Strategic Innovation Fund (SIF)

Round 1 Innovation Challenges – Alpha Phase

Expert Assessors' Recommendations Report

Contents

1. Introduction

Innovation will play a crucial role in delivering best value to energy consumers. Innovation will prepare the regulated energy network companies to deliver Net-Zero greenhouse gas emissions at lowest cost to consumers, while maintaining world-class levels of system reliability and customer service, and ensuring no consumer is left behind.

The Strategic Innovation Fund (SIF) was launched in July 2021 within the RIIO-2 price control for the Electricity System Operator, Electricity Transmission, Gas Transmission and Gas Distribution licence holders. 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. Round 1 is open to the following network licence holders:

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

The SIF adopts a three Project Phase approach to mitigate the risk associated with innovation: 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.

Four Innovation Challenges were launched as part of round 1, focusing on strategic issues currently facing networks – whole system integration, data and digitalisation, heat and zero emissions transport[1]. Projects are progressing through each of the SIF's

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

Phases focusing on one of these Innovation Challenges. Earlier this year over £4.5m was awarded to 40 Projects for the Discovery Phase of round 1[2].

This recommendations report offers recommendations on which of the completed Discovery Phase projects should continue to be funded in to the Alpha Phase. All Projects which completed the Discovery Phase had the option of submitting an Application for the Alpha Phase, merging with another SIF Project and submitting an Application, or not submitting an Application for the Alpha Phase. It should therefore be noted that 29 eligible applications were received for the Alpha Phase across all challenges, from the 40 initial Discovery Phase projects.

In the Alpha Phase, Projects must start by August 1, 2022, end by January 31, 2023 and not request funding of more than £500,000, exclusive of VAT. The Alpha Phase requirements with regards to scope, partners etc. has not changed from the original round 1 Innovation Challenge briefs.

Submitted Applications for the Alpha Phase have been assessed in stages by independent Expert Assessors. Expert Assessors have been appointed by Innovate UK and collectively have knowledge, expertise and are able to demonstrate capability in more than one of the following areas: energy sector, energy network, energy regulatory and policy, challenge focused technical and engineering, cross-sectors, financial and commercial.

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 4.9 of the SIF Governance Document, in line with the methodology for evidencing net benefits to energy consumers described in paragraphs 4.23-4.28 of the SIF Governance Document (b) the end of Discovery Phase reports (c) the show and tell presentations referred to in paragraph 6.11 of the SIF Governance Document and (d) taking into consideration any additional and relevant information available. Their assessment of Applications with reference to those requirements forms the basis of the funding recommendation set out in this report.

[2] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-discovery-projects-approved-funding

As part of each Application assessment, the Expert Assessors also considered whether Projects should receive all the SIF Funding requested for the Alpha Phase, partial funding, or no funding at all. Due to the nature of the Projects at the Alpha Phase in the SIF, where Projects are focussing on preparing and testing the different solutions to the Problem identified during the Discovery Phase ahead of any future large-scale demonstration of the Project, the recommendations from the Expert Assessors were naturally more focused on recommending the Project be funded either in its entirety or not all.

The overall funding recommendation summarised in this report is based upon whether a Project has met each of the SIF Eligibility Criteria, the assessment of the Application questions against the Eligibility Criteria, any Project-specific conditions recommended by the Expert Assessors,[3] and wider concerns or opportunities identified by the Expert Assessors during the interview.

For more information on the Innovation Challenges and their requirements, the assessment process, and the Projects assessed for the Discovery Phase, please see the recommendations report issued for the Discovery Phase[4].

[3] This recommendation report contains the project-specific conditions as recommended by the Expert Asessors. These project-specific conditions may be amended slightly by Ofgem within their funding decision and SIF Project Directions.

[4] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-discovery-projects-approved-funding

2. SIF Round 1 Alpha Phase – whole system integration

2.1 SIF Alpha Phase – whole system integration - Summary

This section covers the assessment of round 1 Alpha Phase Applications received into the whole system integration Innovation Challenge[5].

For the Alpha Phase, 8 Applications were submitted to Innovate UK through the Innovation Funding Service (IFS) portal by the closing deadline of 11am 18th May 2022 and are listed below. All submitted Applications were considered to have met the Innovation Challenge requirements for the Whole System Integration Innovation Challenge and have been assessed by the Expert Assessors.

For information on the scope of the whole system integration Innovation Challenge and the Discovery Phase Applications and assessments please see the recommendations report from the Discovery Phase[6].

Project reference number	Project name	Funding licensee	Total eligible costs (£)	Total Project contribution (£)	Total SIF Funding requested (£)	Recom-mended for funding (Yes/No)
10036946	Network-DC	Scottish Hydro Electric Transmission Plc	£491,905	£68,429	£423,476	Yes
10036949	HyNTS Compression	National Grid Gas Plc	£559,035	£59,137	£499,898	Yes
10036951	HyNTS Green Hydrogen Injection	National Grid Gas Plc	£462,814	£107,665	£355,149	No
10036958	Asset Reuse and Recovery Collaboration (ARRC)	SP Transmission Plc	£481,976	£59,041	£422,935	No
10037143	INCENTIVE - Innovative Control and Energy	Scottish Hydro Electric	£495,408	£114,802	£380,606	Yes

[5] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-innovation-challenges
[6] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-discovery-projects-approved-funding

	Storage for Ancillary Services in Offshore Wind	Transmission Plc				
10037410	Crowdflex	National Grid Electricity System Operator	£606,196	£106,277	£499,919	Yes
10037752	SEGIL – Sustainable Electrical Gas Insulated Lines	National Grid Electricity Transmission	£460,037	£47,009	£413,028	No
10037761	SCADENT – SuperConducter Applications for Dense Energy Transmission	National Grid Electricity Transmission Plc	£499,097	£50,097	£449,000	Yes

2.2 Evaluation of whole system integration Application

2.2.1 10036946, Network-DC, Initial Net Funding Requested £423,467

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Scottish Hydro Electric Transmission Plc	£287,154	£28,715	£258,439
University of Edinburgh	£81,793	£8,179	£73,614
Carbon Trust Advisory Limited	£35,000	£0	£35,000
National Grid Ventures Limited	£18,170	£18,169	£1
National Grid Electricity System Operation Limited	£6,651	£0	£6,651
SuperGrid Institute	£55,287	£5,517	£49,770
Renewable UK Association	£7,850	£7,849	£1

Submitted Project description
To combat climate change, the UK needs clean energy. The UK is well-positioned to generate clean electricity because our coasts provide a large potential for offshore wind. We currently have an installed offshore wind capacity of 12GW and are targeting increasing the total capacity to 50GW by 2030 and more than 100GW by 2050. Given the scale of the developments proposed and their increasing distance from the onshore grid, the most efficient option is to connect these to the network using Direct Current (DC) cables, as it reduces the power lost in the transmission of the energy. The electricity used by the consumer, and what comes out of the sockets in their homes, is alternating current (AC), and there is a need to convert the DC to AC at a convertor station. This is usually positioned on the coast and connected point-to-point to the wind farm via an offshore cable. The current connection method is to connect each wind farm to an AC convertor station with an AC circuit breaker between the convertor station and the rest of the onshore AC network, to protect the electricity grid from faults on the offshore DC network. However, as the number of wind farms increases, so the number of AC convertor stations increases in a point-to-point system. This impacts coastal communities through an ever-increasing number of convertor stations and cables. It is also costly to install and maintain many converter stations, which increases the consumer cost of electricity.

The big idea is to create DC networks connecting multiple wind farms into a DC substation to connect to fewer converter stations. This approach will reduce the impact on coastal communities, reduce costs and has the potential to lower costs to consumers. It will also help us open new areas for developing windfarms. To do this, we need to use DC circuit breakers (DCCB), an innovative technology untested in the UK and European market. DCCB will allow us to bring multiple windfarms into a DC system, containing the impact of any single failure safely and securely and allowing other connected windfarms to be unaffected and continue to supply clean energy. We will need to develop and test these DCCBs before we can create a DC network. This Project will test and prove the use of DC breakers so that we can implement DC networks that can deliver safe, reliable, and cost-effective energy to the consumer.

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

The Project addresses the changing landscape of generation in the UK electricity system and how to connect this to distant demand centres. It specifically focusses on enabling High Voltage Direct Current (HVDC) networks via the development of DCCBs which allows for more coordinated network planning to connect an increasing capacity of offshore wind farms. In the opinion of the Expert Assessors, this Project met this Eligibility Criteria because of this focus.

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

It is possible that wide scale deployment of a High Voltage Direct Current (HVDC) network to connect off shore wind (OSW) to the grid would be significantly lower cost than current solutions. The Project has identified a material benefit primarily from the reduction of ancillary services requirements and associated costs which would result, in the opinion of the Expert Assessors, in net benefit to electricity consumers through cost savings per annum on energy bills and for users of network services. This Project was also considered by the Expert Assessors to potentially significantly decrease the impact of wind farm interconnectors landing on-shore on local communities and the environment. The benefits realisation however hinges on

the future network design choice in GB. Overall, the Expert Assessors considered this Project to have met this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

In the opinion of the Expert Assessors, this Project involves network innovation as there is currently no HVDC network in GB and this project seeks to provide an enabler for that via developing DC circuit breakers. The Project also seeks to develop simulations of DCCB's performance on UK networks which is network innovation, enabling development of specifications and effective configurations.

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

The Project is offering an alternative solution for network development and involves multiple Original Equipment Manufacturers (OEMs) to service this market. It also develops design specifications and effective configurations that will be important to inform the future DC network market development. In the opinion of the Expert Assessors, the Project is therefore not seen to undermine the development competitive markets.

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

There is no existing example of an HVDC circuit breaker in service in a comparable network to the UK system and there is no definition for the specifications that the DCCB would require to meet the needs of this use case. The Project was considered by the Expert Assessors to be a key enabler for the wider HVDC network innovation process, demonstrating an innovative, novel and risky approach.

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

The Project does bring together the range of technical (engineering, modelling and testing), policy, system operation and market expertise required to deliver the proposed scope of work. The Project has also added SuperGrid to the consortium to bring international (European specifically) experience and DC network design. The

Expert Assessors therefore thought the Project demonstrated sufficient participation from a range of stakeholders for this Eligibility Criteria to have been met.

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

The Project is viewed by the Expert Assessors as value for money and costs are reasonable for the scope of work. This can be seen in the potential reduction of costs for users of the network, the Project plan provided by the Project, the contribution towards the Project from the Funding Party and Project Partners, and the benefits which could be realised from a HVDC circuit breaker in the UK. There is also an appropriate spread of resources amongst the partners and sub-contractors.

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.

The Project plan, consideration of risks and the spread of roles across the Project Partners and sub-contractors provide confidence to the Expert Assessors that the scope of work can be delivered in a timely manner and that the Project has a sufficiently robust methodology for the Alpha Phase.

Regulatory barriers noted by the Expert Assessors

YES

Ownership and commercial model uncertainty around DCCB hubs and broader regulatory uncertainties around DC networks.

Recommendation to the Gas & Electricity Markets Authority

FUND

The Expert Assessors noted that the Project was presented with a clear proposition to take the project through Alpha Phase and Beta Phase and in to business as usual (BAU). The Project could enable HVDC networks in parallel with the roll out of increasing capacity of offshore wind. Better understanding of specifications for DCCBs will be necessary to enable a HVDC network in the UK and clarity over the UK's HVDC network strategy is required if the project is to reach BAU deployment and widespread commercialisation.

Recommended Project specific conditions
Before the start of the Alpha Phase the Project should reissue its Project plan addressing errors in the work package subtotals.

2.2.2 10036949, HyNTS Compression, Initial Net Funding Requested £499,898

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National Grid Gas Plc	£95,860	£50,000	£45,860
Siemens Industrial Turbomachinery Limited	£171,075	£900	£170,175
National Grid Electricity Transmission Plc	£6,000	£0	£6,000
Northern Gas Networks Limited	£2,020	£0	£2,020
Southern Gas Networks Plc	£1,848	£0	£1,848
GL Industrial Services UK Limited	£167,995	£0	£167,995
ITM Power Plc	£16,600	£600	£16,000
Cullum Detuners Limited	£97,637	£7,637	£90,000

Submitted Project description
The National Transmission System (NTS) is a network of high pressure natural gas pipelines, that supply gas to about forty power stations and large industrial users, from natural gas terminals situated on the coast, to gas distribution companies that supply commercial and domestic users. In order to move gas from producers to users, the system utilises several compressor systems located strategically across the country. In order to achieve the UKs 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. The HyNTS Compression Project investigates the key challenges associated with compression of hydrogen and hydrogen blends through the NTS assets. The Project aims to determine the technical and commercial feasibility and, provide a

technical demonstration and create a strategy for UK NTS Compression Systems.

The Project will determine whether the use of current compression assets on a hydrogen gas network is feasible, this in turn will help reduce the cost of the energy transition by eliminating the need to replace the compression systems. The largest costs in the current assumptions for migrating the NTS to hydrogen, is the cost to replace the compression systems. If this Project determines that the current systems are unable to function with hydrogen, alternative cost-efficient options will be assessed and demonstrated.

The Project will utilise demand predictions for hydrogen across the NTS along with modelling undertaken by the internal National Grid team and as part of Hydrogen Grid Research & Development (HGR&D) to determine the likely compression to requirements. The Alpha Phase Project introduces further Project Partners to support the future compression scenario development ensuring a whole systems approach.

This will be the basis for the compression strategy, Cost Benefit Analysis (CBA) and environmental assessment.

The technical demonstration is planned to be conducted at the FutureGrid site in Spadeadam, Cumbria and will provide a facility for any future work as an outcome of this Project, whilst enabling the facility to demonstrate further capability such as In-Line Inspection techniques and alternative metering systems.

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

A clear problem has been identified, in the opinion of the Expert Assessors, around the feasibility of repurposing existing compressor assets to work with different hydrogen blends. This was considered by the Expert Assessors to be an important topic to address if large amounts of hydrogen are to be injected into the National

Transmission System (NTS) cost effectively. This Project was therefore considered by the Expert Assessors to have addressed the whole system integration Innovation Challenge.

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

The Project seeks to evidence cost effective reuse of existing compressor assets against potential future options for hydrogen injection into the NTS. This was considered by the Expert Assessors to potentially reduce the cost of repurposing the NTS for hydrogen, thereby delivering a net benefit for energy customers through reduced costs, given the high cost of new compression systems.

Eligibility Criterion 3:
Projects must involve network innovation.

The Project involves network innovation as it was considered by the Expert Assessors as an underpinning enabler for widespread hydrogen transportation via the gas networks. Compressors are a key asset within the NTS and the Project considers potential development of compressor designs capable of working with 100% hydrogen.

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

The Project has engaged with a wide group of stakeholders, including a compressor manufacturer, and the Expert Assessors consider the Project to have met this Eligibility Criteria.

The Expert Assessors note there is only one compressor manufacturer in the Project and considered there to be a minor risk to the Project through a lack of clarity on how the Project will ensure the learnings and IPR from it are available to the wider market. However, the Project has not requested any separate IPR arrangements, which gave the Expert Assessors confidence that the default IPR arrangements are sufficient for the Project and the development of competitive markets won't be undermined by the Project. Additionally, to gain greater clarity on how the Project

will ensure the dissemination of the Project's learnings and the IPR, the Expert Assessors have recommended a Project-specific condition.

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

The innovation and novelty of this Project was considered by the Expert Assessors to be in the development of new compressors and/or compressor upgrade model designs for existing assets capable of working with high and variable hydrogen blends. This Project was considered by the Expert Assessors to be investigating an essential topic which will be needed prior to the use of higher hydrogen blends in the NTS.

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

The Project has engaged with a wide group of stakeholders including compressor manufacturers and was considered by the Expert Assessors to have met this Eligibility Criteria. However, as noted above, the Expert Assessors noted a concern with their only being one manufacturer being engaged in the Project as a Project Partner. Whilst this was seen as minor risk to the Project and not substantial enough for the Project to not be awarded SIF Funding or for it to have not met this Eligibility Criteria, the Expert Assessors have recommended the addition of a Project-specific condition to mitigate the risk.

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

The Project's costs have been costed competitively relative to the work structure proposed, in the opinion of the Expert Assessors. The distribution of costs also seem reasonable relative to the project complexity across the Project Partners. The costs set out for Project Partners was also seen by the Expert Assessors as being competitive.

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.

The Project has provided a clear plan and division of labour and costs in its Project plan which the Expert Assessors considered to be a robust methodology. The Expert Assessors also considered the Project plan to be ambitious for the Alpha Phase but it is nonetheless viewed as capable of progressing in a timely manner.

Regulatory barriers noted by the Expert Assessors
No

Recommendation to the Gas & Electricity Markets Authority
FUND

If hydrogen is going to be used in the NTS, then hydrogen compressors will be essential and will need to be proven in a UK context. Given the uncertainty associated with the role of hydrogen in the UK network (specifically the NTS in this case), it is difficult to assess the full path to business as usual. Nonetheless, assuming significant hydrogen is to be injected into the NTS, this Project considers the whole system aspects of the development of compressor technology with the potential to lead to a whole compressor train demonstration.

There is significant risk and innovation in the Project, consistent with the SIF's aims. The Expert Assessors noted there being only one compressor OEM engaged in the Project as weaker point the Application, and have added a Project-specific condition which seeks to mitigate this risk.

Recommended Project specific conditions

There is a concern from the Expert Assessors that the IPR generated could result in just the Siemens market position being dominant. To help mitigate this risk;

- (i) The allocation of Foreground IPR ownership needs to be addressed before the Project starts in the Alpha Phase.

- (ii) The outputs of the modelling in terms of asset trade-offs would need to be made available to other OEMs and not just to Siemens.

2.2.3 10036951, HyNTS Green Hydrogen Injection, Initial Net Funding Requested £355,149

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National Grid Gas Plc	£73,694	£50,000	£23,694
Element Energy Limited	£79,850	£14,525	£65,325
Scottish Hydro Electric Transmission Plc	£8,430	£0	£8,430
CNG Services Limited	£273,440	£43,140	£230,300
Centrica Energy (Trading) Limited	£27,400	£0	£27,400

Submitted Project description
This Project aims to establish a technical regime for injection of green hydrogen (made by electrolysis using renewable electricity) into the National Transmission System (NTS), displacing fossil gas. This process is a key 'whole system' development that reduces carbon emissions and helps on the journey to Net Zero. At present, there is no regime for injection of hydrogen because of the specification allowed by Gas Safety Management Regulation (0.1%). Blending hydrogen into the NTS avoids issues associated with calorific value that apply for hydrogen injected into the gas distribution network. The NTS connections regime is established for large entry and exit loads which Project CLoCC and the Somerset Farm biomethane project have recently improved to enable lower cost and shorter timeframes for smaller connection projects. The team consists of CNG Services, National Grid Gas PLC (GT&M), Element Energy, Centrica and Scottish and Southern Electricity Networks (SSEN). The Project Partners have a wealth of experience relevant to Hydrogen injection into the NTS

and the Project will be focused on three key workstreams:

1. To establish a technical regime for green hydrogen injection into the NTS. This builds upon experience gained from the biomethane industry including the EMIB (Energy Market Issues for Biomethane Projects) deliverables from 2012 and the Somerset Farm Biomethane NTS project as part of NGG's CLoCC (Customer Low Cost Connection Innovation) project.
2. Whole system integration. Develop models of potential system configurations, including RES-H2 (where RES is wind, solar and batteries) and Grid-H2. The Project will review an NTS feeder close to the SSEN electricity transmission grid in Scotland to establish scenarios of constrained and abundant electricity being converted into hydrogen and blended in the NTS.
3. Review of the economics of green hydrogen production and injection into the NTS to inform the development of appropriate financial incentives. The team will utilise their experience of modelling the costs of hydrogen production via electrolysis using electricity from directly connected renewables, as well as systems using grid electricity, including the availability of curtailed wind.

The initial pilot should help establish the technical regime and give confidence to the HSE and stakeholders that blending Green Hydrogen into the NTS is both feasible and deliverable. The Project will stimulate growth, so that further projects can be installed as business as usual, and will support balancing green Hydrogen, injected to supply a number of difficult to electrify industrial customers.

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

This Project could help to unlock multiple green hydrogen production sources for future injection into the National Transmission System (NTS). By capturing power that otherwise could be curtailed, this Project takes a systems approach. The Expert Assessors consider that the Project involves risk and innovation, as the whole system impact is not guaranteed and will be determined by the role of hydrogen and the future role of the NTS. The Expert Assessors considered the Project as having fulfilled this criteria for these reasons.

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

The Project proposes to develop a regime that could help to turn otherwise unused electricity generation into gas for use by consumers, thereby delivering a net benefit to gas consumers through a potential reduction in gas costs. The Expert Assessors however noted that this solution depends heavily on the ability to drive down hydrogen production costs and scaling up of the solution, and would require funding outside of subsidies for this to implemented at scale. The benefits identified by the Project also depend on the development of the UK hydrogen strategy. The Expert Assessors noted as well that the Project did not fully analyse the whole lifecycle carbon implications of the solution proposed. For these reasons, the Expert Assessors did not see the Project as having met this criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

Network innovation was considered by the Expert Assessors to have been addressed by the Project because it is generating evidence to support raising the percentage of hydrogen allowable into the NTS, and unlocking value of assets where there is a constrained electricity grid without undertaking additional reinforcement.

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

With the necessary and corresponding policy and regulatory changes on hydrogen needed for this Project to be implemented, this Project could be considered by the Expert Assessors to have the potential to open up market participation to multiple small and medium scale hydrogen producers. The size of the market however is dependent on the Gas Safety Management Regulations (GSMR) limits and locational aspects of the demonstration and subsequent scale up.

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

The Expert Assessors noted the high policy, regulatory and market risks for the Project. Technically, the Project was considered by the Expert Assessors to be at a relatively high technology readiness level (TRL) and not necessarily innovative. However, they considered there to be value in demonstration activities to generate

evidence for investors and policy makers. The Expert Assessors considered this Project to have needed to demonstrate greater thought on how evidence is developed and disseminated from the Project.

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

There is good participation from a range of stakeholders from a technical perspective, but greater engagement with investors was seen by the Expert Assessors as a key missing aspect in the Application. This lack of investor engagement or participation in the Project was seen by the Expert Assessors as a crucial missing stakeholder in the Project. Having investment engagement or participation in the Project would have helped the Application in evidencing the 'investability' and the scale up potential of the solution.

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

The Project is starting small, and does not have a clear trajectory for cost reduction and delivering value to consumers without outside funding. The Project needs to go beyond market incentives and show a pathway to be commercially viable. Due to the costs associated with proposed Project without outside investment, it was not considered by the Expert Assessors as providing value for money or being costed competitively.

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.

The Project is well thought out giving confidence that it will be capable of progressing in a timely manner, because of how it is currently scoped and structured. However, the scale of ambition is lower than expected by the Expert Assessors to achieve the ultimate outcomes of implementation without subsidies. As noted above, the lack of engagement with outside funding or investment mechanisms was seen by the Expert Assessors as a key missing component of the Application which presented significant risk to the Project.

Regulatory barriers noted by the Expert Assessors

YES
Currently networks are limited to 0.1% hydrogen injection.

