector modelling using AI-powered optimisation algorithms to recommend new connection and operational modalities. This holistic and quantitative approach will consider benefits and impacts across electricity, hydrogen production and hydrogen heavy-duty transport systems.

The project will undertake live trials, modelling, and stakeholder engagement to develop and validate BAU-ready network solutions for electrolysis and explore the implementation of these solutions in the hydrogen and transport sectors.

Eligibility Criterion 1:
Projects must address the Innovation Challenge set by Ofgem.

Eligibility Criterion not met

The Project was not considered by the Expert Assessors to have addressed the zero-emission transport Innovation Challenge. While the Project was considered to have a whole system focus through its focus of addressing curtailed renewable energy and supporting flexible connection and operation of electrolysers, its consideration of the transport sector challenges, and its user needs were considered only a secondary focus. As a result, the Expert Assessors did not consider the Project to have sufficiently addressed the Innovation Challenge. The Project's move away from the rail sector in the Beta Phase to reflect its findings from the Alpha Phase is evident and, while understandable, the current Application and proposed Project were not considered to have assessed and consolidated sufficient evidence and understanding of the transport sector's needs beyond rail to be able to move into a Beta Phase demonstration. As a result, the Expert Assessors did not consider the Project to have addressed the Innovation Challenge.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion not met

The Project has developed a cost benefit analysis that outlines a £2bn and 6 MtCO2e of lifetime cost and carbon emission reduction benefits which will be unlocked through reducing renewable energy curtailment and the cost of electricity networks and wider energy system. While the Expert Assessors considered these to be sizeable potential benefits for gas consumers, the Expert Assessors understood that the Project could have more clearly articulated how the potential benefits would be realized or a pathway for how they could be delivered. For example, the proposed demonstration plan to test the overall model was considered uncertain and dependent on electrolyser projects at different stages in the planning and consenting process.

Additionally, the benefits stated by the Project are from a power systems perspective with the value potentially flowing through via network bills. Similar to above, the Expert Assessors considered this approach to have clearly identified the potential for benefits but noted that the route to deliver them could have been clearer, specifically around how zero emission transport users will see value through this proposed solution. The Expert Assessors recognised that this might be a result of the Project pivoting away from the rail sector in the Beta Phase, but noted that additional details for delivery of benefits would have strengthened the Application.

While the benefit potential has been identified at a high-level, the Project has not clearly considered and articulated a mechanism to access it and deliver these to energy consumers across power and transport. As a result, the Expert Assessors did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Project is considered to involve network innovation because it aims to develop a new connection method for electrolysers to connect to the transmission network whilst being able to operate flexibly. This was considered to involve network innovation as the approach was novel for the GB energy system and demonstrates a potential approach for using normally curtailed wind energy in the energy system.

The Project also proposes establishing a new AI-enabled process to managing and optimising hydrogen generation across the network. While the Expert Assessors noted that the articulation of the key problem the Project is trying to solve in the hydrogen value could have been clearly communicated in the Application, they also considered this approach of optimising the manufacturing of large scale hydrogen to supply heavy duty transport fuelling outputs to involve network innovation. This is because it has the potential to establish a new AI-enabled process to managing and optimising hydrogen generation across the network, which is not yet an area which has been fully explored.
As a result, the Expert Assessors considered the Project to have met this Eligibility Criteria because it aims to develop a new connection method for electrolysers to

connect to the network and which uses AI to optimise the generation of hydrogen across the network.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors did not consider the Project to undermine the development of competitive markets because the connection model for flexible operation and the refuelling stations could be adopted by other electrolyser manufacturers in the UK and abroad should the proposed solution be successful. They considered this to represent opportunities for the development of new competitive markets. The AI algorithms that underpin the optimisation of the proposed solution will be proprietary, but they will be available to the market through a software as a service offering and a license arrangement. The Expert Assessors also noted that the Project's approach could lead to other similar solutions being developed, thereby resulting in increased competition in the space. The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Project was considered innovative and novel by the Expert Assessors because it is bringing together a novel approach for electrolyser connections with an AI enabled system to help optimise supply operations to meet demand for heavy duty transport users of hydrogen. This combination of novel commercial connection process underpinned by an AI system to optimise the overall hydrogen value chain has not been demonstrated in GB previously and was therefore considered a novel approach. While the Expert Assessors note that the uniqueness of the AI and its key selling points could be have been more clearly articulated, they also recognised the novelty of the approach. The assessors also considered the Project's approach to scaling up the use of electrolysers as part of its proposed solution to be a key risk to the Project as it is not something which has been achieved previously but also demonstrates significant potential if successful. As a result, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion met

The Expert Assessors considered the Project to have an appropriate range of stakeholders involved and participation from the stakeholders for the activities set out. They noted positively the representation across electricity networks, renewable and electrolyser developers, transport sector experts, hydrogen optimisation experts and academia. The assessors also noted that the Project's consortium could have been stronger if it had end users in the transport sectors as Project Partners, rather than as stakeholders, to engage during the Project especially because this Project is addressing the Zero Emissions Transport challenge. It was also noted that the role of Imperial College could have been more clearly explained in the Application.

Overall, the Expert Assessors considered the Project to have met this Eligibility Criteria because it has representation and involvement from the key stakeholders of the proposed solution and because the Expert Assessors considered the stakeholders in the Project to be clearly aligned with and complementary for the work set out for the Beta Phase.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion not met

The Project is not considered to be providing value for money and to costed competitively because the Expert Assessors did not consider the articulation of the Project's proposed solution to be sufficiently developed to demonstrate value for money and because the costs set out were considered high for what was being delivered.

The Expert Assessors considered the scale of the funding requested by the Project (£4.9m) to not be in line with the scope of the work and the deliverables set out, resulting in the Project not being costed competitively. The Expert Assessors also noted the shift in the Project's focus from the rail sector in its Alpha Phase to potential wider transport applications but did not consider the Project to have carried out sufficient preparatory work in its Alpha Phase on this shift to provide confidence in its Beta Phase activities. The Expert Assessors noted specifically that the end use cases beyond rail in the heavy-duty transport sector have not been sufficiently considered and that the proposed innovation lacks supporting analysis of the current hydrogen value chain and associated issues that warrant an AI

optimiser solution. The assessors also noted that, in its current form, they did not have confidence that the Project would be able to progress beyond the Beta Phase and into BAU successfully because of these unknowns.

As a result, the Expert Assessors did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion not met

The Project was not considered by the Expert Assessors to have demonstrated a robust and well thought through methodology for them to have confidence that it will be capable of progressing in a timely manner in the Beta Phase.

The Expert Assessors noted a lack of sufficient preparatory work in the Alpha Phase, owing to the move away from a rail focus, resulting in a methodology that is not robust for the Beta Phase activities set out. The methodology set out did not provide confidence to the assessors that the Project has identified and validated a problem statement for the wider heavy duty transport sector. This has resulted in a methodology that is not focussed on solving a Problem in the challenge area of the Application which is zero emissions transport.

Furthermore, while the Expert Assessors considered the approach to stage-gates in the methodology to be clear, the tasks outlined in WP1 and WP2 ahead of the stage gate 1 would have been expected to be completed in the Alpha Phase. This was considered to be a crucial missing aspect of the Application as a few key steps which should have developed in the Alpha Phase were missing in the Beta Application. This resulted in the Expert Assessors not having confidence in the Project's capability of progressing in a timely manner during the Beta Phase nor in its proposed approach as the Project necessitates further investigation prior to a demonstration or trial.

Regulatory barriers identified for the Project Phase

NO

While the Project and the Expert Assessors recognise that the Project's full potential is reliant on future policy and regulatory decisions, neither have identified any regulatory barriers which would impact the delivery of the Beta Phase activities.

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The Project was considered by the Expert Assessors to focus on an important area of reducing renewable energy curtailment and accelerating the connection of a potentially large and flexible demand on the grid, i.e., electrolysers. While this aspect is clear and evidenced to a reasonable extent in the Application, the Project has shifted its focus away from understanding and addressing the challenges in integrating zero emissions transport to the energy system. The shift away from a rail-specific use case in the Alpha Phase to a wider heavy-duty transport for the Beta Phase was considered to have been hurried and without sufficient evidence building and stakeholder engagement. While such a shift in focus is understandable in an innovation project, the Expert Assessors considered this to have led to the Application not being fully formed and ready to move into a multi-million-pound, large scale Beta Phase demonstration. The Expert Assessors were in agreement that while the H2GO's HyAI system was a good addition to the consortium for the Beta Phase, there was a lack of clear problem statement in the heavy-duty transport sector that the Project was trying to solve. This resulted in the Project being considered as an interesting solution to trying to find an application or problem to solve. The Expert Assessors noted that greater clarification and details on the exact application for the Project's proposed solution proposed by HyAI would have strengthened the Application.

Recommended Project specific conditions
N/A

6.2.2 10062041, HyNTS Deblending for Transport Applications, Initial Net Funding Requested £9,921,257

Project Partner name	Eligible costs (£)(excl. contri. in-kind)	Project contribution (£)	SIF Funding Requested (£)
NATIONAL GRID GAS PLC	1,206,316	1,100,000 (126,000 in-kind)	106,316
ELEMENT ENERGY LIMITED	196,544	0 (37,790 in-kind)	196,544
CADENT GAS LIMITED	12,639	0	12,639
NORTHERN GAS NETWORKS LIMITED	14,570	0	14,570
WALES & WEST UTILITIES LIMITED	12,969	0 (1,297 in-kind)	12,969
SOUTHERN GAS NETWORKS PLC	10,428	0	10,428
DNV INDUSTRIAL SERVICES UK LTD	4,692,556	0 (765,000 in-kind)	4,692,556
ELEMENT 2 LIMITED	891,360	0 (99,040 in-kind)	891,360
HyET Hydrogen B.V.	3,983,875	0 (345,000 in-kind)	3,983,875

Submitted Project description
National Gas have been considering the role of the gas networks in the energy transition, and the associated potential use cases. Hydrogen is one of the solutions to achieving this target and in the transitional period, is likely to be blended with natural gas to provide energy to industry, heat, and transport use cases. The HyNTS Deblending project focuses on the deblending of gases from the high-pressure national transmission system (NTS) to enable delivery to transport applications. Without this technology, refuelling of transportation assets will be limited to the use of locally produced hydrogen, until the gas networks can transport 100% hydrogen. This will limit large scale hydrogen infrastructure availability and therefore the speed of transition for the transport industry.

This project has been developed through to a Beta demonstration of gas separation technology, showcasing the full process from taking blended transmission gas, through separation, purification, compression and culminating in a refuelling pump. Our vision is that in the future a business could apply to connect to the NTS with the sole purpose of extracting the hydrogen for a refuelling station connected to a large-scale road, rail, bus depot or even the marine / aviation sector.

Innovation is key to this project as gas separation technology has historically only been used in specific chemical industrial processes and has never been trialled on a variable gas network. We need to demonstrate that the technology can operate with fluctuations in the gas inlet of temperature, flow, pressure and composition. Additionally, the electrochemical gas separation technology proposed has not been scaled to the planned level in terms of the quantity produced per day, and finally this level of extraction technology has not been connected to a refuelling pump.

Alongside the transport application this technology can also be used to remove hydrogen from a blend with natural gas. In the transition period up to 2050 it is likely that there will be varying requirements from our customers ranging from 100% hydrogen to 100% methane, which is likely to change as our customers migrate to net zero. If this cannot be controlled with the blend coming into the network, then a system will be required at the end customer to ensure delivery of the correct gas mixture. This project develops low-cost mobile solutions for deblending and purification that can be migrated around the UK networks as we transition to 100% Hydrogen.

Eligibility Criterion 1:
Projects must address the Innovation Challenge set by Ofgem.

Eligibility Criterion met

The Expert Assessors considered this Project to have addressed the Innovation Challenge because it aligns with several key aims outlined in the Challenge. In particular, it addresses the need for constraint management and optimisation, a central aspect of the Innovation Challenge.
The Expert Assessors considered the Project to have demonstrated the potential to support hydrogen production for the transport sector. It proposes to link hydrogen production to excess energy generation on the network, employing a novel AI approach to manage operations. This strategy and proposed solution were

considered to directly address the Innovation Challenge through constraint management and optimisation and a potential reduction in system costs.
The Project's approach was also noted by the Expert Assessors, to hold potential significance to various sectors pivotal to the transition to Net-Zero. The Project aims to reduce costs for electrolyser installation and operation, thereby supporting a just energy transition. It has the potential to aid in the decarbonisation of major energy demand for heavy duty transport via green hydrogen, preparing for a Net-Zero power system. Its consideration of the intermittency of renewables and the need for system flexibility to ensure energy system resilience and robustness further exemplifies its alignment with the Innovation Challenge.
On these grounds, the Expert Assessors consider the Project to have addressed the Innovation Challenge, thereby meeting this Eligibility Criteria.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion met

The Expert Assessors considered this Project to have clearly identified potential to deliver a net benefit to electricity consumers. The Project's scope was considered to have met this Eligibility Criteria because it could deliver lower cost grid connection and energy to hydrogen consumers. This could lead to a reduction in the need for network reinforcement, thereby delivering cost savings for consumers.
The Project plans to make use of curtailed electricity production or facilities, which would otherwise remain non-operational outside periods of local demand. This strategy would further contribute to potential net benefits.
The Expert Assessors also considered the Project’s focus on large-scale hydrogen electrolysis to support future Net-Zero transport to clearly demonstrate a potential to deliver a net benefit to gas and electricity consumers. The proposed AI control system could optimise the supply to fuelling stations against the availability of renewable electricity used in the electrolysis process, managing supply and demand effectively and resulting in a cost-efficient approach to supplying the fuelling stations.
The Application was also considered to have provided comprehensive cost-benefit analysis calculations, with robust spreadsheet models included for reference. This transparency in outlining potential financial benefits was considered by the Expert

Assessors to have clearly demonstrated the Project's potential to deliver a net benefit to consumers.