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The Expert Assessors considered the case to fund this Project to be marginal. While there are potential system benefits, the key concern noted by the Expert Assessors was the limited value for money the Project represents for implementation without subsidies. This included questions over whether the Project can significantly progress the green hydrogen sector and, given the lack of a clearly described pathway to a subsidy free business as usual rollout, the eventual cost implications for consumers. At this stage, it is not clear what the role for green hydrogen in the energy system will be. This could range from a large-scale displacement of much of today's natural gas usage at one extreme, to a niche, relatively expensive resource for hard to decarbonise applications at the other. As such, the progression to business as usual for this Project is very difficult to assess with the Project plan and materials provided by the Project. Nonetheless, there is value to the system in defining the regime for green hydrogen injection into the NTS at multiple points. There is therefore potentially material learning from this Project for policy makers and investors, subject to the proposed special conditions being addressed. With further development the Project is viewed as having potential for progressing constructively to later phases. The Project did not clearly articulate how this Project would deliver net benefits to consumers against other hydrogen innovation funding across SIF, NIC and NIA.

2.2.4 10036958, Asset Reuse and Recovery Collaboration (ARRC), Initial Net Funding Requested £422,935

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
SP Transmission Plc	£137,390	£13,739	£123,651
Frazer-Nash Consultancy Limited	£164,846	£16,485	£148,361
Scottish Power Renewables (UK) Limited	£13,500	£13,499	£1
AECOM Limited	£129,280	£12,928	£116,352
SP Distribution Plc	£23,895	£2,390	£21,505
Scottish Hydro Electric Transmission Plc	£13,065	£0	£13,065

Submitted Project description
The Asset Reuse and Recovery Collaboration (ARRC) Project will develop novel solutions to an industry wide problem of sustainably procuring and managing high value assets. Opportunities and challenges will be identified to extend the lifespan of infrastructure assets creating a paradigm shift from linear asset management to circular solutions, resulting in cost and carbon savings across the life cycle of major energy infrastructure which will result in a net saving to the consumer. The end result will look like a suite of evaluated and proven methodologies and standards to be adopted across the energy industry and beyond. This will see a reduction in the environmental impact of the energy industry through the life extension of assets, utilising practices such as refurbishing, repairing, retrofitting, remanufacturing, repurposing, and resource exchange. By considering whole life use, our approach will ultimately reduce duplication and excessive variation of assets. This will reduce virgin material use, carbon and cost

for the energy sector, reduce costs to consumers, and positively impact on wider targets around net-zero transition.

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

The Project was considered by the Expert Assessors to have addressed the whole system integration Innovation Challenge by reducing embedded carbon in the energy networks sector and shifting the sector from a linear to a circular model in terms of asset use.

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

From a high-level, Expert Assessors saw the benefit being potentially delivered as cost reductions by keeping materials in the sector for longer and avoiding the need for new products for a longer time. However, the Expert Assessors also noted the Project did not clearly articulate how the Alpha Phase will build towards the deployment of the Project and consideration for how the Project will prepare, test and develop workable businesses model for uptake of this approach. The environmental benefit case was also considered to require more analysis as it does not currently point to a net positive output. Therefore, the Project has not sufficiently identified a clear potential to deliver a net benefit to electricity consumers.

Eligibility Criterion 3:
Projects must involve network innovation.

The Project was considered by the Expert Assessors to demonstrate network innovation through the reuse of assets across the network which would otherwise be retired or unusable, and demonstrates the potential to extend its learnings to other non-energy sectors.

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

The Project was not considered by the Expert Assessors to undermine the development of competitive markets and instead has potential to improve

competitiveness of markets by challenging established models of asset use and reuse, and removing barriers to efficiency improvements.

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

The Project takes a whole system approach to the reuse and recovery of assets in the energy network sector. There are no circular economy principles established on this scale in the energy network sector, with the only examples of these principles being within limited and isolated examples. The Expert Assessors considered this Project to be innovative, novel and risky. Furthermore, the Expert Assessors also noted that, in order for the Project to be successful, it would need a number of regulatory interventions for market change and will need participation from a wide range of industry stakeholders and the sharing of data, for instance, health of assets and embedded carbon, some of which may not exist today.

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

To be successful, the Expert Assessors thought the Project will need active participation of supply chain participants as Project Partners in the consortium beyond engagement of an industry trade association. The Expert Assessors viewed this as a key weakness in the Project and that, in their view, the Project fell short in participation from the range of key stakeholders. Therefore the Expert Assessors did not see the Project as having met this criteria.

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

There are concerns that the scope presented is not consistent with the costs, such as in the areas of the carbon tool, where primary development activity is not planned. More broadly, in the Expert Assessor's opinion, the Project did not provide sufficient detail under the work packages relative to the monies requested. In the opinion of the Expert Assessors, the Project was therefore found to not deliver value for money and is not costed competitively.

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.
The Project clearly has an important rationale, but it has not established in sufficient detail that it can be delivered in a timely manner. The Expert Assessors recognise that this is a very complex area with many moving parts, and furthermore one which could have a significant impact in the sector. The Project team may consider developing the proposal fuller for submission in future rounds of the SIF. In the opinion of the Expert Assessors, the Project did not have a robust methodology to facilitate a timely progression.

Regulatory barriers noted by the Expert Assessors
No

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The proposal is very strong on vision but weak on the delivery model as it did not clearly articulate how the Alpha Phase will build towards the deployment of the Project and consideration for how the Project will prepare, test and develop solutions for this Project. The Project did not provide a clear and robust methodology as to how the Project was going to progress and address regulatory barriers to ensure successful roll out of the Project. Industry standards must support supply chain engagement to create positive momentum. In the opinion of the Expert Assessors, the Project did not demonstrate participation from a range of stakeholders as there was no participation from the supply chain. This was seen by the Expert Assessors a critical weak point in the Application and one which represented significant risk for the Alpha Phase. Overall, the Expert Assessors view the Project's Alpha Phase Application as lacking the necessary details on how the Project will build towards the deployment of the Project and consideration for the Project will prepare and test models for uptake of this Approach, a key aspect of the Alpha Phase.

2.2.5 10037143, INCENTIVE – Innovative Control and Energy Storage for Ancillary Services in Offshore Wind, Initial Net Funding Requested £380,606

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Scottish Hydro Electric Transmission Plc	£142,356	£14,236	£128,120
University of Strathclyde	£83,295	£4,000	£79,295
National Grid Electricity System Operator	£10,936	£0	£10,936
The Carbon Trust	£258,821	£96,566	£162,255

Submitted Project description

With the urgent need for decarbonisation, the capacity of offshore wind is planned to increase dramatically. Innovation is required to facilitate the rapid roll-out of this non-synchronous generation and stability challenges that the existing synchronous generator-dominated system inherently avoids. Without new solutions, the GB grid will become weaker, which will lead to issues in system operation. These issues include:

- increasing the likelihood of severe instability events (such as the 9 August 2019 black-out event);
- increasing the need for imported energy, due to slower, more costly deployment of UK renewable generation and increased curtailment of operational UK renewable generation; and
- maintaining reliance on synchronous fossil fuel generators on stand-by with exposure to fuel cost volatility.

All of these will lead to price increases for GB energy consumers and slowing down the energy transition, leading to adverse impacts on the environment. This creates an opportunity for the GB energy industry and ultimately consumers.

Throughout 2021, previous work was carried out in the Offshore Wind Accelerator (OWA) programme, the "BAT-STAT" project. It hypothesised that there is an

opportunity to enable offshore wind farms to play a role in stabilising the GB network through the use of innovative solutions that provide voltage, current and frequency control to the grid. Implementing these solutions will require simultaneous technical, regulatory, commercial and market innovation.

The Discovery Phase of INCENTIVE confirmed this hypothesis from the previous work and has identified a wide range of "INCENTIVE solutions" which can be used. These are listed below, and are being studied at the point of connection (the onshore substation) of an offshore wind farm to the grid:

- grid-forming battery energy storage systems;
- grid forming STATCOM (including super capacitor energy storage);
- synchronous condenser;
- HVDC terminal.

However, the Discovery Phase has found that commercial and technical risks remain that need to be addressed in the Alpha Phase and Beta Phase.

INCENTIVE aims to seize the opportunity by studying and demonstrating how these innovative INCENTIVE solutions can allow offshore wind farms to provide stability services to the grid. INCENTIVE will continue to address the commercial and technical risks discovered in the Discovery Phase. Doing so will help to accelerate the fast-paced roll-out of offshore wind in GB to support delivery of the energy transition at best value to the consumer.

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

Providing inertia services to the grid from non-synchronous generation will become increasingly important for the energy system. This Project addresses the whole system integration Innovation Challenge by exploring solutions to deliver this from offshore wind farms by integrating new technology. Delivering such solutions poses regulatory, policy as well technology challenges which the Project aims to address.

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

The Project proposes to increase security of supply by managing network instability events that otherwise could cause blackouts give the replacement of fossil fuel generators that currently provide these support services. There is also a benefit of avoiding capex and opex (and reducing electricity system carbon intensity) by reducing the use of these fossil fuel generators to provide system stability services. The Project therefore has potential to deliver a net benefit to electricity consumers.

Eligibility Criterion 3:
Projects must involve network innovation.

The Project was considered by the Expert Assessors to involve network innovation because it challenges the current location and ownership strategy of assets and the ability of Off Shore Wind (OSW) generators to provide network inertia services.

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

The Project team are engaging with a wide selection of stakeholders including offshore wind developers via the Offshore Wind Accelerator (OWA) via Carbon Trust, and a range of equipment manufacturers. The Project is also helping to bring forward new solutions to support current and new system stability markets that does not exist currently in GB. The Expert Assessors did not consider this Project to be undermining the development of competitive markets.

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

The Project introduces new actors, technologies and business models into the market segment of system stability services via technologies connected to offshore wind farms, where there are sufficient commercial and regulatory risks. In the opinion of the Expert Assessors, the Project is both innovative and risky.

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

The Project includes participation from a suitable range of stakeholders, in the opinion of the Expert Assessors. The Expert Assessors noted positively the wide selection of stakeholders including in the Project, including offshore wind developers via the Offshore Wind Accelerator (OWA) via Carbon Trust. The Expert Assessors also noted the Project's Application would be strengthened with closer relations with the OEMs, but this was seen as a minor risk to the Project. The Expert Assessors have however included a Project-specific condition to help mitigate the risk from this during the Alpha Phase.

Eligibility Criterion 7: Projects must provide value for money and be costed competitively.
The Expert Assessors have no concerns regarding the budgets and costings of the Project. The Project's costs and distribution of costs to Project Partners was seen by the Expert Assessors as providing value for money and being costed competitively. The level of developers' contributions contributed to the Project providing value for money.

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.
The Expert Assessors considered the Project plan to be sufficient and within the scope of Alpha Phase and considered it to be a sufficiently robust methodology. The Expert Assessors have confidence that the Project will be capable of progressing in a timely manner in the Alpha Phase. The Expert Assessors also noted that the Project's Application would have benefited from clearer information on how the Project is preparing and testing different solutions ahead of any large-scale demonstration.

Regulatory barriers noted by the Expert Assessors
YES
Clarification of asset classification of those options analysed and treatment of them under current regulatory frameworks needs to be sought.

Recommendation to the Gas & Electricity Markets Authority
FUND

Overall the Expert Assessors consider this Project to be ambitious, with a good range of stakeholders. The scope is wide ranging and, given this, there is a risk that it may be difficult to ensure a clear outcome for the Beta Phase and beyond. The Expert Assessors also found that, due to the time pressure for this solution, the Project team bring a focus on how the Project can influence the next tranches of offshore wind development during the Alpha Phase.

Recommended Project specific conditions

By the end of the Alpha Phase the Project needs to have;

- Delivered a clear, credible and bought in route to influence the next round of offshore wind auctions- in particular, how this integrates with the system and regulatory recommendations and commercial models for providing the right stability services
- A commercial commitment from at least one developer (with conditions) to implement a pilot on the recommended solution.

2.2.6 10037410, CrowdFlex, Initial Net Funding Requested £499,919

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National Grid Electricity System Operator	£75,978	£18,500	£57,478
Western Power Distribution Plc	£10,248	£1,025	£9,223
Octopus Energy Limited	£73,750	£7,960	£65,790
Element Energy Limited	£222,400	£56,050	£166,350
Southern Electric Power Distribution Plc	£5,320	£532	£4,788
Ohme Technologies	£59,500	£5,950	£53,550
Centre for Net Zero Limited	£159,000	£16,260	£142,740

Submitted Project description

CrowdFlex is a study to understand the role domestic flexibility can play in addressing the system challenge of decarbonisation. As more VRE and 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, reduce stress on the system, while reducing consumer energy bills via new tariffs and incentives. The objective of CrowdFlex is to establish domestic flexibility as a reliable energy and grid management resource, providing it alongside BAU solutions such as network reinforcement or new thermal capacity.

Currently, flexibility services are procured deterministically, contracting a firm capacity, reflecting the operation of large thermal generators. However, domestic flexibility is inherently stochastic. Therefore, to participate in flexibility services, declaring a firm capacity means a derating of its potential flexibility capacity. This leads to lost flexibility and the need to over procure to ensure delivery. CrowdFlex will investigate the potential advantages of moving to a novel innovative method of procuring flexibility stochastically, via a Probability Distribution Function. This will be reflected in a spectrum approach to flexibility services. CrowdFlex will investigate how domestic flexibility can be rolled-out in the near term through deterministic flexibility services, helping accelerate decarbonisation and minimising costs, while

also developing pathways to introduce stochastically procured flexibility services, unlocking more value for the whole system.

CrowdFlex aims to conduct a large-scale trial in parallel to developing a methodology to model domestic flexibility. A trial will be essential to fully understand the potential of domestic flexibility and its technical capability to deliver flexibility services. A model of domestic demand and flexibility is necessary to forecast baseline demand and the availability of assets to offer flexibility services. This will be part of the VirtualES ecosystem, improving demand-side visibility and so the operational and planning activities of ESO and DNOs.

If successful, CrowdFlex has the potential to deliver value across the energy system. Enabling ESO and DNOs to utilise domestic flexibility to reduce operational costs (namely constraints, reserve, 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.

The Project was considered by the Expert Assessors to address the whole system integration Innovation Challenge as it intends to unlock domestic capacity to support flexibility services across the whole energy system, particularly in response to the rapidly increasing electrification of domestic heat and transport.

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

There is potential avoidance of network infrastructure costs as well as payment for flexibility services to consumers, via a potentially novel and changing stochastic approach. These postulated benefits could be very significant to consumers, however this depends on the construction a robust value chain. In the opinion of the Expert Assessors, the Project identifies a potential to deliver a net benefit to electricity consumers through the reduction of costs via the avoidance of network infrastructure costs, and the potential creation of payment to consumers for flexibility services.

Eligibility Criterion 3:
Projects must involve network innovation.

The Project could offer a new source of flexibility (domestic loads) to Distribution Network Operators and the Electricity System Operator (ESO), in the opinion of the Expert Assessors. It is developing novel stochastic approaches to enable new sources of flexibility such as domestic demand side response to participate in flexibility markets. It is therefore considered by the Expert Assessors as involving sufficient network innovation.

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

The Project would introduce new sources of flexibility into the market and thus could improve overall market competition. It is also developing an approach for new flexibility services to be procured stochastically which will further increase competition. The Expert Assessors also noted the importance of the ESO to ensure that the demand and flexibility modelling results be made available to all appropriate market players, including aggregators, to offer services. This was however viewed by the Expert Assessors as being a minor concern for the Alpha Phase and they considered this Project to have met this Eligibility Criteria.

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

The Project is fully whole systems (network, generation and system operation) and the consideration of the stochastic nature of consumer behaviour to unlock domestic flexibility is innovative, novel and risky.

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

The Expert Assessors considered it innovative in itself to bring together the proposed range of stakeholders (ESO, suppliers, flexibility developers and network operators) across to address the Innovation Challenge. The Project Partners were seen by the Expert Assessors as being sufficient for the technical elements of the Alpha Phase.

As the Alpha Phase of the SIF is focused on experimental development ahead of any future large-scale demonstration of the Project, the Expert Assessors recommend

the Project engage with additional expertise around consumer behaviour and trial design. This could include, for instance, Energy Systems Catapult, the BEIS Smart Energy and Behavioural Insights Teams (BIT). This was by the Expert Assessors as an immaterial risk for the Alpha Phase and the Expert Assessors have recommended a Project-specific condition to mitigate this risk.

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

The Expert Assessors considered the Project costs and the costs of Project Partners to provide value for money and being costed competitively. The Expert Assessors also noted positively the greater than 10% contribution across the Project Partners, which was seen as also providing value for money. Therefore, the Project was assessed by the Expert Assessors as 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.

The Expert Assessors considered the Project to have a robust delivery methodology as a whole and had confidence that the Project will be capable of progressing in a timely manner.

As noted above, the Expert Assessors recommended the Project engage with additional expertise around consumer behaviour and trial design during the Alpha Phase. The Expert Assessors also recommended the Project engage with direct consumer engagement segments, including vulnerable groups, to feed into trial design. Both of these recommendations were viewed by the Expert Assessors as being minor risks to the Project in the Alpha Phase, and the Expert Assessors have recommended Project-specific conditions to help mitigate these risks.

Regulatory barriers noted by the Expert Assessors

NO

Recommendation to the Gas & Electricity Markets Authority

FUND

The proposal is viewed by the Expert Assessors as an ambitious and wide ranging Project which could bring significant whole system value and has clearly identified potential to deliver a net benefit to gas or electricity consumers. A robust Project plan and methodology were presented alongside the involvement of appropriate stakeholders.

Some concerns exist that the voice of the consumer should be integrated early in the trial design, and should therefore be considered within the Alpha Phase. The Project also needs further and clear justification on the need for a statistical approach and which specific cases warrant this. This element should become clearer during the Alpha Phase delivery and certainly before the Beta Phase.

Recommended Project specific conditions

- During the Alpha Phase the Project must carry out direct consumer engagement considering different segments, including vulnerable groups to feed into trial design.
- Before the start of the Alpha Phase, provide clarification of which organisation has the responsibility to engage consumers during Alpha, and the scope of this work
- Recommend the Project during the Alpha Phase engages with ESC and the Smart Systems team at BEIS to seek input on how best to engage consumers in the trial.

2.2.7 10037752, SEGIL – Sustainable Electrical Gas Insulated Lines, Initial Net Funding Requested £413,028

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National Grid Electricity Transmission Plc	£50,004	£16,300	£33,704
The University of Manchester	£115,000	£0	£115,000
Frazer-Nash Consultancy Limited	£164,712	£16,471	£148,241
J. Murphy & Sons Limited	£80,080	£0	£80,080
National Gid Electricity System Operator	£7,286	£7,285	£1
SP Transmission Plc	£2,655	£2,654	£1
3M Deutschland GmbH	£4,300	£4,299	£1
Grid Solutions SAS	£36,000	£0	£36,000

Submitted Project description

The UK Government's commitment to Net Zero 2050 is driving significant changes

in GB energy systems:

- Increased renewable generation -- The UK government have committed to deliver 40GW of offshore wind capacity by 2030, including several developments off the East Coast where the transmission network is underdeveloped for the expected connection capacity requirement.
- Decarbonisation through electrification of heat and transport -- This will significantly increase the demand for electricity, particularly in densely populated areas.

Addressing this requirement for increased capacity for electricity transmission

from coastal areas to urban centres will require more efficient, resilient, cost

effective and rapidly deployable solutions than are currently available. Despite

radical grid advancements elsewhere, the core transmission technology (high-capacity HV overhead lines (OHL)) has remained largely unchanged for decades.

The visual impact of OHLs and their impact on wildlife lead to public opposition

and difficulties obtaining planning consents, particularly in the coastal areas of interest for offshore wind transmission capacity. Underground HV cables (UGC) are another currently available transmission technology often used instead of OHLs however they have their own challenges of cost of construction and the time required to reinstate a faulted circuit in a buried asset.

Without alternative technologies to conventional OHLs the required capacity to achieve Net Zero 2050 may not be deliverable to urban centres in time to accommodate fast-growing demand.

Our proposed innovation is the use of Gas Insulated Lines (GIL) as a technology for long-distance cross-country transmission. GILs have some potential benefits over the two conventional technologies mentioned above (higher power transmission than an OHL and less construction work for a UGC of the same power level), however for our proposition to represent a viable solution an alternative insulating gas to the currently used SF6 must be identified and its efficacy and whole system viability demonstrated. A GIL utilising an alternative, more environmentally friendly insulating gas is termed a Sustainable Electrical Gas Insulating Line (SEGIL).

The key aim of this Project is to develop the technology readiness of GIL solutions in order to increase EPC confidence and capitalise on learning rates to drive down technology costs. During the Alpha Phase, this Project aims to address the existing technological challenges to the use of SEGILs for the proposed application, deliver a FEED study for the construction of a cross-country SEGIL system, develop a detailed investment case for a SEGIL grid installation and to design a field demonstrator of a SEGIL.

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

The proposal looks at the need for new high power capacity solutions delivered via Gas Insulated Lines (GILs) as an alternative to over-head lines. This will increasingly be a key challenge as the network expands and integrates a greater capacity of renewables. The scope of this Project was seen by the Expert Assessors as meeting the whole system integration Innovation Challenge.

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

While there were several benefits suggested with a range of uncertainties, the Application did not clearly articulate in the opinion of the Expert Assessors what specific benefit would be achieved for consumers and what metrics would be used to be capture these. The benefits case is also not whole systems (e.g. SF6 replacement benefits), but restricted to a potential reduction in civil works compared to Underground HV Cables (UGC).

Eligibility Criterion 3:
Projects must involve network innovation.

Adoption of gas insulated lines using sustainable gas mixes, could provide an alternative to overhead lines and underground cables used by electricity networks in certain conditions, and, in the Expert Assessors' opinion this constitutes network innovation.

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

As the Project's focus is on technology innovation, it would benefit the competitiveness of energy markets by providing another solution for network development. This Project's focus on developing an alternative to the currently used SF6 also represents the potential to stimulate the market for SF6 alternatives in other applications.

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

The technology is innovative from the perspective of using SF6 alternatives and using it in a novel/different environment. However, the Expert Assessors considered there to be a lack of justification as to level of innovation, novelty and/or risk in the Project. The Expert Assessors did not consider the Project to have provide enough of a justification for the Project to have met this Eligibility Criteria, or whether the Project should be considered under business as usual research. 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.

The Expert Assessors viewed the proposal as having suitable participation from a range of stakeholders. While there was one alternative gas manufacturer in the bid, this could have been stronger given the importance of SF6 alternatives to the proposal and also to unlock wider system or environmental benefits.

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

The Expert Assessors had no concerns regarding the costs of the Project. However, the Project did not provide a sufficiently detailed benefits case against the counterfactual of doing nothing, which was seen by the Expert Assessors as being a crucial missing aspect of determining whether the budget allocated for the Project provided value for money and was costed competitively. Therefore, in the opinion of the Expert Assessors, the Project was not seen as having fulfilled 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.

The Project method focuses mainly on the technology aspects and not so much on the system integration and the subsequent benefits realisation. The Expert Assessors therefore found that this Project did not deliver a robust enough methodology for the Alpha Phase.

Regulatory barriers noted by the Expert Assessors

NO

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
It is important to better understand alternative high power capacity connection for offshore wind and other use cases in a changing energy system. This Project focusses on one specific technology solution that may be valuable along with a number of others. In the opinion of the Expert Assessors, the Project's Application did have several weaknesses. The benefit case for gas insulated lines and the potential net benefit for electricity consumers was not clearly articulated. The Application also did not sufficiently outline whether it is innovative, novel or risky in its Application for the Expert Assessors to have considered the Project to have met Eligibility Criteria 5.. This also made it difficult to assess the value for money being delivered by the Project.