Based on these considerations, the Expert Assessors considered the Project to have clearly identified potential to deliver a net benefit to electricity consumers, thereby meeting this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Expert Assessors considered the Project to involve network innovation in several key areas. Primarily because the Project puts forward the introduction of a novel method for deblending hydrogen from the gas network, a process which has not previously been undertaken. This proposed solution could enable the blended gas delivery and separation for new uses, which is currently not an option, and was therefore considered to demonstrate network innovation.

The Project learnings were also considered to demonstrate network innovation because they could help to accelerate the use of the existing gas transmission network for the transport of a mix of methane and hydrogen across the UK. Learnings such as the sensing of gas mixtures flowing at high volumes, minimising leakage, and identifying any limitations in extracting hydrogen from the network, such as temperature, pressure, flow rate, and other factors.

Moreover, the Project's proposed approach was considered to facilitate network innovation by enabling the operational practicality of blending hydrogen into the gas grid. It does so by providing a solution for gas grid customers seeking high purity hydrogen or methane, as opposed to blends. The participation of gas companies in the Project demonstrates the potential innovations it can unlock, further evidencing its role in network innovation.

As a result, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors all considered the Project to not undermine the development of competitive markets. They considered that the proof of technology provided by the Project could in fact enable competitive supply and use of gas via the National Transmission System (NTS).

They also acknowledged that the market for the solution proposed by the Project is not yet established, which further supports that the Project could develop new competitive markets and does not undermine the development of competitive markets.

Additionally, the Project will not undermine competitive markets as long as regulations restricting access to the gas transmission network are enforced. To ensure this, the Project consortium has planned to maintain close contact with key stakeholders, including the relevant regulators. This provided further confidence to the Expert Assessors that the Project is not undermining the development of competitive markets.

Overall, the Expert Assessors considered the Application to outline an approach that is market-enabling, with learnings shared for the benefit of gas network operators. The Expert Assessors did not consider there to be any restrictions in the Project which would pose the risk of undermining the development of a competitive markets and considered there to be potential for development of new markets.

Therefore, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Expert Assessors considered the Project to demonstrate innovation, novelty, and risk. The technology, which currently exists only at a small scale and has never been used in the UK, is yet to be proven feasible at scale and for significant demonstration periods with real users. The method has not been previously tested at the scale or pressure proposed by the Project. This was considered to demonstrate the novelty of the Project.

The Project was also considered to be innovative as it aims to optimise the use of the existing network infrastructure to accelerate the transmission of hydrogen across the UK. The demonstration of state-of-the-art gas separation technology and the confirmation that high volumes of very pure hydrogen can be reliably separated from a methane/hydrogen mixture were considered key innovations. The

Project allows for the setup of hydrogen fuelling stations close to the gas network, reducing the need for road transport for hydrogen delivery.

In addition, the HyET extraction and purification technology used in the Project was considered to be highly innovative, with its deployment thus far limited to a single demonstration. The Project's approach to scaling up this approach was considered to involve risk for the Project. The overall approach, when compared to competitive methods such as palladium membranes or pressure swing adsorption, is innovative. The proposed use to support the UK gas grid in supplying hydrogen to end users is a novel concept.

In conclusion, the Expert Assessors considered the Project to have met this Eligibility Criteria through its innovative approach and the inherent risks associated with implementing a novel technology at scale.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion met

The Expert Assessors considered the Project to successfully include participation from a wide and diverse range of stakeholders, spanning the full value chain from distribution to end user. This range includes refuelling infrastructure providers, equipment manufacturers, regulators, transport bodies, and hydrogen fuelling station companies, all incorporating the novel technology proposed by the Project. The Project has a clear strategy for stakeholder engagement throughout its lifetime. This engagement is further supported by a multi-partner consortium that plans to interact with stakeholders, including international gas grid operators, and to establish an advisory group. The approach to target customer engagement is well detailed in the Application.

The Expert Assessors considered the participation and mix of stakeholders in the Project to be sufficient for the activities set out. As a result of its comprehensive and diverse stakeholder engagement and partnership approach, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion met

The Expert Assessors considered the Project to be providing value for money and to be costed competitively. They highlight that it aims to deliver a fully operational hydrogen station with a novel deblending method, targeting competitive hydrogen prices. The potential scale of the Project's impact, especially if the proposed blending and separation technology is successfully rolled out, was considered to offer value for money when compared to other sources of hydrogen production, such as on-site renewables and electrolysis.

Although the Project presents complex separation technology and a challenge of demonstrating a high-volume working system, the Expert Assessors agreed that it still offers value for money as it represents potential for this to be overcome. Furthermore, despite the higher than anticipated cost for the demonstration's scale and length, it was considered by the Expert Assessors to be a worthwhile investment given the potential performance and the cost-effective pathway to hydrogen end-use applications which it could unlock.

While the Expert Assessors noted that the Project could have more clearly articulated the need for higher than anticipated costs in certain areas of the Project, such as for equipment, they still considered the Project on the whole to be costed competitively because costs were considered aligned with industry norms. Overall, the Project was considered to provide value for money and to have competitive costs given, therefore meeting this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion met

The Expert Assessors all stated confidence in the Project's methodology, stating that it is robust, clear, and logically planned. The Expert Assessors noted positively the successful progression from the Discovery Phase and Alpha Phase by the Project, coupled with the active utilisation of a risk register, as a key strength in the Project.

They considered the Project to have a clear plan and timing chart, with individual responsibilities assigned to consortium members, which was considered to further their confidence in the Project's ability to progress in a timely manner during the Beta Phase. The Project plan was considered robust and clearly articulated, and capable of delivering trial results within the projected timescale in the Beta Phase.

The contextual background provided, including UK Government targets and Project Union, provided reassurance to the Expert Assessors that the Project would be capable of progressing in a timely manner. The assessors also highlighted that the learnings from this Project are likely to contribute significantly to the pre-front end engineering and design studies. Overall, the Expert Assessors considered the Project's robust methodology and clear planning to give them confidence in its timely progression during the Beta Phase.

Regulatory barriers identified for the Project Phase
NO
The Expert Assessors and the Project did not identify any regulatory barriers which would hinder the delivery of the Project in the Beta Phase. The Expert Assessors did however recognise the role of the Project in informing future policy decisions around the use of hydrogen in the future energy system and the Project Union. The Expert Assessors considered the Project's links with Project Union to be a key dependency with the Project.

Recommendation to the Gas & Electricity Markets Authority
FUND
The Expert Assessors have recommended this Project be considered for SIF Funding and consider it to have met all the Eligibility Criteria. The Expert Assessors considered it to have met several key aims of the Innovation Challenge, such as need for constraint management and optimisation. The Expert Assessors also recognised the Project's potential to sectors and industries beyond zero emission transport. The Expert Assessors considered the Project to have clearly identified a net benefit to electricity consumers as they considered it to have the potential to lower the cost of grid connection, lead to a reduction in the need for network reinforcement, and could more cost-effectively manage curtailed wind production. As mentioned above, the assessors also recognised the Project's potential to deliver a wider net benefit to energy system, which could result in benefits for both gas and electricity consumers. They also noted that the Project clearly involves network innovation, as well as innovative, novelty and risks, because it puts forward the introduction of a novel

method for deblending hydrogen on a scale which has never been used in the UK. This was considered to inherently involves risks because the demonstration proposed has not yet been scaled. The Project was also not considered to undermine the development of competitive markets because if the Project is successful, it could enable a competitive supply and use of gas via the NTS, which is a market not yet established.

The Expert Assessors considered there to be participation from a sufficient range of stakeholders that span the full value chain from distribution to end user. The Project also clearly outlined its strategy for stakeholder engagement support by the whole Project group, which the Expert Assessors viewed positively.

The Project was considered to demonstrate value for money and to be costed competitively as the Expert Assessors recognised that the scale of benefits proposed by the Project and considered the Project's overall costs, while higher than anticipated, to be within a sufficient range for the activities proposed.

Finally, the Expert Assessors had confidence in the Project's approach and methodology, as it was well considered, clearly articulated and robust. The Expert Assessors noted positively the Project's progression that had already been made through the Discovery Phase and Alpha Phase. The Project plan and gantt chart were considered clear and robust, with individual responsibilities set out and assigned to each of the parties involved.

Recommended Project specific conditions

The Expert Assessors recommended this Project for SIF Funding and have recommended the few conditions below as approaches that can help the consortium to maximise the benefits of the project.

1. Expert Assessors would like to see greater and stronger representation of demand users and parties who will provide refuelling stations incorporated in to the Project from early stages. Market customer focus and supply chain providers should be participating as active observers.

2. Direct engagement and collaboration with ZERFT projects, once announced, is a requirement and should be reported upon at quarterly meetings.

3. The Project needs to be able to demonstrate the ability to obtain hydrogen at the volumes required in the first six months of the project, with evidence presented at the second quarterly meeting.

4. Clear IPR arrangements need to be outlined for exploitation and return of investment to consumers. DNV appear to be capturing value by management of the trial site. The Project should develop a business plan for outreach to prospective commercial users of the facility during and beyond the period of the project. National Gas should lead the development of arrangements for how monetary value can be returned to consumers by royalties or other revenue recovery mechanisms. This must be developed for sign off at the first quarterly meeting.

5. IP value to supply chain providers manufacturing the equipment is unclear, the Project must outline the open IP arrangements which will to benefit Project partners but also create opportunities for a competitive market for other prospective partners.

7.1 SIF Beta Phase – Data and Digitalisation – Summary

This section covers the assessment of round 1 Beta Applications received into the 'Data and Digitalisation' Innovation Challenge[10].

For the Beta Phase, 6 Applications were submitted to Innovate UK through the Innovation Funding Service (IFS) portal by the closing deadline of 22 March 2023 and are listed below.

Project reference number	Project name	Funding licensee	Total Project costs (£) (excl. in-kind contri.)	Total Project contribut-ion (£)	Total SIF Funding request-ed (£)	Recom-mended for funding (Yes/No)
10061710	Predict4Resilience (P4R)	SPT	5,020,674	502,069	4,518,604	Yes
10062698	Digital Platform for Leakage Analytics (DPLA)	CADENT	12,068,514	2,572,038 (3,380,000 in-kind)	9,496,476	Yes
10063754	Intelligent Gas Grid - Beta	SGN	6,304,121	231,597 (438,387 in-kind)	6,072,524	Yes
10064078	Energy System of the Future Digital Twin	SGN	14,827,399	2,947,091 (16,236 in-kind)	11,880,338	No
10068173	Predictive Safety Interventions - Beta	SGN	1,189,696	111,438 (7,532 in-kind)	1,070,726	Yes
10073262	Thermal Imagery Analysis - SIF Round 1 Beta	NGN	11,108,045	1,166,000 (50,500 in-kind)	9,942,045	No

[10] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-innovation-challenges

7.2 Evaluation of Applications

7.2.1 10061710, Predict4Resilience (P4R), Initial Net Funding Requested £4,518,606

Project Partner name	Eligible costs (£)(excl. in-kind contri.)	Project contribution (£)	SIF Funding Requested (£)
SP TRANSMISSION PLC	522,275	52,227	470,048
UNIVERSITY OF GLASGOW	488,546	48,855	439,691
SP DISTRIBUTION PLC	649,876	64,988	584,888
SIA PARTNERS UK PLC	2,994,250	299,425	2,694,825
SCOTTISH HYDRO ELECTRIC POWER DISTRIBUTION PLC	365,726	36,573	329,153

Submitted Project description

Severe and extreme weather events can have a major impact on the electricity network, resulting in widespread, extended network outages. These cause significant inconvenience to individuals and businesses who are increasingly dependable on their power supply, and renewable generators who need a reliable connection to the network. Evidence has also shown that a changing climate is contributing to longer and hotter heatwaves, more persistent droughts, more frequent wildfire, and more extreme storms and rainfall.

Today, network operators have developed extensive response plans to react to faults caused by severe weather events, using their experience to manage and deploy resources to restore customers as quickly as possible. However, with more severe events, network operators now need a step change in how they prepare and respond to those events. So, while we cannot control the weather, we can predict it more accurately, with greater visibility and anticipate its impact on the network, in order to protect customers' supply.

Predict 4 Resilience (P4R) will provide accurate fault insights and forecasts for its users during adverse weather events. It utilises probabilistic fault prediction and related decision-support for the first time in a GB innovation project, transforming human-centric decision-making and leading to an improved response to faults on the electricity network.

By utilising hourly data from state-of-the-art weather forecasts and overlaying this onto historic network fault data, LIDAR data and land cover data, P4R will provide Control Room operatives short-term predictions regarding the expected level of faults in each district across the licence area, up to 7 days in advance.

Through this advanced indication of where inclement weather will affect the network and a better prediction of expected fault numbers, P4R will enable resources (engineers, mobile generation, welfare provisions, customer liaison staff, mobile catering for consumers etc) to be proactively placed in those areas most likely to be impacted, something that can be especially important in remote locations where travel distances are significant.

This proactive response will enable power supply to be restored sooner than is currently possible, creating a more resilient network and minimising disruption and stress for customers, particularly for the vulnerable. It will bring about a range of significant financial, social, and environmental benefits to the networks and their customers. The ambition and expectation are that the end software solution will be fit for all GB and international DNOs, as well as any adjacent sectors who suffer weather-related interruptions.

Eligibility Criterion 1:
Projects must address the Innovation Challenge set by Ofgem.

Eligibility Criterion met

The Expert Assessors considered this Project to have addressed the Innovation Challenge. Key to this assessment was the innovative approach the Project proposes taking to digital solutions and data usage, which in turn could contribute to the improvement of network resilience, reliability, and planning. The Expert Assessors noted that the Project has potential to develop and deliver a next-generation digital product, aimed at enhancing system resilience and reliability.