2.2.8 10037761, SCADENT – SuperConductor Applications for Dense Energy Transmission, Initial Net Funding Requested £449,000

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National Grid Electricity Transmission Plc	£50,004	£24,004	£26,000
University of Strathclyde	£84,986	£0	£84,986
The University of Manchester	£43,920	£0	£43,920
Frazer-Nash Consultancy Limited	£164,712	£16,471	£148,241
Western Power Distribution Plc	£7,500	£7,499	£1
UK Power Networks (Operations) Limited	£15,351	£0	£15,351
SP Transmission Plc	£2,124	£2,123	£1
Nexans France	£110,500	£0	£110,500
AMSC	£20,000	£0	£20,000

Submitted Project description
Policy Context: Achieving the UK's Net-Zero ambition, articulated in the Government's Energy White Paper (2020) and Net Zero Strategy (2021), will require the widescale electrification of heat and transport. This will mean substantially increased demand for electricity by 2050, particularly in densely populated urban environments. Infrastructure Challenge: The primary policy focus has been the generation of clean electricity to meet anticipated increase in demand. However, the network infrastructure required to connect that generation to centres of demand will be equally important. Without developing innovative infrastructure solutions, there is the possibility that Net Zero will be constrained by the grid's lack of capacity. Problem: Much of the existing electricity network consists of ageing technology which is difficult to reinforce due to physical limitations and constraints (particularly

in urban locations) and may not be able to deal with the level of capacity that electrification of heat and transport will demand. There are a number of key challenges:

- Cost and time: Conventional reinforcement methods for urban electricity networks are often costly and time-consuming due to the extensive civil engineering, land use permits and cost required.
- Capacity: Conventional reinforcements may not be able to deliver the required capacity and build out speeds needed to accommodate fast charging of electric vehicles, expected by consumers and stakeholders.
- Efficiency: Current cabling solutions have relatively high-resistance, leading to energy losses which require more energy (and peak power) generation to meet consumer demand.
- Environmental: The thermal footprint of conventional cables and their emission of electromagnetic fields (EMFs) can impact on habitats and surrounding infrastructure along the cable route.

SCADENT Solution: Upgrading the electricity network infrastructure will be required to increase capacity. There is the opportunity for innovative deployment of emerging technologies that are able to reduce disruption, costs, and time.

This Project proposes the innovative deployment of High Temperature Superconductor (HTS) cable technology to increase network capacity in the urban environment. It will require technology innovation to drive down cost, deployment innovation to reduce Engineering, Procurement and Construction (EPC) risk, and operation and maintenance (O&M) innovation to allow continued support of the novel cable technology.

Compared to conventional alternatives, superconducting cables have three to ten times higher power density, meaning they deliver higher capacity at lower voltage levels and via a lower number of routes. This will allow faster network capacity increase, delivering time, cost, and carbon savings. HTS technology can also deliver reduced energy losses and environmental benefits.

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

The Project addresses the whole system integration Innovation Challenge as it has potential to increase network capacity, particularly in urban areas with reduced disruption associated with network infrastructure upgrades.

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

The Project could show reduced cost relative to conventional cabling solutions, especially in the context of increasing electricity demand with a smaller footprint as part of the energy transition. It also addresses potential infrastructure barriers around having sufficient build out in time to connect increased electricity demand and supply in line with net zero goals. Both of these represent net benefit to electricity consumers. The Expert Assessors consider that this Project therefore demonstrates a potential to deliver net benefits to electricity consumers.

Eligibility Criterion 3:
Projects must involve network innovation.

The Project may enable increased capacity to be built in urban areas. It will provide important experience of using, integrating and operating super-conducting technology within UK power systems. The proposed Project involves network innovation as it goes beyond existing applications of HTS in Europe by going to higher voltages and running longer cable lengths.

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

The Project may support introduction of a new solution with potential to increase competition for network development and reinforcements in urban areas. In the opinion of the Expert Assessors, the Project does not therefore undermine the development of competitive markets.

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

The Expert Assessors see the Project as innovative as High Temperature Superconductor (HTS) cables have not been used previously in UK energy networks and there are several areas of application engineering that need to be developed for

this to be implemented. These may include cable jointing, current capability of cables, and their length and fault current management, as examples.

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

The proposal presents participation from a range of networks (both transmission and distribution) and cable experts. The addition of Nexans and AMSC as Project Partners further strengthen the consortium. Whilst the Project would additionally benefit from an installation sub-contractor, this was seen as a minor risk and the Project was seen by the Expert Assessors having a sufficient range of stakeholders.

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

In the opinion of the Expert Assessors, the Project provided value for money and was costed competitively as outlined in the Project plan. The Project costs and split of funding requested by Project Partners was also seen by the Expert Assessors as providing value for money and being costed competitively, and being appropriate for the role and scope of the Project Partners in the Alpha Phase. The Expert Assessors noted a minor risk to the Project with the budgets providing in the Application, noting some costs for the work package weren't clearly outlined as to whether they are receiving SIF Funding. Due to this, the Expert Assessors have recommended a Project-specific condition to help mitigate this risk.

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.

The interview presentation answered a number of ambiguities in the written proposal. This made it clear that the team will work with DNOs during the Alpha Phase to evidence robustly if there is a meaningful application, with a quantified view of the likely market size. This was seen by the Expert Assessors as clearly being within the scope of the Alpha Phase of the SIF. In the opinion of the Expert Assessors, the Project provided a robust methodology which gave them confidence that the Project will be capable of progressing in a timely manner.

Regulatory barriers noted by the Expert Assessors

NO

Recommendation to the Gas & Electricity Markets Authority
FUND
This Project could potentially be a valuable new technology to be deployed within the electricity grid, particularly as demand increases in urban areas. The Expert Assessors decision to recommend the Project for SIF Funding was a marginal decision. Whilst the Expert Assessors saw the Project as meeting the Innovation Challenge and the Eligibility Criteria above, the material need for the solution within the whole energy system is yet to be established. In the opinion of the Expert Assessors, this needs to be evidenced during the Alpha Phase. This would likely require deeper engagement with DNOs to establish realism of the material need for the solution and quantity or market size of applications in the UK. The Expert Assessors have recommended several Project-specific conditions to help mitigate the risks presented by the Project.

Recommended Project specific conditions
• The Project team need to demonstrate active work with DNOs during the Alpha Phase to evidence robustly as to whether there is a meaningful application of the solution, along with a quantified view of the likely market size and the associated whole system benefits. • The Project continues to evaluate the technology against counterfactuals including cooled copper cabling and others, and demonstrates this within their end of phase reporting. • The Project re-evaluates and resubmits budgets ahead of Alpha Phase commencement for UKRI and Ofgem approval, as it is not clearly outlined which of the work packages are receiving SIF Funding. • Prior to mid-Project Phase progress report, the Funding Party must provide to Ofgem and Innovate UK an explanation of the target use cases for this Project and how the technology developed as part of this Project could support these use cases.

3. SIF 2021 Round 1 Alpha Phase – data and digitalisation

3.1 SIF Alpha Phase – data and digitalisation - Summary

This section covers the assessment of eligible round 1 Alpha Phase Applications received into the data and digitalisation Innovation Challenge[7].

For the Alpha Phase, 11 proposals were submitted to Innovate UK through the Innovation Funding Service (IFS) portal by the closing deadline of 11am 18th May 2022 and are listed below. All submitted Applications were considered to have met the Innovation Challenge requirements for the Data and Digitalisation Innovation Challenge and have been assessed by the Expert Assessors.

For information on the scope of the data and digitalisation Innovation Challenge and the Discovery Phase Applications and assessments please see the recommendations report from the Discovery Phase[8].

3.2 Evaluation of evaluation of Applications

Project reference number	Project name	Funding licensee	Total eligible costs (£)	Total Project contribution (£)	Total SIF Funding requested (£)	Recom-mended for funding (Yes/N
10036952	HyNTS Pipeline Dataset	National Grid Gas PLC	£632,759	£178,669	£454,090	Yes
10036953	HyS Metering and Gas Analysis	National Grid Gas PLC	£547,351	£55,287	£492,064	No
10036957	Gas System of the Future – Digital Twin	Southern Gas Networks PLC	£847,123	£352,198	£494,925	Yes
10037305	Virtual Energy System	National Grid Electricity System Operator Ltd	£560,583	£60,684	£499,999	No
10037368	Thermal Imagery Analysis	Northern Gas Networks Ltd	£525,075	£55,719	£469,356	Yes

[7] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-innovation-challenges
[8] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-discovery-projects-approved-funding

10037416	Intelligent Gas Grid	Southern Gas Networks PLC	£601,426	£110,351	£491,075	Yes
10037420	Predictive Safety Interventions	Southern Gas Networks PLC	£498,618	£87,532	£411,086	Yes
10037439	Eye in the Sky	National Grid Electricity Transmission PLC	£439,949	£44,180	£395,769	Yes
10037451	Predict4Resilience	SP Transmission PLC	£617,235	£117,236	£499,999	Yes
10037488	Smarter homes for a smarter energy future	National Grid Networks Ltd	£362,559	£0	£362,559	No
10037690	Digital Platform for Leakage Analytics	Cadent Gas	£495,134	£49,563	£445,571	Yes

3.2.1 10036952, HyNTS Pipeline Dataset, Initial Net Funding Requested £454,090

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National Grid Gas Plc	£108,890	£50,000	£58,890
Cadent Gas Limited	£5,450	£0	£5,450
Rosen (UK) Limited	£510,169	£128,669	£381,500
XOSERVE Limited	£8,250	£0	£8,250

Submitted Project description
The aim of this Project is to develop the tools and processes to determine the state of National Transmission System (NTS) and Local Transmission System (LTS) pipelines, and their capability to carry Hydrogen. When looking to repurpose methane pipelines for hydrogen there is a requirement for us to have improved understanding of our pipeline assets; material type and smaller defects such as cracks become critical for hydrogen embrittlement effects and need to be understood prior to hydrogen injection, and whilst in use. Hydrogen will play a significant role in the energy transition required to meet Net Zero emissions targets by 2050. One cost-effective method for hydrogen transportation is to repurpose existing methane pipelines, however, before transitioning the network a fundamental step is to verify that they can be safely repurposed. This requires the networks to attain and assess network asset data against a hydrogen impact assessment. The first critical step is a deeper understanding of the current condition of their pipeline assets, particularly material properties, defect populations and the handling and management of large datasets. The Discovery Phase of this Project examined the current knowledge of engineering data with respect to the NTS and LTS, the ability of inspection solutions to fill data gaps, and how a data management system could facilitate storage, alignment and visualization of those datasets. A number of data gaps and challenges were identified which will need to be overcome.

The proposed Alpha Phase will build upon the work completed in the Discovery Phase by planning how the identified data gaps can be filled, together with preparing for a Beta Phase to trial proposed solutions. To this end, National Grid will select a pilot NTS feeder pipeline where the following topics will be analysed:

1. The currents status of integrity-related data required as inputs to hydrogen repurposing studies;
2. A detailed review of the ability of currently-available inspection technologies to obtain additional datasets both within methane and hydrogen environments;
3. Methodologies investigated and developed to allow existing hard copy records from the pilot NTS Feeder to be digitised;
4. A prototype data management tool to store and manage the data required for hydrogen conversion;
5. A risk ranking methodology will be applied to rank sections of the pilot feeder for conversion to hydrogen; and
6. Plans will be made for demonstrations in a future beta phase for "live" inspections in the pilot Feeder and the Future Grid test loop.

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

The Expert Assessors consider the Project to have addressed the Innovation Challenge because of its focus on developing a digital pipeline dataset which can then be used to examine opportunities for transitioning the NTS to hydrogen and methane.

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

The potential benefits of repurposing the existing gas grid for hydrogen is well articulated and represents, in the opinion of the Expert Assessors, a potential to deliver a potential net benefit to gas consumers through a reduction of consumer costs and potential environmental benefits. The Project also presents opportunities for larger-scale benefits, such as data capture in relation to the material characteristics, condition, and potential reuse of the existing pipeline relevant to multiple parties. There are also bigger picture benefits in terms of data capture in

relation to the material characteristics, condition, and potential reuse of the existing pipeline relevant to multiple parties.

Eligibility Criterion 3:
Projects must involve network innovation.

Development of online inspection tools was considered novel by the Expert Assessors. The case for gathering and using data to inform a technical understanding of the impact of hydrogen in gas network pipes before testing in a physical environment is well made and was considered by the Expert Assessors as involving network innovation.

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

The Project is not viewed by the Expert Assessors as undermining competitive markets as it is focused on enabling technologies and innovation to unlock the nascent hydrogen market. Furthermore, the Expert Assessors recommend the Project use an open data approach with the final data platform to create additional innovation and competition opportunities.

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

A justification for how the idea is innovative and novel is given. The Project's focus on the automation of pipeline assessment is an innovative, novel and risky proposal which will help in accelerating the understanding of the feasibility to safely transition and use existing gas network segments in the transition to Net Zero. The automation of pipeline assessment was also considered by the Expert Assessors as being important in accelerating the understanding of the feasibility to safely using existing network segments.

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

All Project Partners and sub-contractors have relevant roles in the Project, demonstrating sufficient participation from a range of stakeholders, in the opinion of

the Expert Assessors. The Project has brought on XOSERVE as a new Project Partner from the Discovery Phase to the Alpha Phase.

Eligibility Criterion 7: Projects must provide value for money and be costed competitively.
The Expert Assessors agree the costs are in line with other SIF Projects and that they have met this Eligibility Criteria. Although, the Expert Assessors noted the day rates for the Rosen Project Partner do seem considerably higher than other consortium member costs, with little justification or reasoning for why this is the case.

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.
The Project plan is well documented and detailed to a good standard, resulting in a sufficiently robust methodology and timeline. The Project risks seem well considered and appropriate mitigations have been suggested.

Regulatory barriers noted by the Expert Assessors
YES
The Project will be linked to the outcome of the use of hydrogen in the gas transmission and distribution networks.

Recommendation to the Gas & Electricity Markets Authority
FUND
Project knowledge is well-developed. It is clear that the Project is progressing. In the opinion of the Expert Assessors, the Project has met the Eligibility Criteria. The Expert Assessors also noted the Project could give greater thought on how a common approach to information management and data quality can align with the open data priority of Ofgem, BEIS and the wider UK energy sector during the Alpha Phase. The Expert Assessors have also recommended a Project-specific condition to examine how the Project should look can constructively interact with other relevant

SIF Projects. For example, SIF Projects 10037690 Digital Platform for Leakage Analytics, 10036953 HyS Metering and Gas Analysis and 10037659 Velocity Design with Hydrogen.

Finally, the Expert Assessors noted the opportunity this Project presents in coordinating similarities across these Projects and recommended the Project allow time within each Project to ensure coordination between both technical and governance element.

Recommended Project specific conditions

- The Project team should engage with 10037690 Digital Platform for Leakage Analytics, 10036953 HyS Metering and Gas Analysis and 10037659 Velocity Design with Hydrogen during the early stages of the Alpha Phase, and report an assessment of opportunities to coordinate data activities. This should be contained in the mid-point monitoring materials.

3.2.2 10036953, HyS Metering and Gas Analysis, Initial Net Funding Requested £492,064

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National Grid Gas Plc	£78,935	£50,000	£28,935
Cadent Gas Limited	£16,093	£880	£15,213
DES19NCOR Limited	£164,989	£220	£164,769
Northern Gas Network Limited	£5,900	£244	£5,656
Kelton Engineering Limited	£58,830	£1,453	£57,377
GL Industrial Services UK Limited	£199,304	£2,490	£196,814
Institution of Gas Engineers and Manager	£15,050	£0	£15,050
XOSERVE Limited	£8,250	£0	£8,250

Submitted Project description
SIF Discovery Phase Projects 10022352 Hydrogen Metering and 10021808 Gas Analyser Systems for Hydrogen Blends found through the Discovery Phase that a combined approach would provide more value for the networks and provide a more robust solution for our customers. Future gas measurement systems will need to be able to detect varying gas blends and provide accurate data to our network controllers, engineering teams and operational sites to ensure our customers receive the gas they require and our assets are protected from blend changes. Current systems in development are limited to specific gases or specific blends and still require capability demonstration prior to being deployed. If a solution cannot be found for variable blends the connection of hydrogen only producers and the opportunity to deblend will not be possible, leading to a delayed transition to net zero. Through the Discovery Phase it was found that with hydrogen metering there is a requirement to understand the gas composition prior to the gas entering the meter to enable corrections in the measurement based on the likely gas parameters. Some novel technologies have been identified that also look to combine the two systems which should be considered as we progress into the Alpha Phase.

This Project will provide valuable insights into how hydrogen affects fundamental metering calculations, and will provide an assessment of the risk and costs for the repurposing of metering and associated gas assets. It is predicted that in a Net Zero scenario the network will require more gas analyser and metering systems at key points across the network and understanding how to deploy these cost effectively is a key outcome of this project.

Measurement data is gathered today but the systems and analytics required to combine this data from across the network and provide instantaneous data sets is something the networks have not done and will be required to do in a net zero future. This data needs to be open to the surrounding networks, customers and wider energy system to ensure a safe and robust energy network of the future.

This Project will provide assurance from derived real world data from the Beta Phase to assure the safety, performance and accuracy of gas measurement across the gas transportation system. This will ultimately give assurance and confidence that hydrogen metering and gas analysis can provide fair, transparent, and accurate measurements for effective network management.

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

The Project investigates gas analysis and metering systems. The basis of these technologies is sensing, measurement and data analysis techniques. In the Expert Assessors' opinion, this Project meets the requirements of the data and digitalisation Innovation Challenge.

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

There is a clearly identified potential for the Project to deliver a net benefit to gas consumers in the opinion of the Expert Assessors. The Project focuses on finding ways to repurpose existing metering systems and increasing the accuracy and reduce the latency of blend measurements with the result that hydrogen metering and gas analysis can be provided in a fair, transparent, and accurate measurement. This will support more efficient and effective network management and can deliver

net benefits to gas consumers through a reduction of costs associated with network management and greater efficiency.

Eligibility Criterion 3:
Projects must involve network innovation.

The Project focuses on technical innovations required for measuring and metering hydrogen blends in the gas transmission system. The primary focus is on energy network innovation, therefore fulfilling this Eligibility Criteria in the opinion of the Expert Assessors.

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

The Project is not regarded by the Expert Assessors as undermining the development of competitive markets because the Project is focusing on how hydrogen and blended hydrogen impact metering calculations and examining the risk and cost of repurposing the gas network to incorporate hydrogen. The Project's understanding of the need for data generated to be open to the surrounding networks was seen positively by the Expert Assessors.

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

Hydrogen metering and gas analysis of blends is not currently carried out within the gas system, and therefore this is clearly novel. The main innovations to the Expert Assessors appear to be around development of a digital platform that can provide data on types of hydrogen, carbon accounting, and purity of gases.

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

In the opinion of the Expert Assessors, a sufficient range of Project Partners are involved in the Project to meet the eligibility requirements. However, the Expert Assessors would have liked to see further engagement with the end users of the digital platform and metering systems planned for the Alpha Phase.

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

Costs for the Project and Project Partners are within broad market ranges but were assessed as being in the upper limits of being costed competitively.

The Expert Assessors did not see the value for money in the development and delivery of a data platform. Furthermore, the Project did not sufficiently address in its Application why the SIF and the Alpha Phase are suitable for the Project at this stage. This did not give the Expert Assessors confidence that the Project was providing value for money, and therefore, in the opinion of the Expert Assessors, the Project did not meet 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.
The Project plan presents a fairly clear path to the deliverables described. However, the Expert Assessors noted several areas in the Application which could have been stronger. The Project plan would have been strengthened by providing end dates and outputs associated with each activity. The Project also did not demonstrate the correct capability or planning for delivery and development of the data platform. Furthermore, the Expert Assessors felt that the Project was missing a crucial granular assessment of the types and condition of metering systems that are currently deployed. Therefore, in the opinion of the Expert Assessors, the Project did not meet this Eligibility Criteria.

Regulatory barriers noted by the Expert Assessors
NO

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The Expert Assessors see value in delivery of the testing facility, but the digital platform was not sufficiently well described to give confidence that value for money is provided with the Alpha Phase. The Expert Assessors also noted the Application did not include a granular assessment of the types and condition of metering systems that are currently deployed, which was seen a critical piece for the Alpha Phase.

The Project did not demonstrate the correct capability or planning for delivery and development of the data platform. Providing a data stream that could later be used by the industry could be beneficial and would help deliver additional net benefits to gas consumers and gas network users.

The Expert Assessors also noted that the Project did not clearly outline why the SIF and the Alpha Phase were the most suitable funding route for the Project.

3.2.3 10036957, Gas System of the Future - Digital Twin, Initial Net Funding Requested £494,925

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Southern Gas Networks Plc	£194,165	£106,791	£87,374
BM United Kingdom Limited	£274,133	£140,810	£133,323
National Grid Gas Plc	£2,960	£0	£2,960
National Grid Electric System Operator Limited	£5,268	£0	£5,268
DNV Services UK Limited	£193,377	£60,377	£133,000
Amazon Web Services EMEA Sarl, UK Branch	£177,220	£44,220	£133,000

Submitted Project description
The unification of two SIF Discovery Phase Projects (A Hydrogen Production Digital Twin; and a Gas Network Digital Twin) forms the basis of our Project, which for the Alpha Phase aims to explore further the commercial, societal and operational benefits that could be derived from the deployment of a unified "gas system of the future" digital twin. Balancing supply and demand in an ecosystem of connected digital twins is fundamental to the future of the gas industry in the UK as we know it. Managing associated risk -- be it operational, technical or financial -- and security of supply given recent geopolitics is key as supply chain segments are exposed to risk from partners in this chain. Digital Twins have long been heralded as the solution to future energy industry challenges. Millions of decisions concerning real-world assets' design, construction and operation will be taken based on their digital twins. Some digital twins in the gas industry will represent a simple component; others span entire facilities -- or systems. Hydrogen is one of the key technologies on the road to decarbonisation. The coming decade will see increasing cost competitiveness for low-carbon hydrogen from electrolysis by improving efficiency and decreasing CAPEX. In areas with abundant renewable resources and low-priced electricity, the costs of hydrogen will drop even further. Adapting our gas distribution networks to transport hydrogen could lead to

the least disruptive and most cost-effective route to carbon free heating for most homes.

Yet the understanding of how the gas network will manage the future system's foreseen complexity is very uncertain. Networks need to ensure a sustained focus on the safety, resilience and sustainability of the future network whilst ensuring assets and infrastructure are compatible with new gas blends or 100% hydrogen or biomethane.

In addition, ensuring that sufficient energy can be supplied to meet the country's needs and that supply is resilient will be challenged given the increasingly distributed inputs from new producers to the network. Short term modelling of networks will also need to change as energy content changes and further storage locations are needed.

The scope supports energy industry objectives to build knowledge and competence in data, modernise energy data access, and stimulate innovation across the industry through digital twins. While supporting the data and digitalisation theme, it aligns with the whole systems approach that is fundamental to the success of our energy transition and pathway towards Net Zero.

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

The description of the Project is compelling and clearly aligns with the data and digitalisation Innovation Challenge as the Project proposes exploring the commercial, societal and operational benefits that could be driver from a unified digital twin of the gas system.