This approach was considered to fit well with the Innovation Challenge, contributing to the progression of network technology. Furthermore, the Project was commended for aligning its solutions with the Innovation Challenge's objectives, with a specific emphasis on leveraging data and digital methods. This proposal further reinforced its alignment with the Innovation Challenge. In

summary, the Expert Assessors considered the Project to have successfully addressed the Innovation Challenge, thereby meeting this Eligibility Criteria.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion met

This Project was considered by the Expert Assessors to have clearly identified potential to deliver a net benefit to electricity consumers, thus meeting this Eligibility Criterion. Notably, the Expert Assessors recognised the Project's potential to enhance the resilience and recovery time of networks during major storms, which could lead to improvements in service reliability for consumers. The Expert Assessors noted that this could provide benefits to existing electricity consumers promptly following rollout. The Project was commended for its clear identification of the benefit for electricity consumers through improved forecasting of weather-induced network faults, leading to a reduction in Customer Minutes Lost (CMLs). This demonstrates a measurable outcome from the Project that directly benefits the consumer, however other benefits were more difficult to measure. While there was agreement that the Project could bring benefits to customers, these were considered modest. It was noted that the potential for benefits were most impactful for SP Energy Network customers only. The Expert Assessors appreciated that SHE would participate in WP2 but noted that there could have been provision in the Project for further testing with other networks. Scalability was clarified in the interview, with a path to commercialisation articulated. This helped to provide the Expert Assessors with confidence that the Project would deliver a net benefit to electricity consumers throughout GB.

In conclusion, the Expert Assessors considered this Project to have clearly identified potential to deliver a net benefit to electricity consumers, which fulfils this Eligibility Criterion.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Expert Assessors all considered this Project to involve network innovation, fulfilling this Eligibility Criteria. Key to this consensus is the innovative application

of forecasting and fault prediction techniques alongside the development of a novel user interface and user experience. The Expert Assessors considered these elements of the Project to be clear indications of its innovation within network operations.

While the Expert Assessors noted the potential for the Project to be considered as ongoing improvements rather than network innovation specifically, it was also recognised that the Project's novel use of existing data and generation of new data to optimise the network's response to weather events constituted sufficient network innovation for this Eligibility Criteria to be met. The Expert Assessors were satisfied with how the experience of existing control room staff would be incorporated into the model, which would be beneficial due to the need to mitigate skill gaps in future. The Application highlighted that deployment of resource is currently operated on a district model, and clarified that Customer Incidents (CIs) and Customer Minutes Lost (CMLs) savings relate to acting promptly in the company business case. It was affirmed that there was sufficient historical fault data to support the Project’s findings. The application of analytical techniques to learn from and adapt to these weather events was seen as a significant contribution to network innovation.

The Expert Assessors raised concerns that this Project has been submitted under the SP Transmission licence and the benefits will primarily be SP Distribution. Whilst it is understood to benefit the same end users there was concern from the Expert Assessors that this Project should have waited until DNOs were eligible in round 2 of the SIF. This point led to dialogue around SP's position as a dual licence holder (transmission and distribution), and whether this left other similar projects lead by DNO's at a disadvantage. UKPN's WARN which was funded in a subsequent SIF round was cited as bearing close resemblance. The Expert Assessors questioned whether this Project should be delayed a year to assess alongside other DNO projects. However, it was noted by both the Project and the Expert Assessors that it was only during the Alpha Phase activities that it was demonstrated that the primary benefits of the proposed solution were more closely aligned with the distribution network, rather than the transmission network, as was originally anticipated in the Discovery Phase and Alpha Phase. As a result of this, it was not considered to represent an unfair advantage to SP Energy Networks.

In conclusion, the Expert Assessors considered this Project to involve network innovation, satisfying this Eligibility Criteria.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors do not consider this Project to be undermining the development of competitive markets, therefore satisfying this Eligibility Criteria.

The Expert Assessors appreciated that the Project adheres to the IPR requirements of SIF. They acknowledged that while the code specific to the product would not be published, IPR would be accessible to other networks and an IP register created. The interview highlighted that academia will also be able to view and share the statistical methodologies involved in developing the product, which the Expert Assessors welcomed. The interview iterated that by facilitating the adaptation of the Predict For Resilience (P4R) approach by other networks, the Project is likely to invigorate the market and result in the stimulation of competitive markets. In addition, the Expert Assessors welcome the inclusion of an IP register to ensure visibility.

The Expert Assessors noted that the Application could have been further enhanced by including reference to other products on the market and why the Project's proposed solution was different. However, the advanced nature of the analytical solution was also singled out for praise, with the Expert Assessors indicating that it surpasses current expectations and norms in the industry. This high level of technical sophistication was viewed as a strong indicator of the Project's innovative nature.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Expert Assessors all considered this Project to be innovative, novel, and risky, and, therefore, to have met this Eligibility Criterion. The Expert Assessors acknowledged the Project's deployment of unique Machine Learning (ML)

techniques to weather and networks. They shared a mutual understanding that these techniques, while being novel, might encounter difficulties when applied in the field, underlining the risk and innovation factor. Further emphasising the Project's innovative and risky attributes, the Expert Assessors acknowledged the potential challenges outlined by the Project team for the Beta Phase. They noted the Project's reliance on the occurrence of extreme weather events within the testing timeframe and a factor outside of human control, which adds a significant element of risk.

The Expert Assessors highlighted the inherent risk that the anticipated modelling may not operationalise as expected, an issue which requires innovation to resolve.

Finally, the Expert Assessors observed the Project's aspiration to significantly improve the quality and utility of fault forecasts on the network. They noted several areas of technical innovation identified by the Project that still need to be addressed. These areas are novel, present substantial risk, and require innovation funding to overcome.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion met

The Expert Assessors agreed that the Project involves participation from a diverse and sufficient range of stakeholders for the Beta Phase activities set out, and therefore consider it to have met this Eligibility Criteria.

The Expert Assessors acknowledged the combination of network expertise, digital delivery experience, and academic algorithmic proficiency that the Project team brings together. They recognised the value of this multidisciplinary collaboration in fostering successful development and learning. In relation to involvement of other networks in the testing and limited involvement of other networks, they did not see this as a critical risk to the Project. The Expert Assessors considered the Project’s activities to also be sufficiently aligned with the stakeholders’ expertise and therefore did not consider there to be skills gaps.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion met

All Expert Assessors considered the Project to have meet this Eligibility Criteria because it was considered to be costed competitively for the activities set out and to represent a net benefit for consumers when considering the costs of the Project. The Project's lean and competitive costing was welcomed and Expert Assessors considered the costing to be reasonable for the Project's requirements and activities set out. While there was a split on the scale of the benefits from the Expert Assessors, with some feeling that they were modest over long time periods this contributed to some uncertainty around value for money, a positive consensus was reached among Expert Assessors with the view that the potential benefits for the energy consumers would exceed the costs of the Project.

As a result, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion met

The Expert Assessors agreed that the Project meets this Eligibility Criteria and broadly agreed that the Project has a robust methodology that fosters confidence in timely Project delivery. The Expert Assessors have commended the straightforward, pragmatic work plan that outlines clear objectives and incorporates strategies to ensure effective monitoring of progress. The Expert Assessors supported the positioning of the two stage gates to help mitigate risks in the Beta Phase. This attention to detail gave the Expert Assessors assurance that the tool will be thoroughly tested before its integration into the regular business operations. While it was noted by one Expert Assessor that the Project plan's level of detail could have been more clearly articulated, all concerns were alleviated following the interview with the Project team.

Supporting the Project's methodological soundness, it was noted that the Application provided a comprehensive breakdown of activities, identifying specific action owners and presenting plausible mitigation strategies for identified risks. This holistic planning approach reaffirms the belief in the Project's capacity to progress in a timely manner. The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Regulatory barriers identified for the Project Phase
NO
Neither the Expert Assessors nor the Project have identified any regulatory barriers or regulatory uncertainties which would impact delivery of the Beta Phase activities.

Recommendation to the Gas & Electricity Markets Authority
FUND
All Expert Assessors have recommended this Project be considered for SIF Funding. The Project has met all eight Eligibility Criteria. The summary of the Project was well presented and effectively highlighted key points. It acknowledged the relevance and timeliness of the problem and described the technical feasibility of the solution. The innovation justification was satisfied, emphasising that the proposed solution represents a significant step change. However, there was a suggestion to include information on comparable products in the market and how the proposed solution surpasses existing capabilities. The benefits of the Project were considered achievable but modest. The delivery plan was deemed clear and concise, but some areas lacked detail, such as sharing project insights/data and engagement plans. The Project costs were well considered, and the response showed attention to reducing overall costs. Intellectual property rights (IPR) requirements were met, with Expert Assessors welcoming the creation of an IP register. The main concern for the Expert Assessors relates to the Project being submitted under the SP transmission licence and the benefits will primarily be SP Distribution. Whilst it is understood to benefit the same end users there was concern from the Expert Assessors that this Project should have waited until DNOs were eligible. This point led to dialogue around SP's position as a dual licence holder, and whether this left other similar projects lead by DNO's at a disadvantage. The Expert Assessors questioned where this Project should be delayed a year to assess alongside other DNO projects. However, the assessors also recognised that it was only during the Alpha Phase that the Project identified that its main benefits would related more closely to the distribution network than the transmission network and, as such, did not consider to represent an unfair advantage to the Project.

Recommended Project specific conditions
Comply with data best practice. Triage of data and document guidance provided about using the code / guidance for use of historic data / commitment to funding. Interaction with the UKPN WARN project to avoid duplication of effects and avoid reinventing the wheel.

7.2.2 10062698, Digital Platform for Leakage Analytics (DPLA), Initial Net Funding Requested £9,496,476

Project Partner name	Eligible costs (£)(excl. in-kind contri.)	Project contribution (£)	SIF Funding Requested (£)
CADENT GAS LIMITED	4,237,216	887,000 (3,380,000 in Kind)	3,350,216
NORTHERN GAS NETWORKS LIMITED	22,950	0	22,950
WALES & WEST UTILITIES LIMITED	18,120	0	18,120
NATIONAL GAS TRANSMISSION PLC	13,710	0	13,710
SOUTHERN GAS NETWORKS PLC	9,480	0	9,480
GUIDEHOUSE EUROPE LIMITED	7,767,038	1,685,038	6,082,000

Submitted Project description

The Digital Platform for Leakage Analytics (DPLA) Project aims to develop and demonstrate a Prototype for how data, analytics and models can be used to identify and locate gas leaks in the gas distribution network. The core functionality of the DPLA is data-driven leakage modelling, unlocking proactive leak detection capabilities, combined with testing the application of novel gas sensor technologies. Thus, creating opportunities to reduce the reliance on and cost of in-field specialised sensors. Shaping the future network, the DPLA's mission is to reduce carbon emissions, realise customer benefits and improve safety in a cost-effective way. The overarching DPLA deliverable is the demonstration of the viability of the completed system of models, combining upgraded modelling capabilities with innovative leak sensor technologies to detect, localise and characterise gas leaks.

DPLA's innovative nature consists of enhanced network coordination, reduced operational complexities, and improved user experiences, all evidenced via a key project output: the user interface. The user interface will enable Cadent's workforce to view and interact with leakage data quickly, easily, and effectively. Outputs will include real-time alerts of critical leaks, visual heatmaps, reports of calculated leakage emissions by period, region, and asset, and more.

Bringing together all of Great Britain's distribution networks, National Gas Transmission, regulatory bodies, governing bodies (such as the Health and Safety Executive) and more will realise cross industry collaboration as they work towards a common mission. By combining upgraded modelling capabilities, the project will deliver the next generation of user driven digital processes accelerating progress in methane leakage detection, as well as unlock opportunities across hydrogen leakage detection. The DPLA will directly improve data monitoring and insights improving efficiency and resilience of the networks.

Eligibility Criterion 1:
Projects must address the Innovation Challenge set by Ofgem.

Eligibility Criterion met

The Project addresses the Innovation Challenge because the Expert Assessors considered it to have the potential to improve data monitoring for efficiency, safety and resilience of the gas networks, one of the key focus areas of the Innovation Challenge.

With accurate information on the rates and locations of gas leaks, the Expert Assessors recognised the potential to cost effectively reduce the impacts of gas network shrinkage and linkage in the rollout of this Project. The panellists also noted that it has the potential to replace the current Shrinkage and Leakage Model which would be a significant enabler in the drive towards Net-Zero for the gas distribution networks.
The Expert Assessors therefore considered this Project to have met this Eligibility Criteria.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion met

The Project was considered to have clearly identified the potential to deliver a net benefit to gas consumers because the reduction of gas leaks, especially a focus on 'super emitters', offers the possibility of a significant cost saving to customers. This was considered to offer a potential benefit for gas consumers through the cost savings and a reduction in emissions.

The Expert Assessors noted that cost benefit analysis is sufficiently robust for them to have confidence that the Project will be capable of delivering at least a reasonable portion of the benefits stated. While the full set of benefits may not be realised, the analysis provided by the applicant is comprehensive and suggests that even achieving a fraction of the upper limit benefit would still result in a net benefit being realized by gas consumers.

Additionally, the Expert Assessors recommended that the Project undertake a gap analysis or detailed benefits analysis against the counterfactual and outline the progress at stage-gate 2. This was considered to be needed to eliminate any additional risks prior to undertaking additional work and to ensure that the Project's costs are streamlined ahead of this.
Overall, however, the Expert Assessors considered this Project to have met the Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Project is considered to involve network innovation because it uses new and novel techniques to model the gas network and track leakages. The proposal to replace the current Shrinkage and Leakage Model was noted favourably by the Expert Assessors, and one Expert Assessor mentioned that the Project scope successfully goes beyond current price control expectations with its proposed solution to a changed or influenced method for calculating gas network shrinkage and leakage.
It is recommended that there is ongoing governance of the Project and its 'blueprint' for how data, analytics and models can be used to identify and locate leaks and how this approach can be replicated to other gas distribution networks (GDNs). For example, to ensure that other GDNs will be willing to adopt the ontology that the Project produces. This should include a requirement of engagement across GDNs to ensure that the ontology that the Project produces is adoptable. The aim is to avoid this platform producing a satellite ontology and ensure that this approach aligns with regulatory support from Ofgem to move away from current Shrinkage and Leakage Model.

However, overall, all Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors agree that this Project is not considered to undermine the development of competitive markets because it has the potential to open a new market for technology developers of leak detection and mitigation. They believed that the dissemination of learnings from this Project, as well as a new proposal to the Shrinkage and Leakage Model will benefit other GDNs and could result in the development of new competitive markets. The Expert Assessors also did not consider the Project's focus or make up of the Project team to provide any indication that the Project is undermining the development of competitive markets. For these reasons, the Expert Assessors all considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Expert Assessors note that this Project is novel and innovative and presents sufficient risk due to the nature of live network testing. The alternative proposal to the Shrinkage and Leakage Model is a notable change to Gas Network operation which will require regulatory change to support national scale up. The regulatory support and operational change required also presents risk. For these reasons, the Expert Assessors agree that this Project has met this Eligibility Criteria.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion met

The Expert Assessors agree that the Project Partners are sufficient for the Project scope and its objectives, combining a suitable range of both gas network and digital expertise. They noted favourably the engagement with other GDNs as well as network consumers and regulators. It was noted however that the Application

would have benefitted from additional expertise in the crafting of communication materials, although this was not considered by the Expert Assessors to result in the Project being considered to have not met this Eligibility Criteria. The Expert Assessors therefore all considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion met

The Expert Assessors consider the Project to be delivering value for money and to be costed competitively. The costs associated with the Project and its deliverables gave the Expert Assessors sufficient confidence that the benefits could be tracked and measured appropriately. The Expert Assessors noted the considerable number of roles and people associated with the Project, particularly in work package one, and therefore the large costs for this scale of Project but these were sufficiently justified. The Expert Assessors considered the Project to be costed competitively and to provide value for money because the costs put forward for the activities are aligned with industry norms and were considered appropriate for the scale of the activities set out. As a result, they considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion met

The Expert Assessors considered this Project to have a robust methodology as the treatment of the risks have been explained clearly. The Project delivery plan was considered to have appropriate stage gates for the work presented. The Project sets out to increase the technology readiness level of its leak detection technology and the Expert Assessors believe that the benefits of this proposed solution could be realised, provided that the Project engages regularly with the regulatory body to ensure that potential regulatory barriers can be better understood and addressed. This was noted specifically for the Project's plan to introduce a new approach to the existing Shrinkage and Leakage Model used in the sector. Overall, the Expert Assessors consider the Project to have met this Eligibility Criteria and had confidence that it will be capable of progressing in a timely manner.

Regulatory barriers identified for the Project Phase
NO
The Project nor the Expert Assessors have identified any regulatory barriers which would impact the delivery of the Project in the Beta Phase. Both have however recognised that the Project's proposed solution would involve a regulatory change, specifically around the use of the Shrinkage and Leakage Model. The Project has identified and considered the regulatory barriers associated with transitioning from the existing Shrinkage and Leakage Model to the approach proposed by DPLA. The Expert Assessors have recommended a Project-specific condition for the Project to engage with and provide regular updates on its engagement activities with Ofgem to ensure that regulatory change is feasible and on track to realise the benefits.

Recommendation to the Gas & Electricity Markets Authority
FUND
All Expert Assessors have recommended this Project be considered for SIF Funding as it was considered to have met all the Eligibility Criteria. The Project is considered to have addressed the Innovation Challenge by improving data monitoring for gas networks, enhancing efficiency, safety, and resilience. It has the potential to replace the current shrinkage and leakage model, contributing to the transition towards net zero. The reduction of gas leaks, particularly focusing on 'super emitters,' offers cost savings to consumers via financial benefits and environmental benefits. The Expert Assessors considered the cost benefit analysis to be robust and to have clearly identified the potential to deliver a net benefit to gas consumers. The Project is recognised as network innovation, employing new techniques to model the gas network and track leakages. The Project is acknowledged as novel and innovative, presenting risks associated with live network testing and the need for regulatory and operational changes. The proposal to replace the current Shrinkage and Leakage Model was viewed favourably by the assessors, and there is a recommendation for ongoing governance, collaboration, and agreement across networks as well as alignment with regulatory support from Ofgem to avoid fragmentation and ensure a successful transition.

The Project is not seen as undermining competitive markets but rather creating new opportunities for technology developers in leak detection and mitigation.

The Project Partners are considered sufficient, combining gas network and digital expertise, and the engagement with other networks, consumers, and regulators is noted favourably. Improvement in communication materials is suggested. The project is deemed to deliver value for money and to be costed competitively but noted that the Project could have more clearly justified its overall costs.

Finally, the Expert Assessors considered the Project's methodology robust, with a clear explanation of risks and appropriate stage gates in the delivery plan. Regular engagement with Ofgem is recommended by the Expert Assessors as a condition of receiving funding, to ensure regulatory support is available and to overcome potential barriers.

Recommended Project specific conditions

A deliverable prior to kick off is required to outline the 'actual costs' versus contingency for all work packages.

At Stage Gate 1, the Project must demonstrate that all data outlined in Slide 7 in the interview presentation pack has been triaged as described. The Expert Assessors would like to see evidence of dissemination and publication of data modelling used for gas leakage analytics developed in this trial to benefit other GDNs who wish to adopt some of this technology. Strong justification and evidence should be provided to the Stage Gate Assessors for any data or modelling methods which have not been published.

Ongoing governance of the Project and its 'blueprint' for how data, analytics and models can be used to identify and locate leaks and how this approach can be replicated to other GDNs. For example, will other GDNs be willing to adopt the ontology that they produce? This should include a requirement of engagement across GDNs concerning the ontology that they produce which should be adoptable. The aim is to avoid this platform producing a satellite ontology and ensure that the approach aligns with regulatory support from Ofgem to move away from the current Shrinkage and Leakage Model.

The Project would benefit from outlining plans to engage with Ofgem to ensure that regulation does not inhibit the progress and implementation of this project, especially as regulatory support will be required to move away from current Shrinkage and Leakage Model used in the Gas sector.

At stage gate 2: Gap analysis or detailed benefits analysis should be presented to monitoring officer outlining the progress of the project against the counterfactual. This needs to be assessed to eliminate additional risks so that contingency funds can be slimline in project proposal.

The Intelligent Gas Grid, Energy System Digital Twin and Digital Platform for Leakage Analytics should establish a working group with the support of Innovate UK to establish interactions and collaborative working.

7.2.3 10063754, Intelligent Gas Grid - Beta, Initial Net Funding Requested £6,072,524

Project Partner name	Eligible costs (£)(excl. in-kind contri.)	Project contribution (£)	SIF Funding Requested (£)
SOUTHERN GAS NETWORKS PLC	668,019	0 (15,063 in-kind)	668,019
CADENT GAS LIMITED	13,788	0	13,788
NORTHERN GAS NETWORKS LIMITED	19,620	0	19,620
WALES & WEST UTILITIES LIMITED	21,744	0	21,744
NATIONAL GRID GAS PLC	16,815	0	16,815
UTONOMY LTD	4,434,538	0 (423,324 in-kind)	4,434,538
DNV SERVICES UK LIMITED	1,129,597	231,597	898,000

Submitted Project description

Gas distribution networks (GDNs) are facing massive change as they develop strategies for net-zero. At the same time, they aim to reduce methane emissions and to improve operational efficiency and customer service still further. This project will develop and bring to market new digital technologies to address these challenges.

The current level of technology in the network, which includes significant manual intervention, is no longer sufficient to deliver the changes needed. Pressure management is critical to lower methane emissions. Pressures are being managed as low as possible with current technology, but new solutions are needed to bring pressures down still further minimising emissions.

The way the network is operated is also changing. In the past there were a small number of entry points for North Sea gas. But now there are multiple entry points for biomethane into lower pressure tiers in the network. The current manual pressure control of these networks can lead to biomethane plants being unable to feed in during certain times of the year. This can lead to wasteful flaring of the

biomethane. Automated control of these networks is required to maximise the feed-in potential of these plants.

This project develops new applications using the data collected by the pressure management systems together with machine learning and AI to detect anomalies in the network such as water ingress, gas escapes, low pressure events, malfunctioning governors etc. Currently, these anomalies require manual intervention to diagnose and to resolve. Faster diagnosis and remote or automated resolution of the problem will lower operating costs and improve customer service.

The increased ability to intelligently monitor and control the networks will be an essential enabler for the conversion of the networks to hydrogen.

This project builds on the successful NIA project carried out by SGN and Utonomy to develop new pressure management and control systems. These systems are now being rolled out in SGN's Southern network.

Using Utonomy's remote control pressure management system as the enabling technology, the project will collect and use network data alongside external data such as weather to develop machine-learning and artificial intelligence applications that optimise network pressures for methane emissions reduction, increase biomethane injection capacity and diagnose and remotely resolve network anomalies. The project is highly innovative because the use of machine-learning, in conjunction with low-cost, scalable computing power enables a step-change in the monitoring and optimisation that is possible in the operation of gas distribution networks.

Eligibility Criterion 1:
Projects must address the Innovation Challenge set by Ofgem.

Eligibility Criterion met

The Expert Assessors considered this Project to have addressed the Innovation Challenge because it demonstrates the use of machine-learning technology to predict changes to network demand response using external predictive factors. The Project presents various routes to saving carbon and cost, addressing several climate targets including methane leakage reduction, improving biogas injection, reducing overall cost of operating the network as well as overall carbon emissions. This will result in both a more efficient gas network and a reduction of the carbon

impact of the network and will improve the data monitoring, availability, quality and collection, a key focus of this Innovation Challenge.

For these reasons, the Expert Assessors all considered this Project to have met this Eligibility Criteria.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion met

The Expert Assessors considered this Project to have clearly identified the potential to deliver a net benefit to gas consumers because it has identified several aligned but distinct benefit areas around methane leakage, maximising the injection of biogas, network faults and repairs. These areas have potential to demonstrate benefit to consumers through reduced costs whilst reducing the gas network carbon footprint, thereby delivering environmental benefits. The benefits assessment presented by the Project were considered ambitious yet achievable by the Expert Assessors. The quantifiable benefits were considered well-documented, including specific timescales and cost examples based on current industry practices. While the Expert Assessors recognised that the Project also represented a primary benefit for the Project Partner Utonomy, for the development of its tool, the Expert Assessors still considered the Project and its potential to reduce leaks and gas network issues to represent a clear benefit for gas consumers through environmental benefits and reduced costs. The Expert Assessors have also recommended a Project-specific condition be added to ensure the data captured and approach taken by the Project can be replicable if successful to help ensure maximization of these benefits for consumers. The Expert Assessors noted that the Application could have been strengthened if it more effectively communicated how benefits of its approach and proposed solution would translate to wider consumer benefits.

Overall the Expert Assessors considered the Project to have met this Eligibility Criteria because it clearly identified a potential to deliver benefits to gas consumers through environmental benefits through increased network efficiency and reduction gas network costs.

Eligibility Criterion 3: Projects must involve network innovation.
Eligibility Criterion met
The Expert Assessors considered this Project to involve network innovation because it proposes developing a distributed artificial intelligence (AI) solution which does not exist today in a commercial form, and which could not be deployed without a pilot to assist the assessment of key risks, including cyber risks and physical low pressure system risks to gas network. The Expert Assessors agree that the Project's use of Internet of Things (IoT)and AI (to better load balance and regulate pressure across the network) involves the application of innovative digital technologies to the operation of the gas network which will facilitate the participating networks to make greater use of data and machine learning (ML) techniques in daily operations. The Expert Assessors also noted positively that the network innovation proposed by the Project's solution has the potential to benefit gas network users should it be successful. For the above reasons, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 4: Projects must not undermine the development of competitive markets.
Eligibility Criterion met
The Expert Assessors considered this Project to not undermine the development of competitive markets because the Application articulates that relevant data from the networks could be made available to potential new market entrants, which could be further used to develop competitive solutions. The Project has set out how it will work with another SIF Project, Digital Platform for Leakage Analytics, by sharing insights which was noted favourably by the Expert Assessors as it was considered to have the potential to develop a solution which could be used by the wider gas sector. The Expert Assessors also encouraged the Project to provide additional details for how the insights from the Project will be shared with Ofgem and the wider gas sector to ensure that the funding from this competition does not inhibit alternative solution providers across the wider GB market. The methodology employed by Utonomy allows them to utilise the SIF Funding to

develop their own commercial solution, creating a high barrier for potential competitors due to the costs and challenges associated with field trials, cybersecurity, and safety assurance. Utonomy's intellectual property encompasses both hardware and software components. To encourage the emergence of alternative solutions while acknowledging Utonomy's commercial risks, the Expert Assessors have recommended a Project-specific condition to ensure that functional specifications and Project insights are published and disseminated. The Expert Assessors did however note positively that the network operators in the Project will retain their raw data and did not consider the Project to undermine the development of competitive markets.

Overall, the Expert Assessors all considered this Project to have met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Expert Assessors considered the Project to be novel and innovative because it is deploying both new hardware and AI to a problem that has been relatively unexplored. The AI element of the work is particularly unproven and potentially risky due to the nature and availability of live gas network data to train an accurate and reliable model. System risks such as those around cyber security as well as low pressure points need to be assessed and quantified through a trials process before any such product could be rolled out as business as usual. The Expert Assessors note that energy analytics are evolving rapidly, and this Project should include a periodic horizon scan for related research and learning both nationally and internationally. The proposed approach was therefore considered risky by the Expert Assessors but was also recognised as a potential solution which could expedite opportunities to meeting Net-Zero. The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion met

The Expert Assessors considered the Project to include participation from a sufficient range of stakeholders for the activities set out. Whilst the bulk of the work clearly sits with the Project Partner Utonomy, the Expert Assessors recognised clear and meaningful contributions from Faculty, DNV, and the sponsor organisations. The Expert Assessors also noted positively that the Project includes participation from a wide range of peer networks and subject matter experts, which gave the assessors confidence that the Project and its activities were scoped appropriately.

While the Expert Assessors did consider the Project to have met this Eligibility Criteria, they noted several areas where the Application could have been strengthened. Firstly, increased involvement from internal stakeholders within SGN and across other GDNs to help improve the data and change culture across the organisation to ensure relevant internal stakeholders have awareness of the Project and its potential impacts. Secondly, the assessors also encouraged the Project involves a telecoms operator, for example in a consultative capacity, to consider resilience issues due to the distributed/cloud nature of the proposed solution. However, the assessors also recognised that the Project as it was proposed does include participation from a sufficient range of stakeholders for the activities set out and, as a result, no Project-specific conditions were recommended for these activities.