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

The benefits are well explained and demonstrate a potential net benefit for gas consumers because of the Project's focus on developing a digital twin for the gas network. This could support greater efficiencies in the operation and management of the gas network, thereby delivering cost savings for gas consumers and users of the

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

Eligibility Criterion 3:
Projects must involve network innovation.

The Expert Assessors consider that the Project involves network innovation because the Project involves connecting disparate data sets, digital systems, and real time digital twins associated with the gas networks into a single interface. This is focussed on network operations but also considers interfaces with other parts of the system.

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

The Project is not considered by the Expert Assessors to undermine competitive markets, and could help develop novel markets through improved accessibility and visibility of energy system data.

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

The Expert Assessors considered this Project to be innovative, novel and risky as the Project builds on previous data initiatives and cross-sector digital twin learning, with novel approaches and use cases which are sufficiently unproven and risky to meet this Eligibility Criteria. Additionally, the Expert Assessors noted that the Project is not within the remit of the Project Partners to attempt to deliver vision at this scale, which was seen by the Expert Assessors as also being innovative and novel.

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

There are a broad range of stakeholders involved in the Project from multiple disciplines. The Project appears to the Expert Assessors to have engaged with most of the key stakeholders working towards utilities digital twins, as well as other relevant initiatives such as the energy digitalisation taskforce and digital twin hub.

In the Expert Assessors' opinion, this Project included participation from a sufficient range of stakeholders to meet this Eligibility Criteria.

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

The Expert Assessors consider this Project to represent good value for money and consider it to be costed competitively as the Project costs and allocation of costs to Project Partners was seen as sufficient to meet this Eligibility Criteria. The Expert Assessors noted positively the merging of two Discovery Phase Projects which were closely related, thereby avoiding potential duplication in the Alpha Phase and providing value for money. The Expert Assessors also positively noted the Project Partner contributions towards 42% of the Project's total costs.

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.

The Expert Assessors consider the Project plan to be detailed and agile. The Project is aware of risks associated with cyber and data quality. The Project plan gives confidence to the Expert Assessors that the Project will be capable of progressing in a timely manner.

Regulatory barriers noted by the Expert Assessors

NO

Recommendation to the Gas & Electricity Markets Authority

FUND

This Project is focussed on developing enabling digital infrastructure that can be used to help progress initiatives under other challenges for the energy sector. In the opinion of the Expert Assessors the Project has met all the eligibility criteria above.

The benefits case requires greater justification and linkage directly to the outputs of this Project, rather than assuming that all enabled benefits can be attributed to this single Project. However, this was seen as a minor risk by the Expert Assessors.

The Expert Assessors also recommend that the Project consider the creation of a semantic data layer, ontologies and standards as an output of the Alpha Phase. This should be aligned with emerging thinking from the energy digitalisation taskforce recommendations, and the development of an information management framework.

The development of interoperability in data standards and systems is key to the success of this Project. Openness should be a key principle in the development of this and utilisation of tools which enable accessibility and interfacing across a range of users must be considered in development, and justified ahead of the Beta Phase.

Recommended Project specific conditions

The Expert Assessors also recommend that the Project consider the creation of a semantic data layer, ontologies and standards as an output of the Alpha Phase. This should be aligned with emerging thinking from the energy digitalisation taskforce recommendations, and the development of an information management framework.

3.2.4 10037305, Virtual Energy System, Initial Net Funding Requested £499,999

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National grid Electricity System Operator Limited	£110,493	£11,049	£99,444
Ove Arup & Partners Limited	£419,990	£43,188	£376,802
Western Power Distribution Plc	£4,844	£485	£4,359
National Grid Electricity Transmission Plc	£4,886	£4,885	£1
National Grid Gas Plc	£7,192	£0	£7,192
Southern Gas Networks Plc	£5,460	£546	£4,914
SP Transmission Plc	£5,310	£531	£4,779
Scottish Hydro Electric Transmission	£2,508	£0	£2,508

Submitted Project description

National Grid ESO (ESO) proposes to lead an industry-wide initiative to develop a digital twin of the entire GB energy system -- the Virtual Energy System (VirtualES). This will be an enduring programme over several years, consisting of three closely interacting workstreams:

- Workstream 1 -- Stakeholder Engagement
- Workstream 2 -- Common Framework
- Workstream 3 -- Use Cases

In the Discovery Phase, the Project evaluated the range of key factors that set the scope of the Common Framework. In collaboration with network partners and wider industry consultation a Common Framework Demonstrator project has been proposed to allow for these factors to be developed in an iterative method linked to a real-world scenario.

The Alpha Phase will be used to demonstrate the standards and governance framework that will facilitate collaboration and compatibility. The Common

Framework will provide a 'blueprint' so that multiple parties can develop a wide range of digital twins which are interoperable and can interact using open data.

This Project will explore with our partners key areas such as, but not limited to, cyber security, data quality, metadata, data ownership/storage, common attributes of digital twins, interoperability, technology, legal and regulatory issues, risks, and potential use cases. The most challenging and high-risk elements will be explored in the Alpha Phase, and then solutions refined further in the Beta Phase.

We envisage that the VirtualES users will include:

- network companies (Transmission Owners, Distribution Network Owners/Distribution System Operators, Gas Distribution Networks);
- generation asset owners and operators (wind farms, solar parks, thermal generators, batteries, interconnectors);
- retail companies;
- traders;
- aggregators;
- and ultimately GB consumers.

VirtualES will provide these users with access to data and integrated modelling capabilities, to improve data-driven decision making for investments and operations. VirtualES will also prove useful to government departments, regulators, academics, and think tanks to inform whole-system strategies, policies, and regulatory decisions for the net zero transition.

ESO will lead the Project, but since the VirtualES is a whole-system agenda, we have engaged Project Partners who bring the perspectives of electricity (NGET, SPEN, SSEN Transmission, WPD) and gas (NGGT, SGN) networks.

To deliver the Project we have also partnered with a technical consortium of Arup, Energy Systems Catapult and Icebreaker One - who bring considerable expertise in digital twins, systems-thinking, and energy data. Between them they have led and contributed to the delivery of these extremely relevant initiatives:

- Energy Data Task Force

- Energy Digitalisation Task Force
- Open Energy (through MEDA)
- Energy Data Visibility Project
- The National Digital Twin programme

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

The Expert Assessors considered this Project to have addressed the Innovation Challenge because of its focus on developing and demonstrating the standards and governance framework that will facilitate collaboration and compatibility with a range of digital twins which are interoperable and can interact using open data.

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

Significant potential benefits have been identified for energy consumers, with this Project potentially acting as a key enabler to unlocking substantial value for consumers through energy flexibility. Smaller potential benefits have been identified and estimated that may be achieved through the initial use case trials.

Eligibility Criterion 3:
Projects must involve network innovation.

The Expert Assessors saw this Project as providing sufficient network innovation to meet the Eligibility Criteria because the Project proposes leading an industry-wide initiative to develop a digital twin of the entire GB energy system. The Project's focus on developing and demonstrating the standards and governance framework that will facilitate collaboration and compatibility with a range of digital twins which are interoperable and can interact using open data was also seen by the Expert Assessors as being innovative.

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

The Project is not viewed by the Expert Assessors as undermining competitive markets, and in fact, could facilitate wider access to energy markets. Data

accessibility, particularly where licenced, could have markets access impacts but this was not considered by the Expert Assessors as a significant risk.

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

The Project's vision is innovative because of its focus on developing a digital twin of the entire GB energy system with a range of industry stakeholders. In the opinion of the Expert Assessors, the Project was seen as innovative and novel, and the bringing together of industry-wide stakeholders was seen also as innovative. In the opinion of the Expert Assessors, the Project met this Eligibility Criteria.

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

The boundaries of use cases extend beyond the energy networks and therefore the Project should also include and engage key stakeholders in development like local authorities or other energy infrastructure owners (like heat networks, or generators). In the opinion of the Expert Assessors, participation from a suitable range of stakeholders is offered, but given the far reaching stakeholder interactions and impacts of the proposal, further participation would add value to the Project.

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

Enabling maximised benefits of flexibility to the UK energy system would certainly demonstrate good value for money. However, in the opinion of the Expert Assessors, it was poorly articulated in the Application as to what the exact outputs of the Alpha Phase would be and to what proportion of the benefits overall could be attributed to this Project. Whilst the costs do appear to be broadly competitive for the work packages described, the Project was not seen to be providing value for money and being costed competitively because of the uncertainty around the benefits the Project would deliver in the Alpha Phase.

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.

In the opinion of the Expert Assessors, the problem and opportunity were not sufficiently described for the Expert Assessors to have confidence that the Project had a sufficiently robust methodology. Furthermore, it was not clear to the Expert Assessors what the deliverables and outputs would be in the Alpha Phase. The Project plan does not describe any tangible success criteria which are aimed to be delivered within the Alpha Phase of this Project. Due to these reasons, the Expert Assessors did not see this Project as meeting this Eligibility Criteria.

Regulatory barriers noted by the Expert Assessors
NO

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The Expert Assessors recognise the ambition, potential, and future requirements for a digitalised representation of the energy system. However, the tangible outputs and components that are needed to deliver the VES were very unclear. This impacted the Expert Assessors assessment for Eligibility Criteria 7 and 8 and resulted in the Project not meeting all of the Eligibility Criteria.

3.2.5 10037368, Thermal Imagery Analysis, Initial Net Funding Requested £469,356

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Northern Gas Networks Limited	£19,130	£5,739	£13,391
University of Sheffield	£7,500	£0	£7,500
National Grid Gas Plc	£2,520	£0	£2,520
Synovate Limited	£321,250	£38,550	£282,700
Digital Catapult Services Limited	£79,425	£0	£79,425
iTouch Reporting Systems Limited	£95,250	£11,430	£83,820

Submitted Project description
Our vision is to support hydrogen transition at the lowest possible risk and cost to UK gas consumers as fast as possible to protect our climate. This Project will undertake discovery as a primary step to support our vision to provide a network tool and a UK assessment capability. The aim of this is to support a safe, environmental and cost-effective transition by maximizing existing assets informing how much and where legacy PE assets need to be replaced and/or maintained. We do this in a minimally invasive way, scheduled ahead of conversion programs minimising unplanned workloads and time off gas for consumers. The solution uses live access sensing to analyse the internal characteristics of a pipeline transporting natural gas, and simulate changes, typically in the form of deterioration or leakage that may occur through changing factors such as gas type or pressure. This captured data predominantly will give assurance and provide essential evidence to enable a greater understanding of risks associated with legacy assets. This Project would gather underpinning condition sensing data for conversion strategies and build confidence in a common approach between UK networks. The Project will aim to test and understand the viability of leakage sensing for conversion assessment to minimise uncertainty around pressure elevation to maximise the retention of current assets. The Project supports the evaluation the costs, risks and opportunities of repurposing or decommissioning existing gas network infrastructure for use with hydrogen. This supports future energy provision for heating, power and transport, safely, at a low

consumer cost and in a minimally carbon intensive way. We meet the scope by implementing novel sensor and digital assessment infrastructure to improve network planning, modelling and forecasting capabilities around conversion and replacement risk for legacy assets with field gathered datasets. NGN developed and deployed robotics within the UK having operational expertise in solution deployment.

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

This Project addresses the Innovation Challenge as it proposes the development of a sensor and digital assessment infrastructure to improve network planning, modelling and forecasting capabilities for gas network assets.

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

In the opinion of the Expert Assessors, the Project has clearly articulated a potential to deliver a net benefit to gas consumers through increased efficiency of operating the gas network, greater forecasting and modelling capabilities for network infrastructure, and reduction in leakage from network assets. These were seen by the Expert Assessors as the potential to deliver a reduction in costs for gas network users and environmental benefits through earlier detection of leakage from the network.

Eligibility Criterion 3:
Projects must involve network innovation.

The Application was not clear if the innovation exists in the data or the sensing technology. However, during the interview, the Project clarified that the Project proposes experimenting with new technologies in pipeline and gas network assessment, data capture and simulation through the modelling. In the opinion of the Expert Assessors, the Project was seen to involve network innovation because it will experiment with new technologies, data capture and simulation. The Expert Assessors have a recommended a Project-specific condition to incorporate the clarifications from the interview in the Application.

Eligibility Criterion 4: Projects must not undermine the development of competitive markets.
The Project is not viewed by the Expert Assessors as undermining the development competitive markets as the Project is focussed on extending the use of existing assets for new market opportunities and identifying where existing assets need replacing. Through this, the Project was seen by the Expert Assessors as having the potential to introduce additional competition into markets.

Eligibility Criterion 5: Projects must be innovative, novel and/or risky.
The Expert Assessors assessed the Project as being innovative and novel because it is looking at how to integrate live access sensing analysis of gas network assets to provide a greater understanding of the risks associated with legacy assets. This which could then be incorporated by other networks and build confidence in a common approach across GB.

Eligibility Criterion 6: Projects must include participation from a range of stakeholders.
In the opinion of the Expert Assessors, there are a broad range of stakeholders involved in the Project, that Expert Assessors viewed as suitable for the scope of works and the Project plan provided.

Eligibility Criterion 7: Projects must provide value for money and be costed competitively.
In the opinion of the Expert Assessors, the Project is considered value for money and being costed competitively. The Project costs are well spread across the Project Partners indicating close collaboration and costed competitively. The Project costs were also seen by the Expert Assessors as being costed competitively.

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.
The Expert Assessors considered the Project plan to be sufficiently detailed and robust to meet this Eligibility Criteria. The Expert Assessors also had confidence that

the Project would be capable of progressing in a timely manner. In the opinion of the Expert Assessors, the risk register was sufficiently detailed.

Regulatory barriers noted by the Expert Assessors

YES

The Expert Assessors highlighted that there are Health and Safety Executive decisions which would be needed for any demonstrator of the Project.

Recommendation to the Gas & Electricity Markets Authority

FUND

The Expert Assessors recognise the value of the core proposition of data capture and new technology trial and the potential for dissemination of benefits across energy and water.

The Application itself could have been much clearer as to what the Project is actually delivering in the Alpha Phase, although this was clarified in the interview. It would be beneficial if the Project could explain the core technologies and the focus for the Alpha Phase in a clearer and concise way. The Project confirmed it is not looking to integrate any external or third party data beyond the sensor data into a platform. The Project is also not investing in AI and simulation during the Alpha Phase aside from capturing requirements.

The Expert Assessors found there was potential overlap with this Project and SIF Project HyNTS Pipeline Dataset. Whilst this was a minor concern from the Expert Assessors, they have recommended a Project-specific condition for the Project to have active and regular engagement with the SIF Project 10036952 HyNTS Pipeline Dataset.

Recommended Project specific conditions

- The Expert Assessors recommend that NGGT team members from 10036952 HyNTS Pipeline Dataset Project must participate in the quarterly Monitoring meeting.

- Ofgem may want to consider requesting a refreshed work breakdown structure, task list and deliverables ahead of Project kick-off, to ensure that the clarifications made during interview (as detailed above) are implemented.

3.2.6 10037416, Intelligent Gas Grid - Alpha, Initial Net Funding Requested £491,075

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Southern Gas Networks Plc	£124,368	£60,143	£64,225
National Grid Gas Plc	£1,850	£0	£1,850
Utonomy Limited	£475,208	£50,208	£425,000

Submitted Project description

Following the successful collaboration on the NIA-funded 'Pressure Control and Management' project over the last three years, SGN and Utonomy now propose to continue to innovate towards a vision of the Intelligent Gas Grid.

Using Utonomy's remote control pressure system as the enabling technology, the Project idea is to collect and use network data alongside external data such as whether to develop machine-learning and AI applications that optimise network pressures and provide insights on network performance.

The applications developed under this Project will reduce methane leakage and increase the feed-in capacity of renewable gases including biomethane and hydrogen.

Components will be developed to provide autonomous early warning and diagnosis of network faults and dashboards will allow network operators to monitor KPIs and predictive alarms in near real time.

The Project vision is to autonomously and intelligently monitor and control networks, both in terms of pressure management and operational 'planning & maintenance', using data-driven algorithms and decision-making, and to support network digitalisation.

This will lower costs to consumers, and increase the resilience of the network, whilst also supporting the progress to Net Zero.

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

In the opinion of the Expert Assessors, the Project clearly addresses the data and digitalisation Innovation Challenge because it focusses on novel utilisation of digital techniques to address issues on the gas networks.

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

A problem and opportunity have clearly been described, with reasonable justification of how positive outcomes could be achieved by solving the problem and capturing the opportunities. The Expert Assessors consider that the potential for delivery of net benefits to gas consumers is clearly identified because the Project could reduce methane leakage and increase the feed-in capacity of renewable gases, including biomethane and hydrogen. Furthermore, the Project's vision to autonomously and intelligently monitor and control networks, will support greater efficiencies of the gas network. These were considered by the Expert Assessors demonstrate the potential to deliver a net benefit to gas consumers through lower costs of operating and monitoring the network and reducing the gas leakage from the gas network.

Eligibility Criterion 3:
Projects must involve network innovation.

In the opinion of the Expert Assessors, a clear Project summary has been given that involves network innovation and has good prospects for addressing the Innovation Challenge because the Project proposes using a remote control pressure system to collect and use network data alongside external data to examine gas network pressures and provide insights on and monitor network performance.

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

In the Expert Assessors' opinion, the Project does not undermine the development of competitive markets. However, a minor and immaterial concern noted by the Expert Assessors was that it was not clear how the Project would take an approach which enables competition in the longer term in regards to eventual data acquisition and control of pressure in the gas system.

Eligibility Criterion 5: Projects must be innovative, novel and/or risky.
The Project's focus on using a remote control pressure system to collect and use network data alongside external data to examine gas network pressures and provide insights on and monitor network performance was seen by the Expert Assessors as being a convincing justification for how the idea is innovative and novel.

Eligibility Criterion 6: Projects must include participation from a range of stakeholders.
In the opinion of the Expert Assessors, the Project includes participation from a sufficient range of stakeholders to meet this Eligibility Criteria. The Expert Assessors also viewed participation from multiple gas networks as key in helping disseminate and share learnings, and recommended the Project seek to involve more networks in the Project. This was noted as a minor concern and the Project was still seen by the Expert Assessors as having met this Eligibility Criteria.

Eligibility Criterion 7: Projects must provide value for money and be costed competitively.
The Expert Assessors consider the Project to be delivering value for money because the Project costs, Project plan, and the spread of costs across the Project Partners were costed competitively. The Expert Assessors also considered these to be costed competitively. However, a minor concern noted from the Expert Assessors was that the target outcomes of the Alpha Phase could be achieved with a smaller team and for less cost. This however did not impact the Expert Assessors assessment and they consider the Project to have met this 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.
In the opinion of the Expert Assessors, the Project plan was robust and sufficiently detailed to give the Expert Assessors confidence that the Project is capable of progressing in a timely manner. The deliverables described appear achievable within the target duration of the Project, thereby fulfilling this Eligibility Criteria in the view of the Expert Assessors.

Regulatory barriers noted by the Expert Assessors
NO

Recommendation to the Gas & Electricity Markets Authority
FUND
This Project articulates a tangible and actionable use case which has clearly described how it can deliver a value for energy network operations. In the view of the Expert Assessors, the Project was seen to be innovative, have the potential to deliver potential net benefits to gas consumers, includes participation from a sufficient range of stakeholders, is delivering value for money and is costed competitively, and provides a sufficiently robust methodology for there to be confidence that the Project is capable of progressing in a timely manner. In the view of the Expert Assessors, the Project has fulfilled all of the Eligibility Criteria.

Recommended Project-specific conditions
The Expert Assessors recommend that the Project clarify whether the existing IPR arrangements in the SIF Governance Document are sufficient or if separate arrangements are needed to enable access to other market entrants. Data models and methodologies should be published in a reproducible manner, to enable access to other networks or potential solution providers. Ownership should reside with SGN but made available in a way which stimulates a competitive market. This should include publication of a sample dataset, a git repository of model code and instructions on how to repeat the results, and a whitepaper on how the model operates.

3.2.7 10037420, Predictive Safety Interventions - Alpha, Initial Net Funding Requested £411,086

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Southern Gas Networks Plc	£59,568	£49,862	£9,706
National Grid Gas Plc	£1,380	£0	£1,380
FYLD Limited	£437,670	£37,670	£400,000

Submitted Project description

FYLD and SGN have partnered to build a predictive safety system that will analyse which actions contribute the most to worksite safety and productivity, then amplify them across the network.

Safe street works are cheaper, less prone to delay and more accessible to members of the public. However, despite advances in technology, worksite safety in utilities has plateaued for 8 years - last year 15 people died and 2009 were unable to immediately return to work due to the injuries they sustained. The current strategies to improve this involve significant manual data capture and analysis - often predicated on projections and guesswork.

Companies across the sector are at different stages of the safety journey; some have a well-established culture of sharing learnings from safety events internally, whereas others are still trying to incentivise their teams to report incidents. There is no established protocol for sharing their findings between companies, making safety an unfair competitive advantage.

Predictive Safety Interventions will enable fieldworkers to document everything that contributes, positively or negatively, to worksite safety - then help them to take course-correcting actions when risk starts to increase.

Our vision is that every fieldworker makes it home safely, every day.

FYLD and SGN will show how technology can improve the fidelity of the data capture process via the FYLD app and body-worn cameras, then use machine learning models to assess how each input and outcome affects the risk score. Like the workforce, the model will require ongoing training and, as the datasets grow, we

will develop a method to train both (our model and the people using it) at the same time. As the model continues to learn, the interventions will continue to improve. However, unlike before, fieldworkers will learn from the actions of all of their colleagues from across the entire sector.

The earliest point that an intervention can be made is the moment after a risk is recognised. The PSI model will be used to power an augmented reality proof-of concept that will demonstrate how interventions can be made in real time.

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

The Expert Assessors consider the Project to have addressed the Innovation Challenge because it is focused on the use of data capturing and digitalisation techniques to log and share techniques which can ensure safer energy network operations, which has been shown to increase the efficiency of network management. The Expert Assessors noted that the Project could be more closely aligned to some of the Innovation Challenge aims but this was not considered a significant risk and the Project was considered 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

In the opinion of the Expert Assessors, the Project clearly identified a potential to deliver a net benefit to gas consumers through the cost savings associated with a reduction in health and safety incidents on network assets, which has been shown to increase the efficiency of network and infrastructure on-site works.

Eligibility Criterion 3:
Projects must involve network innovation.

"Innovation" in Health and Safety management in the UK is slow and often non-innovative. The application of techniques is focused on gas network operations, with good justification of how this could expand to other energy networks and infrastructures. Building a catalogue of predictive variables, as the Project proposes doing, would constitute a fundamental change to how on-site predictions and health and safety more widely are managed across energy network infrastructures. In the opinion of the Expert Assessors, the Project's proposal for how it will capture,

manage, use and disseminate health and safety improvements was an innovative approach for improving on-site operations. In the opinion of the Expert Assessors, the Project met this Eligibility Criteria.

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

In the opinion of the Expert Assessors, the Project was not considered to undermine the development of competitive markets as it is focussed on the improvement of on-site operations.

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

The Project is using a novel approach to an enduring problem of site safety. The approach is clearly innovative and novel, not just for the energy sector, but also other infrastructure and construction sectors.

The Expert Assessors felt that the applicants made clear that underreporting of incidents was widespread in the energy sector, and new risks will emerge with the deployment of new types of energy technologies. The Project team made a strong case that the approach being taken was truly innovative and sufficient risks exist (including securing the requisite data, and changing the mindset of network operations) to act as barriers to funding this through other routes.