Overall the Expert Assessors consider this Project to have met this Eligibility criteria.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion met

The Expert Assessors all considered the Project's costs to be reasonable overall and noted the potential for the Project to be deployable by gas networks across GB and bring demonstrable social, financial and environmental benefits to gas consumers. The Expert Assessors considered the discounted purchase of equipment to demonstrate value for money by the Project.

While the Expert Assessors did consider the Project to have met this Eligibility Criteria, there were two areas of the Application that could have been strengthened. They recommended that greater financial contribution by the main

Project Partner (Utonomy) would have strengthened the Application and provided greater assurance that the Project is providing value for money and is costed competitively. The Expert Assessors also considered the overall costs for the activities proposed and for the Project Partners to be competitive with industry norms but noted that greater justification for some of the higher than anticipated day-rates from Project Partners DNV and Faculty would have strengthened the Application.

Overall, the Project was considered to be providing value for money and to be costed competitively because the Application shows demonstrable social and environmental benefits to customers and financial savings to the GDNs, the use of discounted equipment purchases results in cost efficiencies, and the overall costs proposed by the Project and the Project Partners were considered reasonable. The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion met

The Expert Assessor consider this Project to have a robust methodology which gives confidence that it will be capable of progressing in a timely manner because the Project plan, milestones, resource expertise, and wider requirements have been well-thought-out and effectively communicated with transparency. There is alignment and complementarity between the milestones, Project plan, and risk register, with clear identification of interdependencies and the ability to deliver in a timely manner. The work packages are clearly described, but the Expert Assessors were surprised that the availability of sufficient data was not established during the Alpha Phase. The Expert Assessors recommended that the Application could have been strengthened by providing a more robust risk management strategy that includes multiple developers using the same training data and algorithms to compare performance and ensure replicability. However, overall, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Regulatory barriers identified for the Project Phase

NO

The Project adequately addresses key regulatory aspects of cyber security and safety. The Expert Assessors have recommended that the Project develop a roadmap to determine the required level of cyber resilience for potential large-scale implementation, with design decisions shaped accordingly. The Project has demonstrated an understanding of the regulatory framework and requirements for cyber security resilience. This presents an opportunity to test cyber resilience under controlled conditions and potentially contribute valuable learnings for other organizations responsible for essential services.

The Expert Assessors have also recommended that system resilience and the protection of supply quality should be prioritised, particularly when deploying automated distributed intelligence in comparison to a passive/manual system. The assessors considered it to be beneficial to provide clarification on the measures in place to prevent data breaches, ransomware, and zero-day vulnerabilities on the cloud platform, as well as the platform's accreditation for secure storage of sensitive data and controls.

Overall, neither the Expert Assessors nor the Project identified regulatory barriers which would impact the delivery of the Beta Phase activities and the Project has not identified any areas of the Project which may require derogations, licence exemptions or regulatory sandboxes.

Recommendation to the Gas & Electricity Markets Authority

FUND

All Expert Assessors have recommended this Project be considered for SIF Funding and considered the Project to have met all the Eligibility Criteria.

The Expert Assessors consider the Project to have successfully addressed the Innovation Challenge by utilising machine learning technology to predict changes in network demand response using external predictive factors. The Project offers various routes to save carbon and cost, targeting methane leakage reduction, biogas injection optimisation, overall network operational cost reduction, and carbon emissions reduction. The Expert Assessors all considered this approach to

have the potential to lead to a more efficient gas network and a decreased carbon impact.

The Expert Assessors acknowledge that the Project involves network innovation, as it aims to develop a distributed AI solution that does not exist commercially. They believe that the use of Internet of Things (IoT) and AI technologies in load balancing and pressure regulation across the network is innovative and will enable the participating networks to make better use of data and machine learning techniques.

The Expert Assessors have considered the impact on competitive markets and did not consider the Project to undermine their development. The Project's Application states that relevant network data can be made available to potential new market entrants, fostering the development of competitive solutions. However, they suggest providing more details on potential duplication between the Intelligent Gas Grid and other initiatives to ensure value for consumer funding. There are concerns regarding the funding primarily benefiting the project's developer, Utonomy.

The involvement of stakeholders is considered sufficient, with meaningful contributions from Utonomy, Faculty, DNV, and the sponsor organisations. However, the Expert Assessors noted that greater involvement from internal stakeholders within SGN and other GDNs, and consideration for the perspective of a telecom's operator for resilience issues would have strengthened the Application. While greater involvement from other GDNs was not considered to be crucial in the Project, the Expert Assessors recognised an importance for the Project to share and disseminate its findings with other GDNs and in telecom formats. As such, a Project-specific condition has been added to its Project Direction to around engagement with telecoms and dissemination.

Overall costs of the Project were considered reasonable and were considered to provide value for money and be costed competitively, although the assessors noted greater justifications, such as for the higher than anticipated costs for some of DNV's costs and Utonomy's subcontractor rates, would have strengthened the Application. The Expert Assessors also recommend providing more information on alternative approaches and cost advantages of an open procurement model. However, the Expert Assessors did consider the Project to be delivering value for

money and to be costed competitively, with demonstrated benefits to customers and financial savings to the gas distribution networks.

The methodology of the Project was considered robust, with a well-thought-out Project plan, milestones, and expertise. The assessors did note that establishing data availability earlier and breaking down aspects of the Project into manageable milestones would have strengthened the Application and made it easier to understand.

The Expert Assessors did raise some concerns about the concentration of commercial IPR by one technology provider but were reassured that the Application states that relevant network data can be made available to potential new market entrants, which they considered to foster the development of competitive markets. The Expert Assessors have also recommended a Project-specific condition for the publishing of data from the Project to further support the development of competitive markets.

Recommended Project specific conditions

At kick off, the Project should outline an engagement and dissemination plan for stakeholder engagement outside of SIF governance for example Gas Operational Forums, telecoms forums etc

A deliverable prior to kick off is required to outline the 'actual costs' versus contingency for all work packages.

At stage gate 1 and 2, the Project should detail and explain how much they can make publicly available using quantitative evidence. Should data be unable to be published then justification should be provided.

At stage gate 1, the Project should outline the rationale why Faculty is a subcontractor rather than a project partner.

At stage gate 1, the Project should present, scope, and describe in more detail activities to ensure cyber security implementation from the outset of development, within the existing Project costs. This should meet national standards for Critical National Infrastructure and engage with the National Protective Security Authority

for assessment of suitability.

The Intelligent Gas Grid, Energy System Digital Twin and Digital Platform for Leakage Analytics should establish a working group with the support of Innovate UK to establish interactions and collaborative working.

The Project should engage with the Round 2 SIF Project CommsConnect to understand interactions.

7.2.4 10064078, Energy System of the Future Digital Twin, Initial Net Funding Requested £11,880,338

Project Partner name	Eligible costs (£)(excl. in-kind contri.)	Project contribution (£)	SIF Funding Requested (£)
SOUTHERN GAS NETWORKS PLC	2,498,267	499,654	1,998,613
IBM LIMITED	10,011,242	2,011,242	8,000,000
NORTHERN GAS NETWORKS LIMITED	19,620	0	19,620
WALES & WEST UTILITIES LIMITED	21,744	0	21,744
NATIONAL GAS TRANSMISSION PLC	16,845	0	16,845
NATIONAL GRID ELECTRICITY SYSTEM OPERATOR LIMITED	65,221	6,522	58,699
DNV SERVICES UK LIMITED	2,144,490	429,673	1,714,817
SCOTTISH HYDRO ELECTRIC POWER DISTRIBUTION PLC	50,000	0 16,236 (In Kind)	50,000

Submitted Project description

Our proposed Beta phase aims to explore the benefits that digital twins can deliver in addressing a cross vector energy system of the future. This includes extending the reach of the digital twin(s) to bring in and model data from other energy sources, and to enabling the data and the digital twin itself to be used by and developed on by other Gas Distribution Networks as well as the rest of the utilities space, local and central government.

If this work isn't done, then the Gas, Electricity and other players in the utility sector will continue to develop more isolated, siloed solutions which address their needs but don't necessarily reflect a holistic view of UK Energy Plc. We believe that were this to happen, then the value to the consumer would be very low and more innovation money would ultimately end up being spent over a longer period without the strategic outcomes we believe our project will deliver.

This is what makes this project innovative: bringing together and exploring technology solutions with a focus on enabling and sharing findings and real-world standards. We'll share approaches to sharing data and expanding the Digital Twin system(s) to incorporate or contribute to a more holistic solution for the UK as a

whole. Using the Strategic Innovation Fund to drive this activity forward will also accelerate the digital advancement of the smart energy system of the future -- something we don't believe will be funded via BAU. Our project will connect networks and key stakeholders in a way not previously seen and will invite those "difficult conversations" within a safe space -- that is, outside of the daily operations yet involving those actors critical to the realisation of change across industry.

The measures of success for this project will be around the savings the system can enable for the networks and CO2 emissions perspective. Also, how the initiative is taken up by other GDNs and other energy sector players to incorporate the ideas, technology approaches, data sharing and combined findings to move the UK towards a comprehensive energy system of the future. Our solution must be multi-network, multi-vector and use connected digital backbones such as the Virtual Energy System to be successful. Embracing other innovations -- some funded through other means -- is essential, not just for our project, but for industry as a whole and at the forefront of our activity.

Eligibility Criterion 1:
Projects must address the Innovation Challenge set by Ofgem.

Eligibility Criterion met

The Expert Assessors considered this Project to have addressed the Innovation Challenge because it is an innovative application of data and digital technologies in the energy sector. The absence of an established digital twin capability of this scale in the UK highlights that it is novel. The Project aligns with the aim of the Innovation Challenge as it enables the modelling of the complete gas system as a digital twin, alongside the electricity digital twin, which can lead to the development of least cost solutions. This Project effectively addresses the data and digitalisation challenge, recognising the potential of data and digitalisation as a crucial enabler across various aspects of the business. The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion met

The Expert Assessors considered this Project to have clearly identified potential to deliver net benefits to gas and electricity consumers because it has the potential to support the identification of least cost pathways to Net Zero for the entire energy system. The Project has identified benefits across all areas of the business and will create advantages beyond those experienced by the participating network consumers.

The use cases referenced in the Application were considered to provide good examples of priority use cases on which to build enterprise data architecture, although some were described at a level which made it difficult to distinguish the tangible operational impacts. Some of the assumptions associated with the benefits could have been more clearly articulated. The vast majority of benefits are calculated on a customer minutes lost (CML) basis, these appear to assume that the current CML levels for RIIO2 are the counterfactual, whereas in practice it is likely that operational improvements will be stipulated through future price controls, thereby potentially reducing the benefits against the counterfactual. The Expert Assessors would have liked to see more benefits being delivered within RIIO2.

Overall, however, the Expert Assessors considered the Project to have met this Eligibility Criteria because it has clearly identified a net benefit to both gas and electricity consumers through a reduction in costs in the transition to Net Zero.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion not met

The Project was not considered by the Expert Assessors to have met this Eligibility Criteria. Although it is considered that a Digital Twin initiative of this scale would be a first of a kind for the energy networks, and there is clear innovation being demonstrated in the form of use case applications and tool development, the majority of Project costs were seen to be associated with enterprise data architecture activities which are expected to be delivered as part of energy network modernisation. The Expert Assessors also had concerns on how this Project would integrate with wider SGN IT architecture and strategic direction.

The Expert Assessors did note that once these underlining aspects have been achieved there is innovation in the real-time hydraulic product, models, and data

triage tools. On this basis the Expert Assessors do not consider the Project to have met this Eligibility Criteria.

The Expert Assessors also raised concern that there are a number of aspects of the Project proposal which would be expected to be delivered under business-as-usual price control licence conditions, particularly for the enterprise data architecture components, which constitute a significant proportion of Project spend. It has been acknowledged by Expert Assessors that there is some ambiguity around what should be funded between innovation and business as usual.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors did not consider this Project to be undermining the development of competitive markets because there is a clear aspiration to develop open standards. This is seen as a positive step towards enabling competition between vendors during the rollout to business-as-usual (BAU).

Additionally, the Project has the potential to facilitate competitive market development and enhance Ofgem's regulatory effectiveness through the sharing of data and methodologies with Ofgem. Expert Assessors expressed that delivery of the enterprise data architecture aspects of the Project viewed as BAU activities should follow a competitive procurement process to ensure that appropriate open data processes are followed, and that the design happens in such a way that the managed service could be adopted in future by another provider, if necessary. The Application acknowledges that the use of data in this manner can grant participating network operators a first-mover advantage, stimulating other network operators to improve their data and digitalisation approaches, thereby raising the overall data maturity level across all networks. For the above reasons, the Expert Assessors believe that this Project has met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion not met

The Expert Assessors acknowledge that whilst the Project has innovative, novel, and risky elements due to its unprecedented nature as a first-of-its-kind endeavour, further clarity is needed to define its specific nature beyond data warehousing and business intelligence (BI). Additionally, there is a recognised challenge concerning the lack of interoperability across data in the energy system, with no clear route established thus far beyond engagement with notable relevant initiatives. This raises the risk of incompatibility with other emerging approaches such as other SIF projects, emphasising the crucial need for close collaboration with the Virtual Energy System, Open Energy, and the DESNZ's 'digital spine' feasibility study.

In addition, as highlighted above there are several elements of the strategic architecture which should be addressed as part of business-as-usual activities before trying to establish a solution. The Expert Assessors also expressed concern around how this Project fits into the overall SGN IT strategy as it was unclear what the driver for the Project was and who would own this product going forward.

As a result, the Expert Assessors did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion met

The Expert Assessors considered this Project to include participation from a sufficient range of stakeholders for this Eligibility Criteria to be met because the Project involves parties with a suitable set of diverse skills and encompasses groups from vulnerable consumers to policy makers in government. The Expert Assessors noted positively the different range of skills the stakeholders involved in the Project bring and their alignment with Project's activities.

Although the Expert Assessors agree that the Project's engagement with a variety of stakeholders was sufficient for the activities set out and considered the Project to have met this Eligibility Criteria, they identified several areas where the Application could have been strengthened. For example, the Expert Assessors noted that including stakeholder engagement with other networks and the wider energy stakeholder ecosystem would have strengthened the mix of stakeholders. This could have also been included with greater overall involvement by the existing

stakeholder mix in the Project and a larger budget for stakeholder engagement. The Expert Assessors did note, however, that dissemination of the Project's activities and findings would help to facilitate sharing with the wider energy stakeholder ecosystem. Additionally, greater clarity on whether the Funding Party has internal buy-in from across would have also strengthened the Application as it would have given reassurance that there is no duplication with existing activities or plans for meeting current licence conditions.