In the opinion of the Expert Assessors, the Project demonstrated a novel and innovative approach through its proposed approach of capturing, managing, using and disseminate health and safety improvements at on-site network operations.

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

In the opinion of the Expert Assessors, the Project demonstrated participation from a sufficient range of stakeholders. FYLD was seen as an important and key Project Partner for the delivery of the Project and the Expert Assessors noted positively it taking a prominent role in development of the innovation.

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

The Project provides good value for money if the benefits described can be captured using the innovative approaches to health and safety management.

Costs for the Project and Project Partners are reasonable and at competitive market rates, demonstrating in the opinion of the Expert Assessors that they are costed competitively.

In the opinion of the Expert Assessors, the Project provides value for money and is costed competitively.

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.

In the opinion of the Expert Assessors, the Project provided a robust Project plan, and noted that the deliverables are tangible and clear.

In general, the approach to delivering the Alpha Phase appears to be well-resourced and coordinated between the Project Partners, giving confidence that the Project is capable of progressing in a timely manner.

In the opinion of the Expert Assessors the Project has fulfilled this Eligibility Criteria.

Regulatory barriers noted by the Expert Assessors

YES

There is an obvious potential risk to personal data management. GDPR requirements should be considered fully and the costs associated with dealing with privacy issues built in to business case development.

Engagement with relevant unions during development is strongly encouraged to ensure that solutions are acceptable across workforces.

Recommendation to the Gas & Electricity Markets Authority

FUND

The Expert Assessors view this as an important Project which will add an innovative approach to managing safety in operational environments. The Expert Assessors considered that this Project has met all of the Eligibility Criteria.

The Expert Assessors pushed the applicants on the degree of innovation that was happening within the Project and the riskiness of the Project. Building a catalogue of predictive variables would constitute a fundamental change to how on-site predictions and health & safety more widely are managed across energy network infrastructures.

The Expert Assessors felt that the applicants made clear that underreporting of incidents was widespread in the energy sector, and new risks will emerge with the deployment of new types of energy technologies. The Project team made a strong case that the approach being taken was truly innovative and sufficient risks exist (including securing the requisite data, and changing the mindset of networks).

The Project focusses on large scale data processing and potentially neglects some of the value of heuristics and tacit knowledge, and this should be incorporated during the Alpha Phase.

Recommended Project specific conditions

Dissemination of learning to other networks is essential to realise full benefits. To test that the methodologies and techniques used are not applicable to a single network type the project partners must disseminate not only the technical outputs but also the learning around the approach to the problem. The Project has committed to publishing code, but must also develop and share 'how to' guides outlining first steps which help with proceeding with an implementation plan.

3.2.8 10037439, Eye in the Sky – Utilising satellite data to improve grid resilience, Initial Net Funding Requested £395,769

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National Grid Electricity Transmission Plc	£186,980	£44,180	£142,800
National Grid Gas Plc	£3,269	£0	£3,269
Spottitt Limited	£148,250	£0	£148,250
DNV Services UK Limited	£101,450	£0	£101,450

Submitted Project description

Aim. This Project brings forward 3 asset monitoring use cases studied during the Discovery Phase, which at maturity would deliver an estimated 22 million GBP (NPV over 10 years) value to NGET and customers through a combination of cost savings by replacing manual ground and aerial monitoring, and cost avoidance through increased risk awareness. A switch away from manual monitoring will also lower emissions associated with Operation & Maintenance activities. This is closely aligned with the Data and Digitalisation challenge's aim to improve data monitoring, increase efficiency, reliability, security, and resiliency of networks.

The Project meets the scope of the competition in following key areas:

1. "How to improve the visibility of infrastructure and assets, for instance new digital infrastructure or novel uses of sensors and communications technologies" The proposed solution will improve the visibility of the infrastructure and assets as follows:
    - a. increase the frequency, accuracy and auditability of change and risk monitoring surveys compared to current ground-based methods.
    - b. provide network operators with detailed historical and near real time information on the movement of the land in and around their assets and of the movement of assets themselves across entire networks compared to current ground-based methods.
2. "How novel uses of data and digital platforms can significantly improve network planning, modelling and forecasting capabilities." The analytics and outputs of the proposed satellite derived solution can be fed into network operator data lakes and workflows, used alone, or combined with other data

streams to better understand changes and risks, to deliver better planning and resource allocation.

Solutions to be developed: The Project will investigate the development of a remote, automated nationwide land and asset motion solution based on the use of SAR satellite imagery and different InSAR analysis techniques. The Project will investigate how the accuracy and concentration of land and asset motion data points can be improved and integrated into NGET's asset monitoring systems. The Project will also investigate the development of a remote, automated, nationwide network monitoring solution based on the use of sub meter resolution optical imagery. The solution will look at risk and change issues in general and specifically unauthorized construction and storage of building materials. The Project will advance understanding of the defects/changes experienced by the network, their size, frequency, EO detection likelihood and risk priority, with a view to integration into NGET's asset monitoring systems.

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

The Expert Assessors considered the Application to have addressed the data and digitalisation Innovation Challenge in an innovative and novel way by looking at the potential for using and integrating satellite data to improve asset monitoring systems.

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

The Projects presents £22 million of Net Present Value (NPV) in estimated potential benefits to energy consumers. The Project provides a reasonable narrative for potential to reduce costs for electricity consumers and electricity network users through greater monitoring of the gas network and increasing efficiencies. The Project's Application mentions that the innovation in this Project would be transferable to other infrastructure sectors for potential wider societal benefits. The Expert Assessors therefore consider this Project to have clearly identified a potential benefit to electricity consumers, thereby fulfilling this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

A clear Project summary has been given that involves network innovation and has good prospects for addressing the Innovation Challenge. In the opinion of the Expert Assessors, the network innovation is in the Project's novel approaches to using satellite data against a range of use cases to increase network asset monitoring systems.

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

A clear route to commercialisation is described, which, in the opinion of the Expert Assessors does not undermine the development of competitive markets. The Expert Assessors noted minor concern that the Project did not detail how commercial opportunities for suppliers will be carried out in the future. However, this risk was seen as minor and did not interfere with the Expert Assessors consideration that the Project met this Eligibility Criteria.

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

The project is using novel and innovative approaches for asset monitoring through the use of satellite data. This was considered by the Expert Assessors to be both innovative and novel.

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

All Project Partners and sub-contractors have a relevant role in the Project and are seen as by the Expert Assessors as being crucial for the scope of the Alpha Phase. The Expert Assessors did note some areas which could have been stronger in the Application. The Expert Assessors concluded that DNV's role could have been better explained and have recommended a Project-specific condition for the Project to address. Additionally, further detail on the interested third parties or stakeholders to be engaged with for operational delivery could have been also been given. However, for the scope of the Project described in the Alpha Phase, the Expert Assessors considered the Project to include participant from a sufficient range of stakeholders.

Eligibility Criterion 7: Projects must provide value for money and be costed competitively.
£22 million of Net Present Value (NPV) has been estimated in potential benefits to energy consumers. The Project provides a reasonable narrative for potential to reduce costs for electricity consumers and the Project was seen as providing value for money. It was also mentioned that innovation in this Project would be transferable to other sectors of infrastructure for potential wider societal benefits. The Expert Assessors considered the use and incorporation of satellite data in network monitoring systems to provide value for money and presents the opportunity for greater efficiencies to be incorporated in network management. The Expert Assessors noted some of the organisational costs for the Alpha Phase do appear on the upper limits of being costed competitively, and would benefit from a more granular breakdown of costs. However, overall the Expert Assessors found the Project presented value for money and was costed competitively.

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.
The leadership from NGET was clear and the Expert Assessors considered that the collaborative way of working presented in the Application gave good prospects for any potential problems to be overcome. The Project Partners are clearly committed and this gives confidence of the Project progressing in a timely manner. The Expert Assessors therefore considered the methodology and deliverables were sufficient to fulfil this Eligibility Criteria.

Regulatory barriers noted by the Expert Assessors
NO

Recommendation to the Gas & Electricity Markets Authority
FUND
The Project clearly shows an innovative use of technology for application against existing real world problems. This solution presented by the Project was considered by the Expert Assessors as a something which could deliver tangible benefits.

The Expert Assessors considered this Project to be innovative and novel, costed competitively and delivers value for money, and does not undermine the development of competitive markets. The participation from stakeholders was considered to have the Eligibility Criteria but greater clarity on the role of DNV could have been explained. The Expert Assessors have recommended a Project-specific condition to help mitigate the risk associated with this minor concern.

Recommended Project specific conditions
Ofgem should request a greater breakdown of DNV costs and activities ahead of Project kick-off. The Project team should consider and continually monitor cyber security risks associated with the Project, a report on this should be submitted at end of the Alpha Phase to Ofgem and relevant security stakeholders.

3.2.9 10037451, Predict4Resilience, Initial Net Funding Requested £499,999

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
SP Transmission Plc	£74,340	£46,156	£28,184
University of Glasgow	£40,775	£4,098	£36,677
National Grid Electricity Transmission Plc	£4,886	£4,885	£1
SP Distribution Plc	£6,372	£6,371	£1
SIA Partners UK Plc	£448,430	£48,430	£400,000
Met Office	£42,432	£7,296	£35,136

Submitted Project description

Predict4Resilience aims to develop an application which uses data science to predict the impact of severe and adverse weather on the electricity networks. Our idea is to improve our control room's preparedness against the faults caused by severe and adverse weather events, which can be forecasted up to two weeks ahead via the ''weather fault tool''. We see this as improving data quality (to be used in our statistical post-processing), and access (to both our data and the Met Office) to improve the security and resilience of the network. These techniques convert weather forecasts into impact forecasts, in this case forecasts network faults, which are more accurate and result in better decision-making than using raw weather forecasts only. What make this project innovative is the work on weather-related fault prediction, probabilistic fault prediction, and medium range forecasting. No other past innovation projects have considered probabilistic fault prediction and related decision-support, leaving a significant gap in DNOs' predictive capability**.** Such capability offers many advantages:

1. Increased accuracy by leveraging advanced weather forecasts, new data sources, and machine learning,
2. Short- to medium-range forecasting with uncertainty quantification, enabling new modes of risk management and increasing resilience though early warnings up to one week ahead, and
3. Consistent forecast data easily made available to all internal and external stakeholders supporting open data and establishing cohesive practices.

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

This Project uses data science to improve fault prediction on the electricity network and has the potential to significantly improve infrastructure resilience, and continuity of supply for customers. In the opinion of the Expert Assessors, the Project addresses the Innovation Challenge and therefore meets the requirements of this Eligibility Criteria.

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

The Project delivers a potential net benefit to electricity consumers through its potential to improve infrastructure resilience and continuity of supply for consumers. This would result in cost savings for electricity consumers. In the opinion of the Expert Assessors, the Project was considered to deliver a potential net benefit to electricity consumers and therefore meets this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

The problem for the network is predictive resource requirements for reacting to weather and how to optimise mobilisation of resource in the event of extreme weather to get customers back on supply. In the opinion of the Expert Assessors, this Project involves network innovation for several reasons. First, because of its proposal to develop a digital platform to predict how the network will behave against previous weather conditions. This was considered to involve network innovative because the tool will be usable by networks in GB and was considered to be an evolution of how networks factor upcoming weather conditions. Second, the Expert Assessors consider the potential response of the network based on the predictions generated by the digital platform to involve network innovation because the network may be able to incorporate or facilitate new measures to adapt the network to upcoming weather conditions. These were considered by the Expert Assessors to be an innovative approach to managing and preparing the network for weather conditions which could result loss of supply or interruptions to consumer supply.

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

The Project is not regarded by the Expert Assessors as undermining the development of competitive markets because it is focused on developing a digital tool which will support in the understanding of how the electricity network may respond to upcoming weather changes. The Expert Assessors did note a minor concern which was not considered to be strong enough for the Project to not meet this Eligibility Criteria, where the Project could have provided greater detail on how the Project will use an open data approach.

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

The Project was seen to be innovative and novel in its use of development of a digital tool to understand potential electricity network impacts from upcoming weather changes. The Expert Assessors noted that the Project could have provided greater detail on how the Project will understand and differentiate between different modes of failure. However, this was seen as a minor consideration by the Expert Assessors and the Expert Assessors considered this Eligibility Criteria to be met.

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

The Expert Assessors recognised the expertise in both University of Glasgow and SPEN Control Room Teams and they demonstrated a clear understanding of the Project and solution. The Expert Assessors considered the participation from the stakeholders to be sufficient for the Alpha Phase and consider this Eligibility Criteria to have been met.

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

The Expert Assessors considered this Project to demonstrate value for money and be costed competitively. The Alpha Phase works are helping incorporate and implement the tool, which could deliver clear societal benefits.

As the Project was considered by the Expert Assessors to provide value for money and be costed competitively, the Expert Assessors considered this 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.

The Expert Assessors considered this Eligibility Criteria to have been met because the Project plan was considered to be sufficiently robust that the Project will be capable of progressing in a timely manner. The Project plan's focus on adding new data sources and extraction of explanatory features was considered by the Expert Assessors to be appropriate for the Alpha Phase. The Project risks were also considered by the Expert Assessors to be well considered with appropriate mitigation actions suggested.

Regulatory barriers noted by the Expert Assessors

NO

Recommendation to the Gas & Electricity Markets Authority

FUND

The Expert Assessors recognised the expertise in the stakeholders brought together for this Project, and they have demonstrated a clear understanding of the Project and solution, and provided a clear Project plan which gave the Expert Assessors confidence that the Project would be capable of progressing in a timely manner.

The Expert Assessors also considered this Project to be innovative and novel in its use satellite data to better plan and prepare for weather which is potentially disruptive to the electricity network, which can deliver a potential net benefit to electricity consumers through less network disruptions and interruptions.

Recommended Project specific conditions

N/A

3.2.10 10037488, Smarter homes for a smarter energy future, Initial Net Funding Requested £362,559

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Northern Gas Networks Limited	£17,380	£0	£17,380
Newcastle University	£168,427	£0	£168,427
Northern Powergrid (Yorkshire) Plc	£4,200	£0	£4,200
Cadent Gas Limited	£1,650	£0	£1,650
National Energy Action	£170,902	£0	£170,902

Submitted Project description
(Please note: this is a name change from Discovery Phase Project 10027307: CEV Critical factors for the adoption of smart homes for energy efficiency: implications for consumers and providers -- we felt this name was too long and not easy to identify with, particularly when hosting dissemination events and webinars.) Following a successful Discovery Phase Project, during which we identified the key factors which can aid or hinder the adoption of smart home technologies, 'Smart homes for a smarter energy future' will further develop our framework into a usable tool for stakeholders to ensure that users' needs are considered and addressed throughout their journey to decarbonising their homes. Although we intend to engage with a wider range of stakeholders, during this Alpha Phase we anticipate the tool will be developed for key, pre-agreed, stakeholder groups, namely networks (resource/infrastructure-orientation), housing associations (house-orientation), and installers (user-orientation). Through a series of extensive engagement activities with stakeholders, users, and their representatives, we intend to test our Discovery Phase findings, identify areas that we can further develop in our framework, and understand the possible solutions which may exist to the barriers which halt the adoption decision. By implementing the principles of co-design and meaningful engagement, we hope to identify and develop solution concepts to some of the biggest challenges facing the adoption of smart home technologies, alongside providing a tool to support

stakeholders to engage more effectively with, and better meet the needs of, various user groups.

We want the range of possible solutions to naturally fall from our engagement, to ensure we have approached this openly and without limitation, or commercial or innovation bias. It is our intention to then narrow down the range of solutions to develop our concepts and agree on which solution(s) to take forward into the Beta Phase. We want to be guided by the insights and the natural fluidity of this process, leading by example with the principles of co-design and meaningful inclusion.

We are confident that 'Smart homes for a smarter energy future' can contribute to addressing some of the biggest challenges facing the energy industry in their journey to Net-Zero, while supporting a fair and accessible transition for all.

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

The Expert Assessors considered this Project to not have addressed the data and digitalisation Innovation Challenge as its focus on the development of a static tool which was considered to be more aligned with a research Project than an innovation Project which addresses the Innovation Challenge, and which will have long lasting, enduring and strategic impact sector wide.

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

The Project proposes a static tool which would be more beneficial if a dynamic element was introduced rather than a static snapshot of consumer preferences. The Expert Assessors found the potential benefit to gas consumers would be limited and would diminish over time as the Project focusses on the development of static tool. As a result, the Expert Assessors did not see the Project as having clearly identified a potential net benefits to gas consumers.

Eligibility Criterion 3:
Projects must involve network innovation.

The Project considered this Project to be more focussed on the energy retail supply market. The value of whole systems thinking is acknowledged, but it was unclear

how the outputs would ultimately be utilised in energy network operations and where the network innovation was specifically. The Expert Assessors did consider this Project to involve sufficient network innovation for this Eligibility Criteria to have been met.

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

The Expert Assessors did not consider this Project as undermining the development of competitive markets. The Expert Assessors considered the proposed open source access approach to the proposed digital tools as something which may help to stimulate market opportunities for smart devices.

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

The Expert Assessors did not consider this Project to be sufficiently innovative, novel and/or risky. In the opinion of the Expert Assessors the Project is more closely aligned with a research Project rather innovation.

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

A wide range of stakeholders have and are intended to be engaged in the Project. In the opinion of the Expert Assessors, however, the Project was missing a critical stakeholder in an organisation with a consumer facing relationship for the Project to be considered to have met this Eligibility Criteria.

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

The Expert Assessors did not consider the Project to represent value for money due to the output being a static research output, which although valuable in its own right, will not be dynamically updated without secure financing, of which there has been no indication of at any point during the assessment. Therefore, in the opinion of the Expert Assessors, this Project did not meet 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.
The Project plan is generic but offers clear milestones and resource requirements. The Project delivery methodology appears reasonably robust and should provide a pathway to timely delivery of the work packages described. Output deliverable functionality and success criteria for the tool under development within the Alpha Phase has not been well described. Overall, the Expert Assessors considered the Project to have delivered a clear timeline but the methodology for delivering functionality and success was not sufficiently robust for the Expert Assessors to have considered this Eligibility Criteria as having been met.

Regulatory barriers
NO
It was stated that no personal or sensitive data would be used, and therefore there do not appear to be regulatory issues at this time.

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The Expert Assessors appreciated the value of capturing and enabling access to anonymised, aggregated data to better understand the reasons why people are not up taking smart devices. In the opinion of the Expert Assessors, the Project did not clearly outline how the Project would provide a potential net benefit to gas consumers. Furthermore, the Expert Assessors questioned where the innovation in the Project was and there was not a sufficiently detailed plan provided to articulate how the Project would be capable of progressing in a timely manner. The Expert Assessors also noted positively the range of stakeholders brought together for this Project, but considered the lack of a Project Partner with a consumer-facing relationship to be critical weakness in the Project's stakeholders.

3.2.11 10037690, Digital Platform for Leakage Analytics, Initial Net Funding Requested £445,571

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Cadent Gas Limited	£75,990	£48,990	£27,000
Northern Gas Network Limited	£3,500	£0	£3,500
Wales & West Utilities Limited	£5,730	£573	£5,157
National Grid Gas Plc	£4,734	£0	£4,734
Southern Gas Networks Plc	£4,680	£0	£4,680
Guidehouse Europe Limited	£400,500	£0	£400,500

Submitted Project description
Cadent Gas Ltd (Cadent), in partnership with Guidehouse, SGN, Northern Gas Networks (NGN), Wales and West Utilities (WWU) and National Grid Gas Transmission (NGGT) are striving to efficiently reduce gas network leakage with this Project. Gas leakage from the UK Gas Distribution Networks (GDNs) represents approximately 1% of the UK's total GHG emissions. Currently, this is being addressed through the Iron Mains Replacement Programme, system pressure management and monoethylene glycol (MEG) treatment. These emissions reduction efforts have historically been strong, with each GDN outperforming regulator targets during the 2014-2021 price control period. However, the lack of accurate, real-time leakage information has limited the networks' ability to make data-driven decisions and more effectively reduce their business carbon footprint, of which shrinkage forms the majority. This Project aims to develop a new digital platform to provide more accurate, dynamic gas leakage information, enabling more efficient investment decisions to reduce leakage and customer bills. Technological advances since the inception of the current Shrinkage and Leakage Model (SLM) open opportunities for reform. The Digital Platform for Leakage Analytics (DPLA) Project will develop a new approach to quantifying and locating leaks from GDNs using a combination of cutting-edge technology, hydraulic modelling and advanced algorithms. This is a big change from the current SLM, which uses a static, theoretical approach, and would make it one of the most advanced methods in Europe. The new approach will also improve operational

decision making, maintenance and asset replacement strategies, customer safety, and deliver better value for customers by decreasing the socialised costs of gas leakage.

The Alpha Phase of this Project will focus on the following areas:

- Testing, research and feasibility studies of leak detection technologies: including novel methane sensors, mobile ground labs, drone-based sensing and helicopter-based LiDAR technology
- Testing, research and vendor assessment for digital leakage analytics platform development
- Impact assessment of leakage methodology change: including IT systems integration, operational protocols, Health and Safety Executive considerations, workforce management
- Regulatory considerations: regulatory changes, arrangements and incentives
- Business considerations: cost benefit analysis business case, commercial design options

A successful Alpha Phase would set the framework for the deployment of a DPLA, enabling the aggregation of leakage information for the first time. The platform would provide insight and confidence to facilitate targeted, proactive investment, and a step change improvement in leakage reduction processes. This Project will build on Cadent's strong track record in reducing emissions and expedite this into the future.

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

A compelling explanation of why this Project is appropriate for SIF Funding and how it addresses the data and digitalisation Innovation Challenge was provided. The Project is focused on the development of a digital platform which will enable novel approaches to identifying methane leakages. In the opinion of the Expert Assessors, the Project has met this Eligibility Criteria.

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

The potential benefits for gas consumers are clearly described and supported by metrics, thereby fulfilling this Eligibility Criteria in the opinion of the Expert Assessors. The Project's focus on developing a new approach to quantifying and locating leaks from gas distribution networks using a combination of new technology, hydraulic modelling and advanced algorithms could help in reducing the amount of gas leakage in the NTS, delivering cost savings to consumers through less gas being required as well as environmental benefits. The Expert Assessors did note that the Project could have more clearly articulated how the Project's benefits will be realised on consumer bills, however this was not considered to be sufficient risk to consider this Eligibility Criteria as not being met.

Eligibility Criterion 3:
Projects must involve network innovation.

In the opinion of the Expert Assessors, the Project's focus on addressing gas network leakage through a combination of new technology, hydraulic modelling and advanced algorithms is innovative. This Project was considered to present an innovative solution to a problem which is clearly an issue throughout gas networks.

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

In the opinion of the Expert Assessors, the Project is not viewed to undermine the development of competitive markets because it focuses on the development on a digital tool for addressing gas leakage in gas network assets. However, in the opinion of the Expert Assessors, the Application could have been clearer on how the Project will enable competitive access to third party solution developers. This was not considered by the Expert Assessors to be a sufficient risk for the Eligibility Criteria to have not been met.

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

The Project's proposal to develop a digital platform to monitor gas leakage using a combination of new technology, hydraulic modelling and advanced algorithms was considered by the Expert Assessors to be innovative and novel and to an extent

risky as the investigates solutions for real-time leakage information to make more informed decisions.

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

In the opinion of the Expert Assessors, the Project brings together participation from a sufficient range of stakeholders. The Expert Assessors also noted positively the focussed work package on stakeholder engagement. The Expert Assessors also considered the buy-in from all GDNs to be key for the Project, and the Expert Assessors recommend the Project look to engage with additional prospective data users and technology providers. Overall, the Expert Assessors considered the participation from stakeholders to be sufficient for this Eligibility Criteria to be met.

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

This Project was regarded by the Expert Assessors as representing value for money because the range of potential benefits described illustrate that the Project is likely to offer value for money to energy consumers. The Expert Assessors also considered the Projects costs for the Alpha Phase to provide value for money.

The Expert Assessors also noted the cost distribution between Partners is heavily weighted towards a single Partner, and some subcontract costs were considered to be at the upper limits of being costed competitively. However, this was not seen as being sufficient risk for the Project's to be considered to not be costed competitively.

As a result, the Expert Assessors considered the Project to provide value for money and be costed competitively.

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.

The Expert Assessors considered the Project plan and risk register to be sufficiently well documented, and offer sufficient time to give confidence of successful delivery in the Alpha Phase. The Expert Assessors noted the ambitious Project plan for the Alpha Phase.

The risk register is clear with reasonable mitigating actions described.

Overall, the Expert Assessors found the Project plan and risk register to be sufficiently robust and the Project should be capable of progressing in a timely manner, although some technical development work package timelines may be challenging.

Regulatory barriers noted by the Expert Assessors
YES
Existing Licence condition relating to calculation / methodology for leakage and the universal approach by all GDNs. This will require Innovation Link to input to an annual review process.

Recommendation to the Gas & Electricity Markets Authority
FUND
The case has been well made that the do nothing option is unattractive from a costs and outcomes perspective. The range of potential benefits described in the benefits case illustrate that successful Project delivery is likely to offer good value for money to the consumer and also provide good opportunities for decarbonisation. The Expert Assessors viewed the Project as being innovative, novel and risky, and considered the GIS visualisations and data communication as highly valuable parts of the Project. The Project's focus on developing a new approach to quantifying and locating leaks from gas distribution networks using a combination of new technology, hydraulic modelling and advanced algorithms could help in reducing the amount of gas leakage in the NTS, was considered by the Expert Assessors as delivering cost savings to consumers through less gas being required as well as environmental benefits.

Recommended Project specific conditions
The Project must provide a collaborative working plan with Project 10037416 (Intelligent Gas Grid) and Project 10036952 (HyNTS Pipeline Dataset) to ensure

interopable approaches and lack of duplicative work in the Alpha Phase, and consider opportunities for merging Projects in later phases.

4. SIF Round 1 Alpha Phase – heat

4.1 SIF Alpha Phase – heat – Summary

This section covers the assessment of eligible round 1 Alpha Phase Applications received into the heat Innovation Challenge[9].

For the Alpha Phase, 4 proposals were submitted to Innovate UK through the Innovation Funding Service (IFS) portal by the closing deadline of 11am 18th May 2022 and are listed below. All submitted Applications were considered to have met the Innovation Challenge requirements for the Heat Innovation Challenge and have been assessed by the Expert Assessors.

For information on the scope of the heat Innovation Challenge and the Discovery Phase Applications and assessments please see the recommendations report from the Discovery Phase[10].

Project reference number	Project name	Funding licensee	Total eligible costs (£)	Total Project contribution (£)	Total SIF Funding requested (£)	Recom-mended for funding (Yes/No)
10036954	HyNTS Protection	National Grid Gas PLC	£531,041	£87,846	£443,195	Yes
10037467	Heat Balance	SP Transmission PLC	£554,712	£55,596	£499,116	Yes
10037468	Flexible Heat	SP Transmission	£558,084	£58,373	£499,711	No
10037659	Velocity Design with Hydrogen	Southern Gas Network PLC	£513,689	£51,369	£462,320	Yes

[9] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-innovation-challenges
[10] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-discovery-projects-approved-funding

4.2 Evaluation of heat Applications

4.2.1 10036954, HyNTS Protection, Initial Net Funding Requested £443,195

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National Grid Gas Plc	£67,984	£50,000	£17,984
Ultima Forma Ltd	£355,543	£20,000	£335,543
Rosen (UK) Limited	£107,514	£17,846	£89,668

Submitted Project description
The National Transmission System (NTS) is a network of high-pressure natural gas pipelines, that supply gas to about forty power stations, large industrial users and gas distribution companies that supply commercial and domestic users. The natural gas is transported from the terminals situated on the coast to the end user. Around 23 million homes are heated by natural gas today, supplied through the NTS. 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. These gases have different properties to natural gas and therefore have different effects on the pipeline assets and systems. In 2026, BEIS are looking to define the heat strategy and conclude the role of hydrogen in heat in the UK, and work is underway as part of the hydrogen grid research and development working group, to define the asset capability. Understanding the effects of hydrogen embrittlement and its impact on the NTS assets is a focus area. This Project looks at active prevention of hydrogen embrittlement through the use of coatings, to increase the lifetime of the assets in a hydrogen environment and reduce the cost to the consumer in maintenance and replacement.

This Project will build on the outcomes of the Hydrogen Barrier Coatings for Gas Network Assets SIF Discovery Project during which an assessment of suitable hydrogen barrier coating materials and deposition techniques to apply on gas network assets was undertaken.

The Project will undertake detailed feasibility studies into the deposition of barrier coatings onto identified gas network assets such as line pipe and welds as well as above ground assets. In-situ deposition techniques involving pipeline inspection gauges, robotics or gas dispersed systems will be investigated alongside a review the opportunities and associated costs with undertaking the coating process offline. A cost-benefit analysis of these re-purposing technologies will be considered alongside replacement with new "hydrogen-ready" assets.

The Project Partners in the Project are experts in coating technologies and pipeline operations.

The output of the Alpha Phase will be; validation of barrier coating materials; determination of coating deposition requirements; component level coating trials; in-situ coating process design and feasibility; and detailed business case assessment. The outputs will feed into a Beta Phase proposal which will demonstrate deployment of the technologies at scale.

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

The Project addresses the heat Innovation Challenge as it supports heat decarbonisation by seeking a cost-effective way to repurpose gas networks to support hydrogen transition and deployment of low carbon heat at lowest cost.

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

The Project showcases large potential to deliver a net benefit to gas consumers from repurposing the networks via coatings and barriers versus potentially building new assets for deploying hydrogen. The Project identified a potential for it to deliver a net financial, environmental and social benefit to gas consumers, with benefits occurring even if wholesale gas network repurposing does not occur.

Eligibility Criterion 3:
Projects must involve network innovation.

Hydrogen cannot be deployed in the current networks without network barrier coatings to protect against embrittlement in the gas transmission network. No viable alternative solutions are currently known, and so novel solutions are required. In the opinion of the Expert Assessors, this Project's focus of seeking a cost-effective way to repurpose gas networks to support hydrogen transition was considered as involving network innovation and therefore meeting this Eligibility Criteria.

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

Coatings specifications will be generic and outcome focussed - the Project does not close options for other providers to develop and implement coatings responding to future National Grid Gas (NGGT) tenders for the work. In the opinion of the Expert Assessors, this Project was not considered to undermine the development of competitive markets.

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

The Project is addressing a known problem around hydrogen embrittlement with in-situ transmission network assets and the solutions being tested are not commercially available. The Project has made a strong case that this work has not been done anywhere else in the world. The Expert Assessors therefore consider the Project to be innovative and risky but with potentially high rewards.

Eligibility Criterion 6: Projects must include participation from a range of stakeholders.
In the opinion of the Expert Assessors, the Project includes participation from a sufficient range of stakeholders for what the Project is examining and the work set out for the Alpha Phase. The Expert Assessors considered this Eligibility Criteria to have been met. In the opinion of the Expert Assessors a minor weakness in the Application was the lack of involvement in the Project from gas distribution networks, which could support a greater sharing of the learnings from this Project and be a benefit to their high pressure gas networks.

Eligibility Criterion 7: Projects must provide value for money and be costed competitively.
The Expert Assessors consider this Project as providing value for money for consumers and being costed competitively. NGGT is contributing over 10% of total Project costs and the Expert Assessors considered the savings the Project could deliver as potentially quite material relative to the costs. In the opinion of the Expert Assessors, a minor weakness in the Application was whether the commercial Project Partner could be contributing more towards the Project's costs given the commercial benefit if the Project succeeds. However, this minor weakness was not considered by the Expert Assessors to be a sufficient enough risk for the Project to be considered to not be providing value for money and costed competitively.

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.
In the opinion of the Expert Assessors, the Project presented a clear and robust methodology which gave the Expert Assessors confidence that the Project would be capable of progressing in a timely manner. The Expert Assessors considered the Project Partners to bring a lot of relevant knowledge to the team and were considered to have demonstrated a strong collaborative working environment, which gave the Expert Assessors confidence that the Project would be capable of progressing and delivering the proposed work in the Alpha Phase. In the opinion of the Expert Assessors, this Project met this Eligibility Criteria.

Regulatory barriers noted by the Expert Assessors
No

No regulatory flags or barriers were identified with the Project by the Expert Assessors. The Expert Assessors noted that Project Union and work underway by the Institution of Gas Engineers & Managers (IGEM) are examining ways of addressing regulatory barriers which may be relevant to this Project.

Recommendation to the Gas & Electricity Markets Authority
FUND
This is an important Project to support gas transmission networks towards a hydrogen transition. It is a well-structured and innovative Project with the relevant skills and capability in the Project team to support successful delivery in the Alpha Phase, and demonstrates the potential to deliver net benefits to gas consumers. In the opinion of the Expert Assessors, this Project has met all of the Eligibility Criteria.

Recommended Project specific conditions
By end of the Alpha Phase, the Project needs to have and provide a clear view of solution applicability to Gas Distribution Networks, and should provide a brief note to UKRI on how this has been assessed by end of Alpha.

4.2.2 10037467, Heat Balance, Initial Net Funding Requested £499,116

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
SP Transmission Plc	£52,569	£5,257	£47,312
University of Edinburgh	£119,558	£11,956	£107,602
University of Glasgow	£122,105	£12,210	£109,895
Ramboll UK Limited	£125,230	£12,523	£112,707
Delta Energy & Environment Limited	£114,000	£11,400	£102,600
Erda Energy Limited	£10,000	£1,000	£9,000
Vattenfall Heat UK Limited	£11,250	£1,250	£10,000

Submitted Project description
Decarbonisation will profoundly change the way we heat our buildings, both commercial and domestic. This proposal forms part of the blueprint required for that transition and supports government objectives. Both inter-seasonal and short-term thermal energy storage (TES) will be essential to balance the demand and supply for the future Net Zero heating system. Large-scale TES (LTES) is one of the lowest cost forms of energy storage. It is innovative in the UK where there is a lack of deployment to date and it is not currently considered as a business as usual (BAU) solution by networks. Credible pathways for decarbonising heat result in a large increase in electricity demand as gas and other fossil fuel fired boilers are replaced by heat pumps. Displacing fossil fuel, primarily natural gas, for heating results in one of the major challenges for the electricity system in managing the huge seasonal variation in the demand for heat. In addition to the challenges raised by electrification of demand, there is a challenge arising from the increasing levels of intermittent renewable generation required to support the demand. Renewable generation is connected predominantly in the north of the UK and load is predominantly in the south. The interconnectors in the transmission system are already constrained in their ability to export renewable electricity at times.

Heat Balance aims to develop demand flexibility from large-scale TES to:-

- Better match heat demand to the output of renewable generation that would otherwise be constrained at significant cost to electricity consumers.
- Reduce peak demand on the transmission and distribution networks over multiple timescales, reducing the need for network reinforcement.
- Enable heat network operators to benefit from low cost electricity by making their load flexible.
- Reduce the investment required in electricity generation by reducing the capacity required to meet peak demand.

The Alpha Phase Project will build capability for LTES deployment by delivering the following work packages:

- Commercial and Regulatory
- Environmental and Social
- Case Study Development
- Archetype solutions guidance

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

In the opinion of the Expert Assessors, the Project addresses the heat Innovation Challenge as it is examining the problem of heat decarbonisation at lowest cost the Project's focus on inter-seasonal storage offers prospects for being a particularly important aspect of that. The Expert Assessors consider that the Project's focus will also support the move away from gas combined heat and power heat networks.

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

In the opinion of the Expert Assessors, the Project identified a potential to deliver a net benefit to electricity consumers through the reduction of constraintment costs and the need for network for reinforcements. Both of these were considered by the Expert Assessors to have the potential to deliver a net benefit to electricity consumers in the reduction of costs. The Project was also considered by the Expert Assessors to have identified a potential to deliver a net benefit to heat networks

operators, users of the electricity network, via its proposed use of large-scale thermal energy storage.

Eligibility Criterion 3:
Projects must involve network innovation.

Large scale thermal energy storage (LTES) is not currently deployed commercially in the GB, and as a result, networks do not currently procure flexibility from large LTES. The Project's focus on examining how this can be enabled and how it can support flexibility was considered by the Expert Assessors as involving network innovation because it is not a technology or solution which is currently being examined.

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

The Project is focused on one specific model of LTES and did not demonstrate consideration for alternative uses of constrained wind power such as hydrogen production or other long term storage solutions. However, in the opinion of the Expert Assessors, the Project's focus on the development and use cases for one technology was not seen as sufficient evidence that the Project was undermining the development of competitive markets and the Expert Assessors considered these other uses cases to be investigated and used outside of this Project. Whilst the Project's Application could have more clearly outlined a consideration for other models of LTES and uses cases for constrained wind, the Expert Assessors considered this Eligibility Criteria to have been met by the Project.

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

In the opinion of the Expert Assessors, the Project is innovative, novel and risky because it is examining how LTES can be developed and used for the first time by electricity networks in GB. The Expert Assessors considered the Project innovative and novel because it is examining existing regulatory barriers around the ownership of sub-surface heat and the social acceptability of LTES.

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

The Expert Assessors considered the Project to have brought together a wide range of stakeholders and demonstrated sufficient participation from these stakeholders for the work packages described for the Alpha Phase. Because of this, the Expert Assessors considered this Project to have met this Eligibility Criteria.

The Expert Assessors did note some weaknesses in the Application, but did not consider these to be significant enough for the Project to not meet this Eligibility Criteria. The Expert Assessors considered that NGESO being involved as Project Partner would have strengthened their application as it would have been able to provide additional details on the consideration for other technologies using curtailed wind. Additionally, involvement from distribution network operators could have provided greater details on the wider use cases for the Project.

Eligibility Criterion 7: Projects must provide value for money and be costed competitively.
The Application clearly outlines the cost allocation and the contribution provided by the Project Partners. The costs and the contributions were considered by the Expert Assessors as providing good value for money for consumers and the Project costs for the Project Partners were considered by the Expert Assessors to be costed competitively.

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.
The Project documentation provided sufficient details on the Project plan, roles of the Project Partners and the risks to the Project in the Alpha Phase. This gave the Expert Assessors confidence that Project's methodology was sufficiently robust for the Project to be progressed in a timely manner.

Regulatory barriers noted by the Expert Assessors
YES
There are some significant issues around ownership of sub-surface heat which the Project hopes to help resolve. Regulation of district heat networks is not yet mature and Ofgem does not yet have powers in this space (although it is expected that they will do in future).

Recommendation to the Gas & Electricity Markets Authority
FUND
Developing long duration storage is crucial to deal with the inter-seasonal challenge that heat decarbonisation presents. This is an important Project to develop innovative commercial arrangements with electricity networks who would benefit from LTES and to test how this existing technology could be made to work in the wider GB legal and regulatory context around heat. This, in the opinion of the Expert Assessors, demonstrated a clearly identified potential for the Project to deliver a net benefit to electricity consumers. The Expert Assessors considered this Project to be innovative, novel and risky because of this approach, and were confident that the Project would be capable of progressing in a timely manner. Whilst there were a few weaknesses identified by the Expert Assessors in the stakeholders, the Expert Assessors considered the Project to participation from a sufficient range of stakeholders for the Alpha Phase of the Project. The Project's costs and work packages described for the Alpha Phase were also considered by the Expert Assessors to be costed competitively and delivering value for money for consumers.

Recommended Project specific conditions
• The Project should ensure any commercial arrangements that are developed be technologically neutral and consider how the LTES proposed would sit alongside other possible solutions. • The Project should endeavour to involve ESO in the Project as it progresses and engage with it to look at the handling of constraint payments. • The Project should endeavour in the Alpha Phase to examine external financing options and how external funding could be utilised in the Project for a demonstration.

4.2.3 10037468, Flexible Heat, Initial Net Funding Requested £499,711

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
SP Transmission Plc	£70,011	£7,002	£63,009
Sunamp Limited	£16,980	£1,698	£15,282
E.ON Energy Solutions Limited	£70,083	£7,008	£63,075
Delta Energy & Environment Limited	£154,850	£15,485	£139,365
Smarter Grid Solutions Limited	£125,980	£15,080	£110,900
Connected Response Limited	£120,180	£12,100	£108,080

Submitted Project description
Flexible Heat is addressing the topic of 'Heat' as set out in the 2021 round of SIF innovation challenges. We know that unmitigated decarbonisation and electrification of heat will lead to networks overloading and therefore we must make heat flexible to avoid significant investment in future network upgrades. Flexible Heat is tackling this problem by researching and demonstrating the value that intelligent management can bring to unlocking flexibility from domestic Thermal Energy Storage (TES). The wider aim of Flexible Heat is to demonstrate the control platform in operation - heating demand will be shifted to meet flexibility needs, whilst maintaining customer warmth and comfort. By determining the benefits for the whole system, it will produce insights to inform government regulatory and commercial policies. Within the Discovery Phase of Flexible Heat research was conducted on the domestic TES market and identified that there is value in using domestic TES to offset conventional network reinforcement. The CBA demonstrated a positive NPV of £2.3k per household by 2020. The Discovery Phase also:

- Developed high level architecture for a regional controller able to access flexibility from domestic TES
- Gathered learnings on customer acceptance and concerns surrounding domestic heating

The Alpha Phase will build upon these findings to define the technical, commercial and customer requirements for a large-scale demonstration within the Beta Phase.

Sites will be selected for the trial based on recommendations in the Discovery Phase and for each a detailed assessment for these will be carried out which will characterise the network, housing and associated heat pump profiles. Further the functional design and test strategy for a regional control platform to be used in the trial will be developed during the Alpha Phase of Flexible Heat.

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

The Project addresses the heat Innovation Challenge as it is focused on the development of deployment of flexible heat and using smart technology to manage large scale heat deployment.

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

It is clear that flexible heat is essential to deliver electrification of heat at lowest cost to customers, with significant benefits. However, there are a number of other major innovation projects looking at heat pump flexibility and the additional benefits to electricity consumers from this particular Project are not clear. In the opinion of the Expert Assessors, the revenue model for consumers was not clear and included some references to customers potentially paying more. The underlying assumptions on the value from the network deferring or avoiding reinforcement was not clear and evidenced.

Overall, the Expert Assessors did not find the Project provided a clearly identified potential for net benefits to be delivered to electricity consumers.

Eligibility Criterion 3:
Projects must involve network innovation.

The focus of the Project is on the development of a "regional controller" - the purpose of which was unclear to the Expert Assessors. On further probing at interview, it became clear to the Expert Assessors that the key feature of this Project is testing the use by the network of direct load control. In the opinion of the Expert Assessors, the Project lacked evidence on the specific area where further network innovation is required, taking into account learnings from other relevant projects.

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

In the opinion of the Expert Assessors, it was unclear how the proposed direct load control model fit with a competitive supplier/aggregator flexibility market or how it would impact the commercial revenue stream for aggregators. The Project has not provided evidence as to how a Regional Control Strategy can be facilitated without creating de-facto monopolies. This was considered by the Expert Assessors to be serious concern and the Expert Assessors did not consider the Project as having demonstrated that it will not undermine the development of competitive markets. Therefore, in the opinion of the Expert Assessors, the has not met this Eligibility Criteria.

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

In the opinion of the Expert Assessors, the Project scope of work is not technically innovative or risky. The direct load control approach could have significant regulatory and consumer risks, but these have not been identified and addressed in the proposal. The Expert Assessors did not see the Project as having fulfilled this criteria.

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

The Project has a good range of technical, commercial and consumer facing Project Partners. However, given the emphasis on the use of constrained wind, the Expert Assessors consider that the ESO should have been involved. Closer involvement of

other DNOs would also be important to ensure business as usual implementation at a GB level. As a result, the Expert Assessors did not see this Project as having sufficient participation from necessary stakeholders.

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

In the opinion of the Expert Assessors, the Project has not adequately considered the range of existing projects looking at heat pump rollout and in particular heat pump flexibility. Some are referenced but a full review of findings and outputs should be provided at this point of Project development. Without a clear sense of what has already been done or is already underway, the Project may well be duplicating learning from other projects. As a result, the Expert Assessors did not see this Project as being costed competitively or providing value for money.

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.

The Project approach of using direct load control has regulatory and consumer risks which have not been adequately considered. It does not have a robust approach to recruitment of customers in a timely manner. The Project plan and consortia capability around technical expertise are good, but the Project scope is not clear on the specific problem it is trying to address.

Regulatory barriers noted by the Expert Assessors

NO

Potential issues with direct load control, supply licence conditions, and consumer consent that should be explored more fully.

Recommendation to the Gas & Electricity Markets Authority

DO NOT FUND

This is research in an important area and the team assembled is technically very strong. However, in the opinion of the Expert Assessors the Project did not meet several of the Eligibility Criteria.

The Expert Assessors considered the Project's narrow focus on direct load control to bring risks that were not acknowledged and which do not fit well in the current regulatory and market landscape. Additionally, there was an unclear consumer proposition for potential net benefits which could be delivered to energy consumers. The Expert Assessors also considered the additionality of value above and beyond other innovation and flex heat projects tackling this area to be unclear, demonstrating a limited value for money for the Project.

The Expert Assessors also did not consider the Project to have evidenced it is innovative and risky enough to warrant SIF Funding.

4.2.4 10037659, Velocity Design with Hydrogen, Initial Net Funding Requested £462,320

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Southern Gas Networks PLC	£22,176	£18,720	£3,456
Cadent Gas Limited	£4,590	£0	£4,590
Wales & West Utilities Limited	£2,292	£0	£2,292
National Grid Gas PLC	£2,804	£0	£2,804
Institution of Gas Engineers and Manager	£2,400	£0	£2,400
DNV Services UK Limited	£479,427	£32,649	£446,778

Submitted Project description
The UK natural gas pipe networks have the potential to flow blended hydrogen and to be re-purposed to flow 100% hydrogen. The hydrogen networks can contribute to the Challenge 4: Heat, through the transformation to meet national 2030 and 2050 emissions targets. To demonstrate how the current gas networks can be intelligently and efficiently transition to provide low carbon heating, the gas velocity constraint(s) for hydrogen, applied at the design stage, need to be identified. The constraint(s) determined will impact directly onto the levels of capital investment required in the transition of the system to accommodate blended and 100% hydrogen. Hydrogen delivers approximately one third of the energy per unit compared to natural gas so, depending on the evolving demand of heating gas through the transition to low carbon heating, it is likely that re-purposing existing gas networks may require increased design gas velocities if pipe sizes are not to be increased. Increasing the design velocity safely will minimise the costs of re-purposing the networks.