Overall, the Expert Assessors agree that this Project has met this Eligibility Criteria.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion not met

The Expert Assessors did not consider the Project to be delivering value for money and be costed competitively because there are some significant concerns around the scale of the funding for the Project given the level of clarity about deliverables and outputs for £12M of spend. Some concerns were raised by Expert Assessors that it is unclear what aspects of this work should be expected to be part of business-as-usual data management funding under the business-as-usual price control framework.

A significant element of the overall Project costs was considered to fit under business-as-usual activities, including the underlying enterprise data architecture which enables data to be openly published. There is some concern that funding the solution here is financing that enterprise data architecture and risks supplier lock-in by not following competitive procurement practices.

There are elements of the Project which the Expert Assessors viewed as providing value for money, notably the user facing tools that would serve the use cases and deliver consumer benefits. However, the Project would require significant rescoping to focus on these areas in parallel to the delivery of the underlying data architecture to support them.

The Expert Assessors therefore did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 8: Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.
Eligibility Criterion not met
The Expert Assessors considered the Project's methodology to not be sufficiently robust to provide confidence that it will be capable of progressing in a timely manner because they observed a lack of a clear cohesive explanation of how deliverables and outputs were linked together to deliver benefits against the use cases identified. The Project's objectives were described in high level terms and were considered to sometimes be lacking a detailed plan for practical implementation. The Gantt chart provided a realistic Project completion timetable although there is confusion surrounding the naming, sequencing, and explanation of the work packages. When questioned in the interview the Project did not provide confidence in their familiarity with the plan. In particular, the Project would have benefited from including stage gates, helping the Project to de-risk investment decisions and introduce spend controls. For a Project of this scale and delivery by third party Project Partners, the lack of clarity of what the governance for spend controls and decisions on future spend was considered as untenable. The Expert Assessors therefore did not consider the Project to have met this Eligibility Criteria.

Regulatory barriers identified for the Project Phase
NO
The Project did not identify any risks to the potential delivery of the Beta Phase activities. The Project did note that greater clarity on the roles and responsibilities of the Future System Operator would help to provide greater certainty on the Project's proposed solution.

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The Expert Assessors did not recommend this Project for SIF Funding because the development of enterprise data architecture was considered to be an activity which should be funded under BAU activities to comply with Ofgem's license conditions. Although it was acknowledged as an interesting Project, which was considered to have addressed the Innovation Challenge by applying data and digital technologies in the energy sector which enables a first of a kind development of a complete

energy system digital twin. Overall, whilst the Project demonstrates innovative elements and potential benefits, there are areas that require further clarification and improvement to meet all the Eligibility Criteria.

Concerns were raised by the Expert Assessors about the ambiguity of spend for areas such as strategic architecture requirements. In many aspects of the Project these are considered to be BAU activities which should be delivered under the existing price control framework, and there is a need for more clearly articulated use cases and the benefits associated with each. The Expert Assessors recognised that the tools that would be developed as part of this Project, additional to the enterprise data architecture, would be eligible for SIF Funding, and the Project should consider how to seek SIF Funding in future rounds to develop these aspects of the Project.

The Expert Assessors also emphasised the importance of interoperability and collaboration with other initiatives in the energy sector. Stakeholder engagement and involvement in the Project was considered sufficient, but the Expert Assessors did note that the Project would have benefited from enhanced engagement with other energy networks and improving communication materials. Cost competitiveness and clarity of deliverables were also identified as areas of concern, along with the need for a more robust methodology and governance structure.

Recommended Project specific conditions
As this Project was recommended not to be considered for SIF Funding, no Project-specific conditions have been proposed.

7.2.5 10068173, Predictive Safety Interventions – Beta, Initial Net Funding Requested £1,078,258

Project Partner name	Eligible costs (£)(excl. in-kind contri.)	Project contribution (£)	SIF Funding Requested (£)
SOUTHERN GAS NETWORKS PLC	75,312	0 (7,532 in-kind)	75,312
CADENT GAS LIMITED	6,894	0	6,894
NORTHERN GAS NETWORKS LIMITED	10,890	0	10,890
NATIONAL GRID GAS PLC	8,440	0	8,440
FYLD LIMITED	1,088,160	111,438	976,722

Submitted Project description

According to HSE annually released statistics, at least 10,000 working days were lost to injury in the wider utility sector in the 21/22 financial year, with the estimated cost of fatal and non-fatal injuries more than £160m. The Predictive Safety Interventions project (PSI) has a clear and direct target to prevent the occurrences of fatal and non-fatal injuries, which will reduce the cost of operating energy networks, a direct objective and aim of the SIF challenge for Data and Digitalisation.

Through the Discovery and Alpha phases, FYLD and SGN partnered to produce an artificial intelligence model to enable Predictive Safety Interventions. The predictive model is trained on safety indicator event data, and previous near-miss and injury occurrences, to accurately forecast the likelihood of an injury occurring to a fieldworker.

The Beta project phase will develop this model further, increasing data inputs into the model to include human behaviour factors. We will integrate fatigue levels into the predictions, and test and research the ability to detect changes in voice tone or pitch as an indicator of how human behaviours impact safety events. We will also integrate live network data, such as traffic and roadworks, alongside further development of the object-recognition model, including pioneering research to detect non-compliant control measures.

The project will build the capability to deliver an AI powered personalised intervention pushed directly into the hands of field teams and their remote

managers at the point of starting work, and dynamically doing so as the workday progresses. This will enable the near automation of sharing of learning from previous safety indicator events, including near misses and injuries, directly to the front-line on high-risk activities. The project will then progress to deploying the prediction model to all of SGN field operations to successfully reduce safety incidents.

Successful delivery of this project will see a market-leading AI model to predict on site incidents before they happen and power an intervention to prevent them from occurring. This will deliver a reduction in fatal and non-fatal injuries in the sector and will reduce the cost of operating energy networks from eliminating the associated cost of injuring and killing our workforce.

Eligibility Criterion 1:
Projects must address the Innovation Challenge set by Ofgem.

Eligibility Criterion met

The Expert Assessors considered this Project to have addressed the Innovation Challenge because it entails the application of innovative digital and data technologies to tackle a fundamental challenge in maximising the value of the gas network while safeguarding staff and consumers. Such technologies are considered novel and risky, therefore the Expert Assessors agreed that the Project sits comfortably within the aims of SIF and the Innovation Challenge. The Project proposes a new approach to enhance the safety of utility workers on-site through the utilisation of data and digitalisation. If successful, this was considered to have the potential to diminish disruptions and contribute to the efficiency of a decarbonised energy system in future. The Expert Assessors considered this to be directly aligned with several of the key focus areas within the Innovation Challenge, including delivering the next generation of user driven digital products which span across transmission and distribution, and improving data monitoring, availability, quality, collection and interoperability to improve the efficiency, security and resilience of networks. The Expert Assessors recognised the potential to decrease operational costs by harnessing the proposed new technology to automate incident review and eliminating the necessity for manual reporting, driving forward efficiency in this area, which will contribute to cost savings for the

end user. The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion met

The Expert Assessors considered this Project to have clearly identified potential to deliver a net benefit to gas consumers because the Project aims to create a safer workforce and worksite, benefiting consumers by reducing incidents in network maintenance and lowering costs for operators and resilience of the workforce. Additionally, the Expert Assessors also noted the benefits of increasing the protection to on-site staff.

By reducing disruptions and improving energy system efficiency, the Project has clearly identified the potential to deliver a net benefit to consumers by potentially delivering cost savings for the end user through preventing safety incidents. The improved service delivery and preserved network resources were identified to have the potential to avoid lost time due to on-site injuries and the time associated with manual data capture and review. Additionally, the assessors also recognised the potential social and environmental advantages the proposed solution could bring. The assessors noted positively that the benefits proposed are also likely to be realised in the near term should the Project be successful.

While the Expert Assessors consider the Project to have met this Eligibility Criteria, they also recognised that the Application could have been strengthened by including additional detail around scalability of the proposed solution, particularly around what other data is available to other networks and innovators to offer alternative solutions.

Overall, the Expert Assessors considered the Project to have clearly identified potential benefits to consumers and considered it to have met this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Expert Assessors considered this Project to involve network innovation because it is utilising data to predict the safety of different environments. It is primarily focused on gas networks, aiming to enhance the safety of both network staff and the public who may be impacted by the networks. Additionally, the Project aims to automate the learning from safety incidents and improve the manual recording, reporting, and review processes. The Application highlighted that the Project would incorporate AI prediction alongside human behaviours. An innovative element of the Project lies in the use of computer vision to detect and analyse non-compliant sites, which the Expert Assessors considered to clearly involve network innovation. All Expert Assessors acknowledged this Project was of interest, unique and self-contained with a clear need to test this proposed solution.

The Expert Assessors also considered that they were comfortable the Project is working to the best of its abilities within working within the sample size available, and that there is a further opportunity in future to share and bring added information and learnings from other areas. They noted the proposed solution could result in the innovation being shared and incorporated by other gas networks. Overall, the Project was considered to have met this Eligibility Criteria.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

Overall, the Expert Assessors did not consider this Project to be undermining the development of competitive markets. The training of the machine learning FYLD model understandably cannot be shared with competitors due to intellectual property rights, however the Project was still considered to have met this Eligibility Criterion because the acquired knowledge will be openly shared, allowing interested parties to adapt the learnings to their own unique situations. There is no barrier to other, similar tools being introduced to the market and stimulating competition, therefore establishing the initial feasibility of on-site real time safety assessment will likely encourage other vendors to enter the market. The Expert Assessors therefore considered the Project to have the potential to stimulate the development competitive markets for real-time safety assessments.

Even though SGN will continue to have access to their own data, the Expert Assessors have suggested it would be beneficial if the GDNs explored a data sharing agreement for this sort of data similar to that of the National Underground Asset Register to ensure security.

The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Expert Assessors considered the Project to be innovative, novel and risky because of its application of unproven AI and sensor technology to address a complex challenge in infrastructure maintenance. The approach is acknowledged as innovative and untested, necessitating thorough trials and experimentation prior to widespread implementation. Its innovation and risk stem from the utilisation of AI-based predictive models, a relatively new concept, particularly in the realm of safety management. The evolving nature of AI introduces potential unknowns, which was considered to contribute to the Project's inherent risk. Furthermore, the Project's inclusion of human behaviours as data inputs and its aim to employ AI to achieve desired outcomes further emphasise its innovative, novel and risky nature, although the specific methodology for incorporating human behaviours remains an aspect within the Project which seeks to develop.

The Expert Assessors also noted the risk about the human interface aspects of the Project such as the voice tone, pitch and fatigue recognition. Whilst the Project stated in the interview that the relative unions have been engaged, the Expert Assessors noted a risk to the Project around the willingness of employees and employee union to provide this information.

The Expert Assessors therefore consider the Project to have met this Eligibility Criteria because it proposes a novel and innovative approach to on-site safety management which involves risk due to the inclusion of human behaviours.

Eligibility Criterion 6: Projects must include participation from a range of stakeholders.
Eligibility Criterion met
The Expert Assessors considered this Project to meet this Eligibility Criterion. The Project includes participation from a sufficient range of stakeholders; while it primarily involves FYLD delivering the technological solution, the Project includes support from three GDNs and National Grid. The interview clarified the point around employee union involvement; body cameras were considered in prior phases as a method for collecting data, however this was not considered as necessary for the successful development of a tool and raised some concerns around privacy as outlined above. For this reason, the Project did not expect union involvement to be an issue or barrier to the Project. There was discussion around potential stress and fatigue recognition in voice technology, which could be added to the model, and the Expert Assessors noted the need for this biometric data to be treated with caution and any plans for its use to be flagged in monitoring. To help mitigate any potential delays later in the Project, the Expert Assessors suggested that it may be useful to have union representation within the Project. The assessors also suggested that FYLD engage more proactively with the Health and Safety Executive (HSE) through regular catchups. The Project acknowledged that the regulatory barrier may be related to the HSE but assured that close collaboration would mitigate this concern. Overall, with the participation of major gas networks and FYLD's critical technical expertise, the Project was considered to encompass a sufficient range of stakeholders and include participation from a sufficient range of stakeholders for the activities set out. As a result, the Expert Assessors consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 7: Projects must provide value for money and be costed competitively.
Eligibility Criterion met
The Expert Assessors considered the Project to be delivering value for money and be costed competitively because of the low Project costs and its overall ambition. The applicant has provided the HSE data illustrating the significant costs associated

with doing nothing compared to the actual Project costs. Moreover, the assessors viewed positively the Project's incorporation of existing learnings for on-site safety, which they viewed to demonstrate value for money and to result in realistic estimates. The Expert Assessors also considered the Project and Project Partner costs to reflect standard labour rates for the relevant expertise and therefore considered the Project to be costed competitively. Finally, the Project is considered to provide value for money and is costed competitively since the potential annual savings, if the Project succeeds, far exceed the cost of implementation. Overall, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion met

The Expert Assessors considered the Project to have a robust methodology which gives confidence to the Expert Assessors that it will be capable of progressing in a timely manner because the Project demonstrates how it intends to achieve its desired outcomes with 18 months and delivery of benefits shortly after testing. The robust methodology and clearly defined work packages were praised by the Expert Assessors, including the Project's success criteria. The assessors therefore had confidence in its ability to progress in a timely manner.

While the assessors noted that greater clarity could have been provided within the Application, they noted that the Project management approach is outlined in the relevant appendix. Overall, the Application was considered to have identified external and business adoption risks, outlined clear milestones, presented a clear Project plan, and to have highlighted identified risks. In summary, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Regulatory barriers identified for the Project Phase

NO

The Expert Assessors did not identify any regulatory barriers which would impact the delivery of the Beta Phase activities. The Expert Assessors did note the large role the Health and Safety Executive (HSE) in the implementation of the proposed solution and did recommend that FYLD engage more proactively with the HSE through regular catchups. The Health and Safety at Work Act was viewed as

potentially presenting both opportunities and potential risks for implementation of the proposed solution following the Beta Phase. In one sense it could help SGN, and other organisations meet their obligations under the Act, or it may trigger changes which could impact the timelines around the implementation of the Project. Overall, engagement with the HSE and managing potential safety policy impacts were considered important considerations for the Project to manage.