Current design velocity limits are long standing industry practice; the innovation lies in establishing if these limits are appropriate for low carbon heating gas supply and the entrainment behaviours of debris in hydrogen and gas blends is unknown.

Network designers apply a standard industry practice that limits the design velocity of the gas under peak flow conditions to limit erosion from entrained debris and other integrity risks due to excessive noise or vibration.

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

In the opinion of the Expert Assessors, this Project addresses the Innovation Challenge because it is examining how and whether hydrogen can be best used in gas networks in the transition to low carbon heating. The Expert Assessors considered this Project to represent a necessary piece of knowledge to understand the cost of network transition to hydrogen.

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

In the opinion of the Expert Assessors, the Project has identified a potential to deliver a net benefit to gas consumers from reduced costs for gas network reinforcement. The Project could result in less network reinforcement because it is examining the safe velocity limits for hydrogen within the gas network. This Project more broadly was considered by the Expert Assessors as a necessary piece of information to understand the cost of a safe and robust network transition to hydrogen and helps support making an informed decision, which would deliver a net benefit to gas consumers.

Eligibility Criterion 3:
Projects must involve network innovation.

The Project has articulated that the work done in this area thus far has been theoretical using digital hydraulic modelling. This Project's focus of developing a conceptual design of testing facilities and conducting laboratory testing in the Alpha Phase was considered by the Expert Assessors as innovative work which has not been examined in this way. The Expert Assessors considered this to be a crucial part of the Alpha Phase as it could help develop evidence-based change from

physical testing or retention to/of velocity limits of gas in the network. In the opinion of the Expert Assessors, this Project met this Eligibility Criteria.

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

This Project will ultimately develop a standard, but expanding scope to consider wider solutions, including a dynamic approach to velocity limits, could increase competition and flexibility to develop cost effective hydrogen transport in the network, therefore not undermining the development of competitive markets, in the opinion of the Expert Assessors. However, because the Project is focused on developing a standard, the Expert Assessors did not see the Project as undermining the development of competitive markets and considered this Project to have met this Eligibility Criteria.

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

In the opinion of the Expert Assessors, the facility to be developed to test hydrogen velocity limits is innovative and risky. The Expert Assessors also considered that the Project could feature more innovative approaches after the Alpha Phase. The Project, in the opinion of the Expert Assessors, takes a fairly conservative approach to velocity limits by moving to a new static figure or retaining the existing standard and is not exploring other solutions or moving to a dynamic velocity range. However, because of its development of a facility to test hydrogen velocity limits, the Expert Assessors this Project to be innovative and risky, therefore meeting this Eligibility Criteria.

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

The Project has brought on other gas networks from the Discovery Phase, which was viewed positively by the Expert Assessors as it provides a greater range of relevant stakeholders participating in the Project. The Expert Assessors also considered the participation from the range of stakeholders to be sufficient for the works planned in the Alpha Phase. In the opinion of the Expert Assessors, the

Project includes participation from a sufficient range of stakeholders to have met this Eligibility Criteria.

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

There is a good focus on reusing assets in Spadeadam, which the Expert Assessors considered as providing good value for money. The apportionment of costs across the Project was also considered by the Expert Assessors as appropriate given the roles and responsibilities set out for the Alpha Phase. The Project's area of investigation (gas velocity limits) does not have comparable costs, as the previous work was done a decade ago. However, this was considered to be a minor risk by the Expert Assessors and they considered this Project to be providing good value for money and being costed competitively.

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.

In the opinion of the Expert Assessors, the Project provides a robust methodology for the scope chosen in the Alpha Phase and gives the Expert Assessors confidence that the Project will be capable of progressing in a timely manner. The Expert Assessors noted that the Project could have shown more ambition and creativity in its Project plan, risk register and methodology. However, this was considered to be a minor concern by the Expert Assessors and they considered this Project to have met this Eligibility Criteria.

Regulatory barriers noted by the Expert Assessors

NO

No regulatory barriers were flagged. Regarding the timeliness of this Project in relation to the decision to use hydrogen in the distribution networks, the Expert Assessors felt that the findings and outputs of the project would be beneficial to making those decisions and should therefore happen in advance. Now seems to be timely to progress the Project.

Recommendation to the Gas & Electricity Markets Authority

FUND

The Expert Assessors have recommended this Project because it represents an innovative and risky approach to examine the velocity limits of hydrogen in the gas network. The Expert Assessors considered the Project to have clearly identified an opportunity to deliver a net benefit to gas consumers, and provided value for money and was costed competitively with its reuse of existing assets and distribution of Project costs across the Project Partners.

The Expert Assessors noted a minor concern that the Project could have been more ambitious and innovative in its scoping and plan of works in the Alpha Phase, but this was not seen as significant enough for any of the Eligibility Criteria to have not been met.

Recommended Project specific conditions

The cost/benefit analysis should include the costs of cleaning pipes before introducing hydrogen to allow a higher velocity allowance.

5. SIF Round 1 Alpha Phase – zero emission transport

5.1 SIF Alpha Phase – zero emission transport - Summary

This section covers the assessment of eligible round 1 Alpha Phase Applications received into the zero emission transport Innovation Challenge[11].

For the Alpha Phase, 6 proposals were submitted to Innovate UK through the Innovation Funding Service (IFS) portal by the closing deadline of 11am 18th May 2022 and are listed below. All submitted Applications were considered to have met the Innovation Challenge requirements for the Zero Emission Transport Innovation Challenge and have been assessed by the Expert Assessors.

For information on the scope of the zero emission transport Innovation Challenge and the Discovery Phase Applications and assessments please see the recommendations report from the Discovery Phase[12].

Project reference number	Project name	Funding licensee	Total eligible costs (£)	Total Project contribution (£)	Total SIF Funding requested (£)	Recom-mended for funding (Yes/No)
10036950	HyNTS Deblending for Transport Applications	National Grid Gas PLC	£389,298	£75,900	£313,398	Yes
10037168	HyPark	Wales and West Utilities Ltd	£511,708	£51,172	£460,536	No
10037383	Pipeline Hydrogen for Northern Multimodal Mobility	Northern Gas Networks Limited	£330,967	£64,213	£266,754	No
10037453	A Holistic Hydrogen Approach to Heavy Duty Transport (H2H)	SP Transmission	£449,783	£47,919	£401,864	Yes

[11] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-innovation-challenges
[12] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-discovery-projects-approved-funding

10037459	Resilient and Flexible Multi-Energy Hub Networks for Integrated Green Mobility	SP Transmission PLC	£586,680	£86,681	£499,999	No
10037523	Rail decarbonisation	Northern Gas Networks Ltd	£378,757	£38,199	£340,558	No

5.2 Evaluation of zero emission transport Applications

5.2.1 10036950, HyNTS Deblending for Transport Applications, Initial Net Funding Requested £313,398

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
National Grid Gas PLC	£182,798	£50,000	£132,798
Element Energy Limited	£104,600	£25,900	£78,700
Cadent Gas Limited	£1,401	£0	£1,401
Northern Gas Networks Limited	£2,424	£0	£2,424
Element 2 Limited	£98,075	£0	£98,075

Submitted Project description
The UK has committed to Net Zero Emissions by 2050 which will require a range of new energy and technical developments. National Grid Gas PLC have been considering the role of the Gas Networks in this 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. Each use case requires different gas quality and blends which will be managed through deblending and purification technologies. The HyNTS Deblending Project focuses on the deblending of gases from the high pressure national transmission system (NTS) to enable delivery to transport applications. The Project is aligned to Cadent's Hy4Transport project (purification from distribution networks) and NGNs Pipeline Hydrogen for Multimodal Mobility for the North Project (refuelling infrastructure design for the north); together these projects provide a comprehensive landscape for hydrogen mobility applications. 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 solutions. 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.

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 hydrogen infrastructure availability and therefore the speed of transition for the transport industry. The Project works with refuelling partners to explore the opportunity to utilise this technology to enable transport applications, through refuelling stations directly connected to the NTS network. The Alpha Phase will select the optimum technical option for taking gases from the NTS assets, and develop designs for a deblending and refuelling system tailored to the NTS and hydrogen transport user needs. This will enable progression to a demonstration in the Beta Phase in coordination with Cadent and NGN.

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

The Project addresses the Innovation Challenge by exploring the distribution of hydrogen via the National Transmission System (NTS) for subsequent use particularly in the transport sector with deblending being a critical enabler.

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

In the opinion of the Expert Assessors, the Project clearly identified potential net benefits for a variety gas consumers because the Project is examining low cost mobile solutions for deblending and purification can be migrated around gas networks to meet different purification needs. As different uses and requirements for hydrogen and natural gas are needed depending on the use case (industry, heat and transport) this Project is examining how mobile solutions for deblending and purification can be utilised. The represents a net benefit to gas consumers through a reduction of costs in switching fuel sources and the continued use of existing gas network assets, and through a greater potential efficiency in operating the gas network.

Eligibility Criterion 3:
Projects must involve network innovation.

The Discovery Phase demonstrated this solution could fit with hydrogen Heavy Goods Vehicles (HGVs) as a transport application. However, the Expert Assessors

considered deblending options to still be unproven and considered this Project to involve network innovation as it is examining how deblending solutions could be best used by industries, such as the transport industry. In the opinion of the Expert Assessors, this Project has met this Eligibility Criteria.

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

This Project is pre-market stage and does note, in the opinion of the Expert Assessors, undermine the development of competitive markets as existing alternatives to on-site deblending and purification exist with electrolysis. The Expert Assessors considered the outcome of this Project to support the development of a new supply option for on-site deblending and purification, helping providing the additional competition within this sector. The Expert Assessors also noted there is no exclusivity amongst the networks for the findings from the Project and there is a commitment from the Project to disseminate the results. 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.

In the opinion of the Expert Assessors, this Project is innovative and novel as it is examining a new on-site option for deblending and purification which could benefit various types of gas consumers. The Expert Assessors also considered this Project to be risky as the regulations and standards associated with deblending have yet to confirmed, providing an opportunity for the Project to help inform the regulations and standards.

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

The Project also uses the whole gas network (Distribution and Transmission) and therefore having Cadent, Northern Gas Networks and National Grid Transmission along with a potential end user and consultant is the right range of stakeholders for this Project in the opinion of the Expert Assessors. The Expert Assessors noted that a broader range of end users as interested stakeholders, such as the successful applicants of UKRI's Zero Emission Road Freight Trials (ZERFT) programme, would

have strengthened the Application. As a whole, 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.

In the opinion of the Expert Assessors, the Project provides value for money and is costed competitively because the Project costs, distribution across the Project Partners were considered as sufficient and appropriate for the Alpha Phase. The Expert Assessors also considered the contribution from National Grid towards the Project to provide good value for money. 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.

In the opinion of the Expert Assessors, the Project presented a detailed and logical Project plan with a suitable partnership approach. Key milestones are identified. New Project Partners to the project seem sensible for the works in the Alpha Phase. The Expert Assessors found the methodology to be sufficiently robust and the outline of key milestones gave confidence that the Project is capable of progressing in a timely manner.

Regulatory barriers noted by the Expert Assessors

YES

The Project will be linked to the outcome of the use of hydrogen in the gas transmission and distribution networks.

Recommendation to the Gas & Electricity Markets Authority

FUND

The Expert Assessors agree this Project was well thought through and the Project Partners answered the questions professionally and demonstrated a strong knowledge.

In the opinion of the Expert Assessors, the Project identified a clear potential to deliver a net benefit to gas consumers, delivered value for money and was costed

competitively for the Alpha Phase. The Expert Assessors also considered the Project to be innovative, novel and risky as it is examining how mobile purification and deblending could be used to meet the needs of different gas users and consumers in the transition to Net Zero. The Expert Assessors had confidence in the methodology proposed and that the Project would be capable of progressing in a timely manner.

Recommended Project specific conditions
The Project must engage with successful project participants funded under UKRI's Zero Emission Road Freight (ZERFT) programme and consider ways to align activities in demonstration activities.

5.2.2 10037168, HyPark, Initial Net Funding Requested £460,536

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Wales and West Utilities Ltd	£56,505	£5,650	£50,855
Western Power Distribution PLC	£4,392	£440	£3,952
MSP Technologies Ltd	£68,500	£6,850	£61,650
Southern Electric Power Distribution PLC	£3,000	£300	£2,700
SP Distribution PLC	£3,186	£319	£2,867
Passiv UK limited	£370,625	£37,063	£333,562
Easee UK Ltd	£5,500	£550	£4,950

Submitted Project description

The Government's decision to decarbonise cars and vans by 2030 will radically disrupt the way in which energy for transport will be generated and distributed to consumers. Conventional network reinforcement necessary for EV charging hubs is disruptive and expensive, particularly in constrained urban settings where they will be increasingly required.

Our vision for HyPark is to develop a modular, multi-vector solution for EV charging stations, that leverages power from both gas and electricity networks to optimise on-site generation from grid-aware fuel-cells, energy storage and solar PV. This innovative technology integration will offer an investable, "plug-and-play" system to enable at scale zero-emission transport options and a flexible energy system.

HyPark will help reduce consumer bills by optimising on-site generation to enable multi-EV charging at sites such as retail parks, fleet depots, commercial buildings and housing developments without off-street parking, to deliver a flexible, adaptive, low-cost and low-carbon charging solution on an increasingly constrained network. HyPark will improve charging convenience for all urban EV users, particularly benefitting the 25% of the population that cannot access off-street home charging.

As more sectors electrify, generation is becoming more decentralised and variable through intermittent wind and solar. Supplementing available network capacity, HyPark delivers an innovative new product that generates power for multiple EV

chargers using a scalable, integrated gas grid fuel-cell and battery power-system that supports network DSR services.

The use of fuel-cells delivers compatibility with different fuels including gas, biogas, or hydrogen. This flexibility ensures the design is future-proof as it will make use of the existing natural gas network (until 2030s), and provide a roadmap aligned to the transition to hydrogen (by 2040's). This flexible approach also offers eventual compatibility for on-site hydrogen refuelling.

HyPark's smart controls will evaluate and utilise the lowest carbon and cost intensive source of power for the charging-hubs based upon the available generation mix. This grid-aware fuel-cell and battery module will not only help accelerate the deployment of EV charging infrastructure by reducing the need for costly reinforcement but will offer valuable flexibility services to an integrated smart energy-system.

To improve cost efficiency, meet customer needs and improve convenience, HyPark Alpha Phase will prioritise multi-vector optimisation, integrating EV charging loads, the sale of fuel-cell heat to buildings and use of onsite PV generation (whilst integrating slower AC charging alongside faster DC options). We will also explore innovative power management systems within the module and complementarity with other network innovation projects.

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

The Expert Assessors felt the Project's key strengths lay more in the whole system integration Innovation Challenge and would better achieve the target objectives of that Innovation Challenge. The EV charging aspect of the Project, which relates to this Innovation Challenge, was not viewed as the innovative aspect for energy network innovation because this has also been examined and existing alternatives currently exist, in the opinion of the Expert Assessors.
The Expert Assessors recognised the need for solutions to help add EV charging at grid constraint locations but considered the innovation in this Project to be more focussed on energy efficiency optimisation for energy systems in a commercial building or community energy context rather than as a solution to accelerate EV

uptake. As a result, the Expert Assessors did not consider the Project as having met this Eligibility Criteria.

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

This Project will support energy optimisation for the networks if applied in the applicable use cases. The Expert Assessors noted the variety of use cases and considered this complexity to be a challenge for the short duration Alpha Phase. The Project, in the opinion of the Expert Assessors, identified a potential to deliver a benefit to gas consumers in specific instances or circumstances, such as for hospitals and universities. The Expert Assessors did not consider the Project to have clearly identify how the Project would deliver a net benefit to gas consumers beyond these specific use cases and considered the paybacks outlined as challenging to materialise for gas consumers. The Expert Assessors did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

In the opinion of the Expert Assessors, the Project demonstrated limited network innovation as the Project is focused on the integration and control of technologies. The Expert Assessors noted greater network innovation could have been presented by the Project with the testing of individual technologies and how they can be utilised to support flexibility services. The Expert Assessors did not consider the Project to have met this Eligibility Criteria.

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

In the opinion of the Expert Assessors, the emphasis of the Project is on the integration and control of flexibility technologies for different types of customers. This was not considered by the Expert Assessors to undermine the development of competitive markets because of this focus and noted alternatives in this space already exist.

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

The Expert Assessors considered the Project to deliver limited innovation as many established sites are already examining similar focuses to the Project's. The Expert Assessors considered the novel aspect of the Project being the coupling of energy supply and storage to optimise energy efficiency and supply for instances when the grid is constrained. However, because the Expert Assessors considered the Project to be delivering limited innovation, they did not consider the Project as having met this Eligibility Criteria.

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

In the opinion of the Expert Assessors, the Project brought together a good project team. However, the Expert Assessors considered the lack of an identified 'customer' for the Project to be a critical missing stakeholder from the Project. As a result, the Expert Assessors did not consider the Project as having met this Eligibility Criteria.

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

In the opinion of the Expert Assessors, the Project did not provide sufficient detail or clarity for the Expert Assessors to be confident that the Project provides value for money and is costed competitively. The Expert Assessors noted that the technologies used in the Project and the focus of the Project are not new, and therefore considered the Project costs to be high. The Expert Assessors also noted that existing alternatives to the Project exist at lower costs than the Project. Therefore, in the opinion of the Expert Assessors, the Project did not meet 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.

In the opinion of the Expert Assessors, the Project presents an adequate Project plan and the responsibilities of the various Project Partners were clearly explained. Some of the Expert Assessors were concerned about the interdependencies between work packages, notably how 2 and 3 could be run simultaneously and how this would feed through to the Project outputs. The Expert Assessors also considered the

purpose and outputs of work package 6 to lack clarity. As a result of this, the Expert Assessors did not consider the Project to have met this Eligibility Criteria.

Regulatory barriers noted by the Expert Assessors
NO

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The Expert Assessors considered this Project to be an interesting Discovery Phase Project, but noted the Project presented limited innovation, net potential benefits for gas consumers, and value for money. The Expert Assessors also did not consider the Project to have met this Innovation Challenge, and considered the Project to be closer aligned to the whole system integration Innovation Challenge. The Expert Assessors considered the Project to demonstrate limited innovation and value add for transport/EV roll out, apart from a few very specific use cases.

5.2.3 10037383, Pipeline Hydrogen for Northern Multimodal Mobility, Initial Net Funding Requested £266,754

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Northern Gas Networks Ltd	£17,280	£11,577	£5,703
Heriot-Watt University	£91,627	£0	£91,627
Element Energy Ltd	£152,870	£30,237	£122,633
Durham University	£32,569	£0	£32,569
Cadent Gas Ltd	£1,401	£0	£1,401
National Grid Gas PLC	£2,220	£0	£2,220
Transport for the North	£22,400	£22,399	£1
Ryze Hydrogen Ltd	£10,600	£0	£10,600

Submitted Project description

The Pipeline Hydrogen for Northern Multimodal Mobility project will evaluate the potential for hydrogen's use in heavy-duty transport across the North of England. It will create a joined-up, regional strategy to cost-effectively kick-start the hydrogen economy in the North. This Project will directly support the growth of zero emission transport by looking to develop a large-scale, public, multi-modal hydrogen refuelling station that is connected to a hydrogen pipeline.

The Project contains three sequential work packages that focus on bringing together the major infrastructure pieces needed for a successful roll-out. Each work package contains modelling and feasibility aspects:

1. Hydrogen vehicles -- modelling the uptake scenarios for vehicles most suited to decarbonisation by hydrogen and engaging and supporting operators in deploying a number of these vehicles in a demonstration and test.
2. Hydrogen stations -- modelling optimal locations for large multi-modal hydrogen stations and using this modelling work to engage with station providers in station siting and deployment feasibility work.
3. Hydrogen supply -- a techno-economic analysis of hydrogen production and delivery technologies with the aim of supplying the demands of the hydrogen stations identified in work package 2 with hydrogen at the lowest cost. Modelling work and stakeholder engagement will inform the feasibility assessment of demonstrating a hydrogen pipeline connected refuelling

station. We will engage with hydrogen production and pipeline projects to assess the feasibility.

The long term vision of this Project is to evidence and communicate the cost and system benefits of hydrogen in a decarbonised gas and road transport system.

Therefore, a fourth work package will focus on communicating the Project's conclusions and best practice findings with a wide group of key stakeholders. This will include communicating the conclusions of the modelling and strategy aspect as well as engaging with parties beyond the SIF Project scope e.g. vehicle operators and hydrogen producers to develop a feasible pipeline connected hydrogen mobility project for the Beta Phase.

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

In the opinion of the Expert Assessors, the Project addresses the zero emission transport Innovation Challenge because the Project demonstrates the potential to support decarbonisation of freight and wider transport applications through its focus on analysing, modelling and developing a large-scale, public, multi-modal hydrogen refuelling station that is connected to a hydrogen pipeline.

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

In the opinion of the Expert Assessors, it was unclear following the assessment the extent to which the Project will benefit current gas or electric customers if new gas network infrastructure is needed to be built. This was considered by the Expert Assessors to potential result in a cost increase for the gas or electricity consumers. Whilst the Expert Assessors noted that the Project could support the provision of lower cost hydrogen to transport consumers and users. As a result, in the opinion of the Expert Assessors, the Project did not meet this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

The modelling proposed for the Alpha Phase is innovative and worthy of further investigation because it could support in understanding the future uptake of hydrogen vehicles and where hydrogen charging stations are needed.

However, the Expert Assessors considered there to be lack of clarity and information strong enough for them to question the level of network innovation in the Project. The Expert Assessors noted specifically a lack of clarity on whether the Project was proposing examining deblending and use of the wider gas network. The Expert Assessors understood there to be limited network innovation without the examination of deblending, as the Project would then only be examining this topic under the understanding that new gas network infrastructure assets would be installed for the Project. Without this clarity, the Expert Assessors did not consider the Project to have met this Eligibility Criteria.

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

The Expert Assessors noted that this Project could undermine the development of electrolysis refuelling, although it could also strengthen the overall hydrogen refuelling market by reducing the risk of outages at refuelling stations and mixed solutions (pipeline plus electrolysers) may be developed. The Expert Assessors did not consider this Project to have sufficiently detailed that it would not undermine the development of competitive markets for this Eligibility Criteria to have been met.

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

The modelling aspect of the Project in the Alpha Phase is innovative and novel, in the opinion of the Expert Assessors, including the potential scalability and rollout of a piped hydrogen network for the north of England.

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

The Expert Assessors considered the Project to have participation from a sufficient range of stakeholders for the works proposed in the Alpha Phase. The Expert Assessors considered this Project to have met this Eligibility Criteria.

Eligibility Criterion 7: Projects must provide value for money and be costed competitively.
The Expert Assessors considered the Project costs to be reasonable and costed competitively for the activity being undertaken in the Alpha Phase and considered the Project to deliver good value for money.

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.
The Project plan was clear and well thought through for the Alpha Phase and there was a good level of supporting information provided, in the opinion of the Expert Assessors. As a result, the Expert Assessors considered the methodology to be sufficiently robust to have confidence that the Project would be capable of progressing in a timely manner.

Regulatory barriers noted by the Expert Assessors
YES
The Project will be linked to the outcome of the use of hydrogen in the gas transmission and distribution networks.