Recommendation to the Gas & Electricity Markets Authority

FUND

All Expert Assessors have recommended this Project be considered for SIF Funding as they considered it to have met all eight Eligibility Criteria. The summary of the Project was well presented and effectively highlighted the main points and key areas of innovation within the proposed solution. The Application effectively captured how the innovation justification was satisfied, emphasising that the proposed solution represents a move towards utilisation of AI and machine learning, replacing traditional manual methods of information capture with new technology to enhance safety and efficiency. The main benefits derived from the project being reduced disruption, savings for end user and safety for employees were well articulated. The speed these benefits would be realised was recognised as one of the positive aspects of this project.

The Project plan was well received, with clear planning and methodology. The expert assessors suggested the incorporation of a stage gate in January 2024 (between Human behaviours & voice research and scaled planning for demonstration on the Project's gantt chart) with a deliverable for an outline data ethics employee contents and due diligence 'report'. The stage gate panel should include representation from internal employees and unions representation from SGN and other networks. The new deliverable and project specific condition was considered to help mitigate against any concerns in relation to data ethics and ensure ongoing employee involvement, which the Expert Assessors identified as important. A special condition in relation to convening an internal working group (within SGN) to hear concerns and directly receive feedback from user operatives would be able to supplement the report in the deliverable.

Recommended Project specific conditions

The Project should outline how it will address the data ethics around the voice tone, pitch and fatigue recognition and comply with Ofgem's Data Best Practice when the data is processed.

The Project should convene an internal working group as well as other network unions at the early stages of delivery to directly hear the feedback from the field operatives of the roll out of the voice tone, pitch and fatigue recognition components and how the data will be processed.

Add a stage gate in January 2024 between the human behaviours and voice research and scaled planning for demonstration on the Gantt chart attached with a deliverable for an outline data ethics, due diligence and employee report.

7.2.6 10073262, Thermal Imagery Analysis - SIF Round 1 Beta, Initial Net Funding Requested £9,942,045

Project Partner name	Eligible costs (£)(excl. in-kind contri.)	Project contribution (£)	SIF Funding Requested (£)
NORTHERN GAS NETWORKS LIMITED	2,052,974	500,000	1,552,974
CADENT GAS LIMITED	397,833	280,000	117,833
NATIONAL GRID GAS PLC	17,965	0 500 (In Kind)	17,965
SYNOVATE LIMITED	8,639,273	386,000 (50,000 in-kind)	8,253,273

Submitted Project description

As the UK, and the world, moves towards achieving net-zero emissions, Gas Distribution Networks (GDNs) are faced with the challenge of transitioning their operations to low-carbon fuels while also managing changing workforce demographics and potential skills shortages. To ensure that the transition is successful, scalable new technologies and approaches are needed to increase productivity, minimise future workloads, and avoid costs.

One important issue is managing leaks in existing gas pipelines and possibly abandoning assets as we transition to low-carbon fuels. Currently, methods for Escape, Locate and Repair (ELR) are reactive and rely on public reports of gas escapes. These techniques can be slow and imprecise, as workers use above ground monitoring and digging to locate leaks. This can lead to higher operational costs and disruptions for gas consumers and the public. Additionally, information about the condition of assets is not always easily accessible to the industry, which could help reduce costs and assess risk. As we transition to low-carbon fuels, new methods will be needed to manage and mitigate leaks, such as in-pipe verification, pinpointing and remediation, which could offer many benefits over traditional replacement.

Our solution is a comprehensive approach to addressing leakage in gas distribution that leverages cutting-edge digital technologies and robotics to improve performance and enable a cost-effective transition to net zero with minimal cost to the energy consumer. At the heart of our solution is a novel sensing methodology that can accurately detect low pressure gas leaks from within gas pipes for the first

time. This technology is complimented by a digital recording platform that captures and collates detailed asset data and interventions, allowing for optimised future interventions. Our solution utilises live access sensing to maximise leakage intervention productivity per excavation and can be used to treat leakage directly, effectively, and efficiently.

Within the Beta phase, we aim to pilot our solutions for wide scale ELR to demonstrate how robotics and advanced sensing can be used to improve leakage performance within gas distribution. To achieve this, the leak sensing technology leverages live access robotics to efficiently treat the leakage and minimise the time and cost of interventions. Combining these technologies aims to streamline the entire process of detecting and repairing gas leaks, from identification of the problem to remediation of the leak. This will provide an overall body of evidence to enable a transition away from manual ELR methodologies towards the future digital ELR approach.

Eligibility Criterion 1: Projects must address the Innovation Challenge set by Ofgem.
Eligibility Criterion met
All Expert Assessors considered this Project to have addressed the Innovation Challenge because it aims to use the latest digital technology and data to provide increased awareness of gas network leakage, thus enabling more accurate operational and investment planning decisions. The Project aims to reduce methane leakage and build a digital picture of the networks to support the transition (whether to hydrogen or to decommissioning). The Expert Assessors considered the Project's focus to be directly related to one of the aims of the Innovation Challenge, which is to improve data monitoring, availability, quality and collection to improve the efficiency, security and resilience of networks. The Expert Assessors therefore considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 2: Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers
Eligibility Criterion met

The Expert Assessors considered this Project to have identified a clear benefit for gas consumers through the reduction of gas leakage as well as improvements in operational processes within low pressure networks through greater use of data and digitalisation. The Expert Assessors noted the clear potential to deliver benefits to gas consumers by operational cost savings through reduced network interruptions, as well as safety and environmental benefits through a reduction in gas leakages. For these reasons, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Expert Assessors considered this Project to involve network innovation because it uses sensory equipment to produce digital records of leakages within the gas network. All Expert Assessors commended the fact that the technology innovation went beyond activities ordinarily associated with the operation of the network and noted the potential value it could deliver. Although the level of innovation in this Project was considered to be sufficient to successfully meet the Eligibility Criteria, the Expert Assessors noted that the Application could have been strengthened by providing further details on data usage and the AI elements of the Project, as well as an understanding of how this would be rolled out into business as usual. In particular, the Expert Assessors noted it would have been useful to see how the technology sits in NGN's digital strategy and how this innovation would be fully integrated. However, overall, all Expert Assessors considered this Project to have met the Eligibility Criteria.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion not met

The Project was considered by the Expert Assessors to be undermining the development of competitive markets. The Expert Assessors highlighted several reasons behind this consideration. First, it was not clear within the Application that the technology development would not hold exclusive rights to the solution, thereby resulting in limited opportunity for the development of competitive markets. Second, the Expert Assessors noted a lack of commitment and clarity in

the Application to open data, which did not provide them with confidence that it would not undermine the development of competitive markets. The Expert Assessors noted that even though there are many technology options for addressing gas leakage, the Project was unclear on where the IPR data would stand post trials. The Project team also stated during its interview that this would be explored in the Beta Phase, but the Expert Assessors did not consider this to be sufficient for them to have confidence that the Project would not undermine competitive markets. As a result, the Expert Assessors did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Expert Assessors considered the Project to be innovative, novel, and risky because it proposes a method for identifying and recording the condition of small diameter gas pipes that is not currently available and in the use of data and digitalisation and the development of sensing technologies. The Project's focus on the use of data and digitalisation for the development of sensing technologies was considered to be an innovative approach. The Expert Assessors also noted specifically the potential use case of creating a large-scale digital picture of the network to be novel.

However, the Expert Assessors noted that the Application lacks clarity around what data will be collected and how it is used by the Project. The assessors also noted a lack of clarity on the ability of the sensory equipment following the Alpha Phase and its use cases in the Beta. While they consider the Project to have met this Eligibility Criteria, they noted that greater explanation and clarity in the Application to have likely benefited the Project's Application.

Overall, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion met

All Expert Assessors considered this Project to include participation from a sufficient range of stakeholders for this Eligibility Criteria to be met because three out of four of the GDNs as well as academics are involving, meaning the Project encompasses both end users and academia. The Application could have been enhanced if the scope of internal stakeholder participation within NGN particularly in the IT/information management functions and how this approach sits with the internal data strategy.

While the Expert Assessors considered the Project to have met this Eligibility Criteria, it was suggested the Project could have increased engagement with a broader set of stakeholders such as local authorities, or other utilities to identify wider opportunities and gain from their experience.

Overall, the Expert Assessors considered the Project to have met this Eligibility Criteria.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion not met

The Expert Assessors did not consider the Project to be delivering value for money and be costed competitively because the overall the benefits were insufficiently justified and modest, and limited evidence was provided to realise the benefits within a reasonable time. The Expert Assessors noted that the benefits were low in comparison to the SIF Funding requested and for the overall costs of the Project and Project Partners. The Expert Assessors also considered the Project to lack detail on how this technology would be used and scaled across other GDNs and therefore this would limit the overall benefits to consumers and the value for money presented by the Project. The Expert Assessors expressed that it would be beneficial for the Project to engage with the team behind the Beta Phase Project Data Leakage Analytics Platform to understand the methodology of how this technology would be integrated into business as usual for all GDNs. It was also unclear how or if this Project duplicates efforts to deploy data and digitalisation approaches to reduce gas leakages across other SIF Beta Phase Projects.

The Expert Assessors therefore did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion not met

The Expert Assessors considered the Project's methodology to not be sufficiently robust and to not provide confidence that it will be capable of progressing in a timely manner because it was unclear on the success criteria of the Project. The Application was considered to lack detail on how the proposed technologies will work in practice and how it is scalable with other gas networks. In addition, it was a concern for all Expert Assessors that the differing views of the use case was a concern for delivery.

Whilst the interview clarified some questions the Project gave limited information on the IP and scalability, it would have been useful to have indicated a default position and then stated they will explore further opportunities in the Beta Phase. In addition, it was considered unclear how the Alpha Phase was used to firm up the capability and the potential use cases. It remains unclear what will be delivered in the Beta Phase.

It was also noted that the duration of the Project (4.25 years) could introduce a risk, in that the Project methodology may need to evolve during this period to capture more up-to-date methods for handling, storing, processing, and sharing data as well as the sensing technologies. The assessors also noted a lack of clarity on how the Project would monitor developments across the industry and work to achieve interoperability.

The Expert Assessors therefore did not consider the Project to have met this Eligibility Criteria.

Regulatory barriers identified for the Project Phase

NO

The Project did not identify any regulatory barriers which would impact the potential delivery of the Beta Phase activities. The Project did note that there are currently no provisions in the RIIO-2 price control mechanism to support strategic implementation into business as usual and noted that, should the Project be successful, collaboration and support across the GB gas networks and with policymakers would be needed.

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The Expert Assessors have recommended this Project not be considered for SIF Funding and did not consider it to have met all the Eligibility Criteria. This Project was considered to have addressed the Innovation Challenge by utilising the technology and data and digitalisation techniques to increase awareness of gas network leakage with an aim to reduce methane leakage and develop a digital representation of the networks to facilitate the transition to either hydrogen or decommissioning gas networks. All Expert Assessors agreed that this approach was innovative and had the potential to deliver benefits to gas consumers. All Expert Assessors agreed that the Project involved sufficient participation from a range of stakeholders for the activities set out. The main concern identified by the Expert Assessors was that they did not find the Project to deliver value for money or to be competitively costed. They believed that the overall benefits had not been proven to constitute a strong business case, and limited evidence was provided to demonstrate the timely realisation of these benefits. The Expert Assessors also noted that the Project could offer value for money if it achieved greater use of data and digitalisation across the organisations, while simultaneously reducing leakage. It was noted that the interview gave more confidence than the written Application. The Expert Assessors felt that the lack of clarity regarding the Project's success criteria and how the proposed technologies would function in practice and scale to other networks was limiting for the Project. The Expert Assessors expressed concerns about the differing views on the use case amongst the different GDNs and the limited information provided about intellectual property (IP) and scalability during the interview. It would have been useful to have a default position outlined and a commitment to further exploration during the Beta Phase as the current approach did not provide the assessors with confidence that competitive markets would not be undermined. It was also highlighted the importance of leveraging the Alpha Phase to solidify capabilities and use cases and it was pointed out that it was unclear what would be delivered in the Beta Phase. This concern was heightened due to the level of discrepancies and lack of clarity in the Application. These concerns led the Expert Assessors to believe that the Project's methodology to be

insufficiently robust and lacking in detail, which raised concerns about its ability to progress in a timely manner.

Recommended Project specific conditions
N/A

8.1 SIF Beta Phase – Heat – Summary

This section covers the assessment of round 1 Beta Phase Applications received into the 'Heat' Innovation Challenge[11].

For the Beta Phase, one Application was submitted to Innovate UK through the Innovation Funding Service (IFS) portal by the closing deadline of 23 March 2023 and is listed below.

Project reference number	Project name	Funding licensee	Total Project costs (£) (excl. in-kind contr.)	Total Project contribut-ion (£)	Total SIF Funding request-ed (£)	Recom-mended for funding (Yes/No)
10068217	Velocity design with hydrogen - Beta	SOUTHERN GAS NETWORKS PLC	6,554,990	642,846 (574,286 in-kind)	5,912,144	Yes

[11] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-innovation-challenges

8.2 Evaluation of Applications

8.2.1 10068217, Velocity design with hydrogen – Beta, Initial Net Funding Requested £5,912,144

Project Partner name	Eligible costs (£)(excl. in-kind contr.)	Project contribution (£)	SIF Funding Requested (£)
SOUTHERN GAS NETWORKS PLC	125,520	0 (12,552 in-kind)	125,520
CADENT GAS LIMITED	13,740	0	13,750
NORTHERN GAS NETWORKS LIMITED	13,200	0	13,200
WALES & WEST UTILITIES LIMITED	14,496	0	14,496
NATIONAL GRID GAS PLC	13,835	0	13,835
INSTITUTION OF GAS ENGINEERS AND MANAGER	72,150	0	72,150
DNV SERVICES UK LIMITED	6,302,037	642,846 (561,734 in-kind)	5,659,193

Submitted Project description
The project will establish safe design gas velocity limits for the UK industry to use in re-purposing gas networks in the UK to safely deliver 100% hydrogen. Hydrogen carries approximately one-third of the energy per unit than delivered by natural gas. Therefore, an increase in mass flow can be expected to deliver the same heat energy to consumers using hydrogen. Design gas velocity limits are used by network designers to ensure there is no integrity risk to pipe components caused by erosion, noise, or vibration from excessive gas velocity in the pipes. While current design codes use gas velocity limits proven to be safe in designing networks carrying natural gas by long standing practice, no suitably valid and representative data has been gathered to establish safe limits while carrying hydrogen in UK gas distribution networks.

If hydraulic modelling of gas networks shows gas velocities in the networks that exceed the safe velocity limits, additional pipe must be installed (network reinforcement).

This project will deliver a test campaign, on a full-scale test rig, to produce data that will be accepted by the industry and the professional body representing gas engineers in the UK as valid to amend the design codes to ensure the safe transport of hydrogen in UK gas distribution infrastructure.

Analysis completed in previous phases of the project show significant network reinforcement costs can be avoided during the energy transition if the gas design velocities can be safely increased from current limits.

Eligibility Criterion 1:
Projects must address the Innovation Challenge set by Ofgem.

Eligibility Criterion met

The Expert Assessors considered this Project to have addressed the Innovation Challenge. The Project's ambition to support provision of potentially low-carbon hydrogen to consumers in a cost-effective way through existing infrastructure is aligned with the challenge's main objectives. The Project's potential to deliver key evidence, insights, and capabilities, currently absent in the GB energy market, are innovative steps towards addressing the challenge.

Specifically, the Project's focus on creating standards for hydrogen velocity in pipelines could reduce the necessity for costly gas network upgrades, providing a cost benefit and promoting energy system-wide advantages beyond heating. This innovative approach to addressing the velocity of hydrogen in pipelines is pioneering within the context of GB energy market.

The Project also demonstrates the potential to repurpose existing gas infrastructure for hydrogen without necessitating significant and costly reinforcement works. This approach is particularly beneficial to UK consumers and further aligns the Project with the Innovation Challenge.

Finally, the Expert Assessors acknowledged the Project's efforts to develop the evidence required to set new safety standards for operating gas networks transporting hydrogen. This innovative step aims to advance the understanding of hydrogen as a feasible solution for decarbonising heat. This approach is novel as it

is the first attempt to develop such standards for hydrogen gas flow, offering critical robust physical evidence to bolster evidence to support hydrogen roll and develop new standards.

In summary, the Expert Assessors consider the Project to have adequately met this Eligibility Criterion due to its innovative approaches and alignment with the aims of the Innovation Challenge.

Eligibility Criterion 2:
Projects must have clearly identified potential to deliver a net benefit to gas or electricity consumers

Eligibility Criterion met

The Expert Assessors considered that this Project will deliver some benefits to consumers through enabling of testing for hydrogen velocities. It was noted that the Project is necessary to effectively utilize existing gas infrastructure for hydrogen transportation and could remove the necessity for specific gas network upgrades and therefore lead to both cost and carbon savings. The Expert Assessors agreed that this information is timely and valuable for policymakers and covers a gap in the evidence needed to consider hydrogen's potential role in the UK's energy system. While this could have been better justified in the Application, the Expert Assessors reached the consensus that the Project will indirectly benefit consumers through enabling informed policy-making.

The Expert Assessors considered the cost benefit analysis of the Project, indicating a substantial positive lifetime net present value (NPV), should the maximum gas velocities for hydrogen be increased. This benefit, derived from reduced network reinforcement needs, identified the Project's potential for providing net benefit to gas network consumers. Although the Project used relatively optimistic assumptions regarding the level of hydrogen conversion, the Expert Assessors considered alternative assumptions to also likely lead to a positive NPV. In conclusion, the Expert Assessors considered this Project to have identified a clear potential to deliver a net benefit to gas and potentially electricity consumers, thereby meeting this Eligibility Criterion.

Eligibility Criterion 3:
Projects must involve network innovation.

Eligibility Criterion met

The Expert Assessors considered this Project to involve network innovation in as it aims to enable changes to the use of the network for hydrogen deployment.

The Project proposes an examination of the evidence required to establish new velocity standards for hydrogen in smaller diameter pipes. This represents network innovation as the current knowledge base around this is sparse, and the Project seeks to address this gap.

The Expert Assessors also noted the Project's innovative approach to testing new velocity limits using new test equipment. This methodology is necessitated by existing regulatory constraints that prevent such tests on the current gas networks.

Lastly, the Project's focus on network design and operation as it pertains to the potential transition to hydrogen was considered innovative. In the event of the UK Government enabling the use of hydrogen in gas networks, it will fall to gas network companies to design, convert, and operate parts of their network to transport hydrogen. The Project's role in developing evidence to support the formulation of new standards is a clear instance of network innovation.

In conclusion, the Expert Assessors considered this Project to have demonstrated network innovation in a variety of ways, fulfilling this Eligibility Criterion.

Eligibility Criterion 4:
Projects must not undermine the development of competitive markets.

Eligibility Criterion met

The Expert Assessors did not consider this Project to be undermining the development of competitive markets. It was noted that the Project focuses on hydrogen, a "new" fuel alternative necessary for replacing the currently utilized fossil fuels in line with the UK's climate change ambitions.

The Expert Assessors highlighted that the intellectual property or knowledge developed through the Project would be beneficial across the gas sector as it contributes to the creation of standards. They made a strong case that the development of these standards actually tends to foster competition within markets rather than undermine it.

Additionally, the Project is clearly structured not to undermine competitive markets, as it is seeking to develop new technical standards that will be made available to all network designers and operators. The planned industry engagement will ensure that all relevant stakeholders are aware of the new standards ahead of their implementation.

The Expert Assessors also noted that the Project's scope, which relates specifically to regulated network activities, supports a competitive market in hydrogen, assuming its use in gas networks is allowed. However, they did express a concern that while the Project involves all GB regulated gas network companies, it does not involve or describe engagement with Independent Gas Transporters. The Expert Assessors highlighted the potential value in specifically engaging with this segment of the gas network sector.

Despite this slight concern, the Expert Assessors consider the Project to have met this Eligibility Criterion, as it does not undermine the development of competitive markets.

Eligibility Criterion 5:
Projects must be innovative, novel and/or risky.

Eligibility Criterion met

The Expert Assessors concurred that the Project is to be innovative, novel and risky.

One of the primary reasons for this is its focus on the investigation of the use of hydrogen in the network, a field that has not been previously tested extensively. This innovative and novel approach was considered to make the Project stand out.

The Expert Assessors also noted that the Project is risky due to its potential outcomes. For instance, the evidence gathered might lead to the discovery that hydrogen velocities require more upgrades than currently assumed based on the natural gas design criteria. In such a case, the cost-benefit analysis (CBA) projected for the Project would not materialise. However, they also pointed out that the knowledge gained and the evidence created would still be valuable, even if it unveils unexpected challenges. Furthermore, the proposed approach hasn't been tested in any other nation, adding to its novelty and the associated risks.

Lastly, the Expert Assessors considered the Project novel because it involves the development of evidence to set new standards for the operation of gas networks transporting hydrogen. This research and development aims to provide robust evidence that is accepted by the industry and can be used to define models and eventually standards, which will in turn define limits on the operation of any future hydrogen networks. Thus, it is clear that the Project meets this Eligibility Criterion, as it is both innovative and carries inherent risks.

Eligibility Criterion 6:
Projects must include participation from a range of stakeholders.

Eligibility Criterion met

The Expert Assessors agreed that the Project has successfully included the participation of a sufficient range of stakeholders, thus satisfying this Eligibility Criterion.

A major strength of the Project lies in its inclusion of all major Gas Distribution Network Companies and Gas Transmission operators in GB. Additionally, the collaboration with the industry standards body Institution of Gas Engineers & Managers (IGEM) is also seen as highly beneficial for the development of its proposed solution. The Expert Assessors also mentioned the Health and Safety Executive (HSE) as a relevant body that should have appropriate input and output from the Project.

It will be important that all Project Partners engage and contribute to the Project, in particular it is important that all gas network Project Partners play an active role throughout the Project to ensure scalability of any solution and capturing of challenges.

Expertise is ensured by involving DNV, who provide the necessary experience in developing and delivering bespoke test-rigs and testing programs at Spadeadam. Additionally, IGEM's role of conducting workshops with technical experts and including a peer review as part of their work is an important part of the Project.

The Expert Assessor suggested that to ensure the high-quality results crucial for the Project, there could be value in including additional partners to challenge, assess, and validate the findings independently from the main Project team. The involvement of such external bodies would likely strengthen the Project's outcomes

and further solidify its compliance with this Eligibility Criteria. Additionally, the Expert Assessors agreed that public perception particularly around the type of hydrogen being used in the trial, and it's emissions in addition to impacts of flaring on nearby communities were considered as being potential areas for further consideration.

Eligibility Criterion 7:
Projects must provide value for money and be costed competitively.

Eligibility Criterion met

The Expert Assessors overall considered the Project to demonstrate value for money and to be costed competitively, thus meeting this Eligibility Criteria.

The Project's potential benefits to the network and its users are recognized as indicating value for money. This was supported by the limited and justified upper budget for a comprehensive 30-month testing programme.

The significant contribution to the Project costs from Project Partners also was considered to indicate value for money. The transparency of the provided cost inputs adds to the confidence in the Project's cost-effectiveness and justification costings were further articulated at interview.

The use of appropriate day rates for labour and costs related to the test rig and testing program are identified as features demonstrating competitive costing. However, one Assessor raised concerns about the lack of specific details, such as the specific design of the test rig or the justification for the chosen test-rig/testing design over others. Further clarity on these aspects was provided in the interview, including why compression and flow loop options for testing were not chosen. The Expert Assessors commented that further information as to the type of hydrogen to be supplied (blue, green or grey) would have been helpful in assessing value for money. Additionally, the Expert Assessors questioned why cast iron testing was not included in the testing program, considering the stage of the Repex Programme, and reached a consensus that this could be further explored.

In addition, while the Project mentions that one aspect of Project Partners contribution is to absorb more of the risk of cost overruns, no further information is included. More detailed information on how potential cost overruns will be managed would further solidify the Project's compliance with this criterion.

The Expert Assessors noted the importance that consumers get value for money from the investment throughout its lifetime and that it will be important that any value inherent in the test rigg beyond completion of this Project is considered in light of consumers contributions to the initial capital investment.

Overall, the Expert Assessors considered the Project to demonstrate value for money and to be costed competitively because the Project has identified a clear potential to deliver benefits to consumers, there is a clearly articulated breakdown of the Project's costs, which were considered reasonable with the justification provided, and there is significant contributions coming from the Project consortia. While the assessors noted several areas where the Application could have been strengthened, they considered it to have met this Eligibility Criteria.

Eligibility Criterion 8:
Projects must be well thought through and have a robust methodology so that they are capable of progressing in a timely manner.

Eligibility Criterion met

The Expert Assessors all agreed that the Project has a sufficiently robust methodology which gives confidence in its progression, thus satisfying this Eligibility Criteria. This consensus is supported by the Project's clear plan and defined roles within the delivery team.

The high level of experience of the Funding Party and DNV, the main delivery Project Partner, supports this confidence. The Project is considered a low non-delivery risk, particularly given its importance to the wider sector and DNV's capacity and experience.

Sufficient detail on work package management and risk mitigation, as well as a clearly articulated Project management structure, strengthen the belief in the Project's ability to progress on time. The Project plan, Gantt chart, sensible work packages, milestones, and deliverables also contribute to this confidence. However, all Expert Assessors agreed that the Application could have included additional insight into the sourcing of the hydrogen for the trial to bolster this section. The Expert Assessors noted that Project methodology could further have highlighted linkages and synergies with other hydrogen projects being carried out at the site, and articulated how this Project intended to align with them.

Overall, the Project was considered to have met this Eligibility Criteria.

Regulatory barriers identified for the Project Phase
NO
The Project did not identify any potential regulatory barriers which would impact the delivery of its Beta Phase activities. It has noted however that overall implementation of its proposed solution would rely on a future policy decision around the potential use of hydrogen for heating. The Project has also identified that its potential learnings could help to inform this future policy decision and any potential design codes and practices which would govern the use of hydrogen in gas networks.

Recommendation to the Gas & Electricity Markets Authority
FUND
All Expert Assessors have recommended this Project be considered for SIF Funding as it was considered to have met all eight Eligibility Criteria. The summary of the Project was well presented and effectively highlighted key points. It acknowledged the relevance and timeliness of the problem, namely that a clear evidence-led view on hydrogen velocity limits in typical GB pipeline designs is an important piece of evidence in making a strategic decision on the future role of the gas networks in delivering hydrogen. The benefits of the Project were considered achievable but modest. The delivery plan was deemed clear and concise, but some areas could have been further articulated such as the source (and type) of hydrogen being used for the trial. The Project costs were adequately considered, and the interview further articulated why the type test model was chosen. IP requirements provided confidence that the Project would not undermine the development of competitive markets. The main concern for the Expert Assessors related to the need for highlighting of synergies with other hydrogen projects being carried out at the test site Spadeadam and the linkages to the Hydrogen Programme and Network Safety Impact Board (NSIB) projects. The Expert Assessors commented on the level of planning for the supply of hydrogen to be used in the trial, in addition to the lack of information available as to type of hydrogen (blue, green or grey). Public

perception around the type of hydrogen was noted as being a potential consideration.

Recommended Project specific conditions

The Project should outline how it will align and create synergies with other Hydrogen projects, particularly other projects being delivered at the Spadeadam site, and feed into the wider Hydrogen Programme.

The Project should include a work package for testing on iron mains.

The Project should aim to use Green hydrogen where possible and demonstrate understanding of emissions from the project.

The project should provide a proposal to Ofgem focused on ensuring that consumers benefit from any legacy value of the infrastructure developed for the project.