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The Expert Assessors considered the innovation as part of this Project to be beneficial to the development of the hydrogen freight and transport sector. Whilst the Expert Assessors considered the modelling aspects of the Project to be innovative and novel, they noted the Project should have also take into consideration different fuels, such as liquid hydrogen and on-site electrolysis, and should consider the impact of deblending The Expert Assessors did not consider the Project to have sufficiently outlined how there was network innovation in the Project. The Expert Assessors also did not consider this Project to have provided sufficiently detail on how the Project would deliver a potential benefit to gas or electric

consumers. The Expert Assessors also noted a concern that the Project may undermine the development of electrolysis refuelling.

The Expert Assessors also expressed that the SIF is perhaps not the most appropriate route for funding a new hydrogen pipeline.

5.2.4 10037453, A Holistic Hydrogen Approach to Heavy Duty Transport (H2H), Initial Net Funding Requested £401,864

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
SP Transmission PLC	£150,630	£15,063	£135,567
University of Leeds	£37,614	£4,138	£33,476
Ricardo – AEA Ltd	£140,481	£15,345	£125,136
Ricardo Rail Ltd	£121,058	£13,373	£107,685

Submitted Project description

The rail industry has a target of removing all diesel passenger trains by 2040 (2035 in Scotland).

In the next 5 to 10 years the rail sector will decide which rolling stock to use (electric, battery or hydrogen). Conventional rail electricity connections will commit 8TWh of demand to be controlled by rail timetables for many decades, a large uplift of inflexible demand.

Our Discovery Phase Project assessed three solutions to make rail electricity demand more flexible:

1. Full electrification -- Overhead 25kV connected to higher voltage electricity networks
2. Discrete electrification with battery trains: Using storage on the train and recharging under 10km sections of overhead 25kV line
3. Hydrogen-electric: Green hydrogen production and fuel cell trains

For the longest lines hydrogen-electric proved to have the lowest overall costs, over 50% fuel carbon savings and the lowest embodied carbon.

Hydrogen-electric trains supplied with green hydrogen:

- Will be fuelled at a rail depot between midnight and 6AM.
- Green hydrogen will be stored at the rail depot -- so can be produced days in advance of need by the railway

This offers the potential to reduce constraint payments and benefit electricity and rail consumers.

Of the solutions assessed, green hydrogen also offers the clearest route to provide flexibility benefits for TSOs, DSOs and hence reduce costs for consumers.

For example, in 2020 onshore wind generation of 3.5TWh was curtailed, costing £243million or £8.5 per household -- future rail electrification is over 3TWh p.a. thus, hydrogen-electric trains supplied with green hydrogen in rural areas can reduce constraint costs.

In the Discovery Phase we assessed 2 rail lines in Scotland, developing an outline business case that showed:

- Green hydrogen is the lowest cost option for the 280km line from Inverness to Thurso & Wick
- Battery trains with trackside batteries are the lowest cost option for the 65km line Girvan to Stranraer

The H2H Alpha Phase Project will focus on green hydrogen. The related Hubs Alpha Phase Project led by University of Leeds will focus on the trackside battery solutions.

In H2H Alpha Phase we will:

- Assess in full the benefits of flexible green hydrogen for rail traction
- Develop concept for full demonstration
- Develop the team and proposal for demonstration in a Beta Phase project Scottish Power, Network Rail, ScotRail & Transport Scotland will support throughout as the project Steering Group.

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

In the opinion of the Expert Assessors, this Project is clearly working towards what would be a first of a kind demonstrator for the UK. It aims to bring hydrogen trains to UK and therefore meets the zero emission transport Innovation Challenge. This

demonstrator would bring value by de-risking innovation in both the rail and energy networks.

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

In the opinion of the Expert Assessors, the Project outcomes may result in reduced network reinforcement, leverage renewable energy, and increase flexibility to the UK energy network. The Project's focus on bringing a first of kind in the UK demonstrator Project will also provide a reference for renewable hydrogen, which could help similar Projects in the future accelerate by offering a business case. These potential outcomes represent a clearly identified potential for delivering a net benefit to gas consumers through a reduction in costs, in the opinion of the Expert Assessors.

Eligibility Criterion 3:
Projects must involve network innovation.

The Project is considered by the Expert Assessors to represent an opportunity to examine the distribution of hydrogen at scale through the rail network, including a more flexible rail network to respond to renewable energy demand to support the energy networks. This focus on the distribution at scale through the rail network and a more flexible rail network to support energy networks was considered by the Expert Assessors to involve network innovation.

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

In the opinion of the Expert Assessors, the Project does not undermine competitive markets as there is currently no market for hydrogen trains and this Project would help in bringing a first of a kind Project to the UK, which could help to stimulate or facilitate similar Projects. The Expert Assessors also did not consider the outputs of this Project to undermine the development of other similar Projects. This Project in the opinion of the Expert Assessors stimulates the supply chain for UK rail, and therefore does not undermine the development of competitive markets.

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

This Project is a first of a kind demonstrator proposal for the UK and was considered by the Expert Assessors to be inherently innovative, novel and risky both for the energy network and rail supply chain. The Project's aim to bring hydrogen trains to the UK is a first of its kind innovation in the UK, and was considered by the Expert Assessors to be innovative, novel and risky as a result.

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

The Project has heavily engaged stakeholders and the Project Partners are suitable, in the opinion of the Expert Assessors. The Expert Assessors did note an area of weakness in the Application was a lack of an industry advisory group for the Alpha Phase, but they did not consider this to be a significant enough omission for the Project to be considered to not have met this criteria. The Expert Assessors therefore considered the Project to have included participation from a sufficient range of stakeholders for the Alpha Phase.

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

In the opinion of the Expert Assessors, the costs are reasonable and costed competitively, and represent value for money. The Expert Assessors considered the Project costs, distribution across the Project Partners, and value from this first of a kind Project in the UK to provide value for money and be costed competitively. The Expert Assessors were pleased to hear the Project is also looking at other funding sources beyond the SIF, presenting an additional opportunity to deliver value for money.

The Expert Assessors noted that more information on how the 10% private contribution will be incorporated in the Project. However, the Expert Assessors considered this 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.

In the opinion of the Expert Assessors, the Project has been well thought through and has a robust methodology for timely delivery through clear risk registers and Project plan. The Expert Assessors noted the information provided on the Project's milestones could have been clearer but still had confidence the Project would be capable of progressing in a timely manner. The Expert Assessors considered the methodology to be sufficiently robust and capable of progressing the Project in a timely manner.

Regulatory barriers noted by the Expert Assessors

YES

A demonstrator for this Project will require a safety demonstration licence conditions for rail. A plan for obtaining this in a timely manner should be incorporated into future activities.

Recommendation to the Gas & Electricity Markets Authority

FUND

The Expert Assessors all agreed the Project demonstrated network innovation which is novel and risky, and aligns with this Innovate Challenge. The Expert Assessors considered the Project to have a robust strategic rationale and innovative features within the Project, and identified a clear potential to deliver a net benefit to gas consumers. The Project Partners gave a strong presentation during the interview and demonstrated a strong understanding of the topic, which provided the Expert Assessors with confidence that the Project would be capable of progressing in a timely manner in the Alpha Phase.

All Expert Assessors agreed it is positive to see other funding options being explored beyond the SIF in the Alpha Phase, which could help deliver additional value for money.

Recommended Project specific conditions

The Project should engage with Health and Safety (HSE) and Office of Rail and Road (ORR) to confirm safety requirements. The Project may wish to obtain a licence exemption to perform hydrogen demonstration.

Within the Alpha Phase, the Expert Assessors would like to see attention on the flexibility and the benefit it can unlock for the energy users.

The Project has heavily engaged stakeholders and the Project Partners are suitable, but it would be advantageous for the project to have an industry advisory group including Transport Scotland.

5.2.4 10037459, Resilient and Flexible Multi– Energy Hub Networks for Integrated Green Mobility, Initial Net Funding Requested £499,999

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
SP Transmission PLC	£163,821	£43,859	£119,962
Costain Limited	£50,000	£5,000	£45,000
University of Leeds	£278,731	£27,874	£250,857
Ricardo-AEA Ltd	£38,928	£4,428	£34,500
Entrust Smart Home Microgrid Ltd	£55,200	£5,520	£49,680

Submitted Project description

The success of this Project could bring significant value to many of the 2500 stations across over 10,000 miles of UK rail as energy and transport nexuses, with the aim of building multi-energy hubs - the first of their kind - which connects these stations and their surrounding cities/communities, to support green mobility and a future low carbon power grid, running almost entirely on renewable sources.

The Discovery Phase has clearly validated the potential for roll-out of the energy hub technologies, which will lead to faster and more cost-effective rail decarbonisation, with cost and investment savings of over £3Bn from 2030 to 2050, a reduction of 3 Mt CO2e p.a., payback time of 4.7 to 12.6 years, and enhanced performance and flexibility of the distribution network, contributing to both the government's decarbonisation strategy and its Ten-Point Plan. This technology would not limit the energy benefits to a specific city/region, but across the whole of the UK, with this innovative concept transferable to other areas (for example, the London Underground), across the UK and globally.

This innovative energy hub design bridges gaps in unlocking renewable energy/smart grid potentials within the global railway community, where the efficiencies & potentials at populous, urban railway stations as energy and transport nexuses, are barely explored. This is paramount in the redevelopment of such stations under the agenda of 'transit-oriented development (TOD)'.

The energy hub is underpinned by four technological pillars, namely machine learning assisted digital twin technology, novel power electronics-based energy hub

technology, advanced control framework, and wide area optimal planning and operation framework, which can:

- Significantly reduce carbon emissions by removing fossil fuel consumptions and maximising local renewable energy use.
- Improve energy efficiency and reduce running costs, for example by using regenerative power from trains and support vehicle to station.
- Enhance the quality of power supplied from the grid by providing ancillary services.
- Reduce traction power supply faults, in turn reducing passenger delays, improving user satisfaction.
- Improve the stability of critical infrastructure for both railways and power sectors, in the low-carbon energy future.

Endorsed by key stakeholders, the Alpha Phase will undertake detailed engineering design of hubs tailored for up to two stations in Scotland, fully addressing challenges and constructional complexities arising in adapting hubs to the peculiarities of individual stations and develop implementation and commercialisation plans. The Beta Phase will then see the actual implementation of the Hubs at 'live' stations.

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

All Expert Assessors agree that the proposal addresses the Innovation Challenge for zero emission transport because of its focus on developing energy hub technologies, which could lead to faster and cost-effective rail decarbonisation.

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

The Expert Assessors considered the Project to have identified a net benefit to electricity consumers in a reduction of costs through avoided network reinforcement costs to support the electrification of electric vehicles. However, the Expert Assessors considered the Project's main identified benefits to be realised mostly by

transport users rather than electricity consumers. The Expert Assessors noted the Application has a clear proposition related to the development of energy hubs, but noted the scalability across the UK rail network was questionable due to the payback challenges for some archetypes and use cases.

As a result, the Expert Assessors noted that the Project identified a clear potential to deliver a net benefit to electricity consumers in the geographies proposed, but there was questionable scalability throughout the rest of the UK. This limited scalability in the Project was also considered to be a limitation in the potential for the Project to deliver a net benefit to electricity consumers. The Expert Assessors considered the Project to have met this Eligibility Criteria because the scalability across the UK was questionable but still possible, but noted the limitations presented by the scalability of the Project were a weakness to the Project in the Alpha Phase.

Eligibility Criterion 3:
Projects must involve network innovation.

The Expert Assessors considered the innovation in this Project to be more about the integration of technologies rather than the application of the technologies for zero emission transport. One Expert Assessors also noted that the need for new innovation in power electronics and control systems was overstated by the Project. The included technologies in the Project, such as solar, were considered by the Expert Assessors to be a higher technology readiness level and not necessarily involving network innovation. The Expert Assessors therefore did not consider the Project to involve sufficient network innovation and did not consider the Project to have met this Eligibility Criteria.

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

The Expert Assessors considered the Project to not be undermining the development of competitive markets as it focusses on the integration of locally sited renewables, energy storage and energy management to avoid grid reinforcement and support the mainstream transition to Net Zero. The Expert Assessors considered the Project to have met this Eligibility Criteria.

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

In the opinion of the Expert Assessors, the Project had limited innovation as many of the technologies involved are market ready and are higher TRL. The Expert Assessors viewed the integration of the technologies proposed by the Project to not be particularly innovative, novel or risky. 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.

The Expert Assessors considered the Project Partners as representing a suitable range of stakeholders appropriate for the Alpha Phase activities. The Expert Assessors also considered the interest of Transport Scotland in the Project to make it more likely that the Project will be potentially able to influence additional stakeholders in the Alpha Phase.

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

The Expert Assessors considered the Project's costs to be appropriate for the Alpha Phase and to be costed competitively.

However, the Expert Assessors considered the Project to be provide lower value for money than other SIF zero emission transport Projects due to the commercialisation route being limited to particular archetypes.

Whilst the Expert Assessors considered the Project to be costed competitively for the Alpha Phase, they noted limited value for money because of limited commercialisation opportunities. The Expert Assessors therefore did not consider this 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.

In the opinion of the Expert Assessors, the Project provided evidence to meet this Eligibility Criteria as the majority of Expert Assessors stated the Project plan is structured well with good outlines of deliverables, work packages and clearly highlighted the roles for the Project team. The Application, in the opinion of the

Expert Assessors, had a good assessment of risks for the Alpha Phase. It was noted by the Expert Assessors that there is a reliance on Network Rail to achieve some outcomes which should be detailed properly.

Regulatory barriers noted by the Expert Assessors
NO
Not Applicable

Recommendation to the Gas & Electricity Markets Authority
DO NOT FUND
The Application has a clear case for energy hubs in Scotland, but all Expert Assessors agreed the scalability across the UK rail network of the approach is questionable given the complexity of rolling it out with the stakeholders involved. This represented, in the opinion of the Expert Assessors, limited value for money by the Project. The Application was considered by the Expert Assessors to have a good summary with clear roles for the consortium members with distinct activities between the Discovery Phase and Alpha Phase. The Expert Assessors raised concerns that this should not be funded through the SIF as the Project would benefit rail consumers to a significantly greater extent than energy and electricity network consumers.

5.2.5 10037523, Rail Decarbonisation, Initial Net Funding Requested £340,558

Project Partner name	Eligible costs (£)	Project contribution (£)	Initial Net Funding Requested (£)
Northern Gas Networks Ltd	£17,110	£14,000	£3,110
Frazer Nash Consultancy Ltd	£116,662	£0	£116,662
Northern Powergrid (Yorkshire) Plc	£3,150	£0	£3,150
EA Technology Ltd	£194,432	£0	£194,432
UK Power Networks (Operations) Limited	£13,203	£0	£13,203
Network Rail Ltd	£19,000	£9,000	£10,000
Eversholt Rail Ltd	£15,200	£15,199	£1

Submitted Project description

Significant work has already been done to determine the best approach to decarbonise the rail industry, however, minimal consideration has been given to the available capacity on the energy networks. The Discovery Phase has reaffirmed that investment and decarbonisation plans across the three sectors (electricity, gas and rail) are not aligned and have been developed in isolation.

Despite electrification being the preferred option for principal routes, the level, costs and timescales for electrification on the national rail network remain uncertain. Further work is required to understand the viability of the proposed electrification schemes and the whole-life costs of different electrification system types versus alternative traction power technologies.

Each sector is faced with different challenges as a result of decarbonisation. Each sector relies on support from one another, however they have limited understanding and exposure to the others challenges. As a consequence Project timescales are extended, extra costs are incurred and in some cases the optimum solution may not be found. The innovation of this Project in the Alpha Phase will be the development of a data-driven analytical tool that will improve efficiency of decarbonisation planning and demonstrate the cross-sector considerations required in future infrastructure and investment plans. This will identify least regrets opportunities in the electricity, gas and rail sectors for coordinated investment to accelerate rail decarbonisation at lowest cost to GB consumers.

This Project will complete an analysis that has input and consideration for each sector from the start of the planning phase. Our solution will develop a fully integrated view of the rail and energy sectors, allowing the most appropriate fuel sources for the decarbonised train fleet. This will take into account not only the rail sector decarbonisation goal but also the available energy resources and delivery methods for that energy in the local area where the trains will be operating. As part of the Project an evaluation will be made of the extent to which the process can be repeated across GB, for rail and other industries.

Without cross-sector collaboration, the existing plans for rail decarbonisation could lead to inefficiencies, missed opportunities for carbon savings, potentially wasted investment, and a lack of coordination from investing partners. This current lack of an effective methodology, owned by the rail industry and energy stakeholders, is the key problem that this Project will seek to address.

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

The Expert Assessors considered the Project to have met the zero emission transport Innovation Challenge because it is bringing the energy and transport sectors together to assess how to optimise each network rather than working in silos, with the aim of driving greatest value for money. This was considered to be an important aspect in the decarbonisation of the transport sector.

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

In the opinion of the Expert Assessors, the Project provides a strategic output which could inform where electricity and gas could be best used on the rail network. This was considered to potentially support a more effective and timely planning for the gas and electricity networks, which could result in cost savings and environmental benefits through CO2 reduction

However, the Expert Assessors noted several limitations on the potential benefits the Project could deliver. First, they considered there to be limited detail about how the distribution networks operators and transmission operators would use the output tool will, noting the limited participation from these sectors in the Project.

Second, the Expert Assessors considered the output tool to be more likely utilised by the rail sector rather than the energy sector, representing a limited overall potential to deliver a net benefit to gas and electricity consumers.

Therefore, the Expert Assessors considered the Project to have identified a limited potential for benefits for gas and electricity consumers and they did not consider the Project to have met this Eligibility Criteria.

Eligibility Criterion 3:
Projects must involve network innovation.

The Expert Assessors considered the Project to involve network innovation as it would bring together gas, electricity and rail companies to examine rail decarbonisation together. This was considered by the Expert Assessors to involve network innovation in an efficient approach to decarbonise a key transport sector.

Whilst the Expert Assessors considered this Project to have met this Eligibility Criteria, they did note that the network innovation demonstrated by this Project would have been strengthened had the Project considered the role of DNOs and TOs.

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

This Project does not, in the opinion of the Expert Assessors, undermine the development of competitive markets in the Alpha Phase because the Project is in the pre-commercial phase and is exploring multiple fuel sources. The Expert Assessors did not consider the Project to be influencing any one market or technology, and considered the Project to have the potential to unlock new markets for transport fuels in future. The Expert Assessors considered the Project to have met this Eligibility Criteria.

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

The Expert Assessors were not aware of any other modelling tool with the same inputs or capabilities as the one the Project is proposing developing, and therefore considered this Project to be innovative and novel.

Eligibility Criterion 6: Projects must include participation from a range of stakeholders.
In the opinion of the Expert Assessors, the Project demonstrated a sufficient range of stakeholders for the Alpha Phase. However, the Expert Assessors noted that the two rail Project Partners were only involving regional teams and not wider internal engagement. This was considered by the Expert Assessors to be a risk to the scalability and applicability of the Project. Whilst the Expert Assessors considered the Project to have brought together a sufficient range of stakeholders for the Alpha Phase, the participation from these stakeholders could have been stronger for the Alpha Phase.

Eligibility Criterion 7: Projects must provide value for money and be costed competitively.
In the opinion of the Expert Assessors, the Project was considered to provide reasonable value for money. However, the Expert Assessors considered the Application to lack clarity and sufficient detail on the breakdown of the Project costs for some of the Project Partners, which did not enable the Expert Assessors to assess whether the Project was costed competitively.

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.
In the opinion of the Expert Assessors, the Project plan was satisfactory for the Alpha Phase. However, the Expert Assessors regarded the risk register as unclear and lacking sufficient detail for the Expert Assessors to have confidence that the Project has a robust enough methodology for the Project to progress in a timely manner. More information in the risk register was needed for how the consortium will be managed and on the impacts of policy risks.

Regulatory barriers noted by the Expert Assessors
YES
A demonstrator for this Project will require a safety demonstration licence conditions for rail.

Recommendation to the Gas & Electricity Markets Authority

DO NOT FUND
The Expert Assessors considered the Application from this Project to have only met some of required Eligibility Criteria and lacked sufficient detail and/or clarity on others for the Expert Assessors to consider the Eligibility Criteria to have been met. For example, whilst the Expert Assessors considered there to be a sufficient amount of stakeholders in the Project for the Alpha Phase, they noted the participation from some of the Project Partners to not be sufficient. Similarly, the Project plan was considered as satisfactory, but missing details in the risk registers did not give the Expert Assessors confidence that the Project's methodology was robust enough to be capable of progressing in a timely manner. Furthermore, the Expert Assessors considered there to be limited innovation and noted that the Project should have considered how DNOs and TOs could use the model the Project plans on developing.

6. 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.

6.1 Gas Sector Projects recommended for SIF Funding

Whole system integration

Project Name	Funding Licensee	Initial Net Funding Requested (£)
HyNTS Compression	National Grid Gas Plc	£499,898

Data and digitalisation

Project Name	Funding Licensee	Initial Net Funding Requested (£)
HyNTS Pipeline Dataset	National Grid Gas Plc	£454,090
Gas System of the Future – Digital Twin	Southern Gas Networks Plc	£494,925
Thermal Imagery Analysis	Northern Gas Networks Ltd	£469,356
Intelligent Gas Grid	Southern Gas Networks Plc	£491,075
Predictive Safety Interventions	Southern Gas Networks Plc	£411,086
Digital Platform for Leakage Analytics	Cadent Gas Limited	£445,571

Heat

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Velocity Design with Hydrogen	Southern Gas Networks	£462,320
HyNTS Protection	National Grid Gas Plc	£443,195

Zero emission transport

Project Name	Funding Licensee	Initial Net Funding Requested (£)
HyNTS Deblending for Transport Applications	National Grid Gas Plc	£313,398

Total SIF Funding requested by gas Projects recommended for SIF Funding: £4,484,914.

6.2 Gas Projects not recommended for SIF Funding

Whole system integration

Project Name	Funding Licensee	Initial Net Funding Requested (£)
HyNTS Hydrogen Injection	National Grid Gas Plc	£355,149

Data and digitalisation

Project Name	Funding Licensee	Initial Net Funding Requested (£)
HyS Metering and Gas Analysis	National Grid Gas Plc	£492,064
Smarter homes for a smarter energy future	Northern Gas Networks Limited	£362,559

Heat

All gas Projects which submitted an Application for the Alpha Phase Heat Innovation Challenge were approved for SIF Funding.

Zero emission transport

Project Name	Funding Licensee	Initial Net Funding Requested (£)
HyPark	Wales and West Utilities Ltd	£460,536
Pipeline for Hydrogen for Northern Multimodal Mobility	Northern Gas Networks Limited	£266,754
Rail Decarbonisation	Northern Gas Networks Limited	£340,558

7. SIF Round 1 Alpha 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 Alpha Phase, subject to the various conditions outlined above, and the electricity projects that are not recommended for funding.

7.1 Electricity Projects recommended for SIF Funding

Whole System Integration

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Networks-DC	Scottish Hydro Electric Transmission Plc	£423,476
INCENTIVE – Innovative Control and Energy Storage for Ancillary Services in Offshore Wind	Scottish Hydro Electric Transmission Plc	£380,606
CrowdFlex	National Grid Electricity System Operator	£499,919
SCADENT – SuperConductor Applications for Dense Energy Transmission	National Grid Electricity Transmission Plc	£449,000

Data and Digitalisation

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Eye in the Sky	National Grid Transmission Plc	£395,769
Predict4Resilience	SP Transmission Plc	£499,999

Heat

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Heat Balance	SP Transmission Plc	£499,116

Zero Emission Transport

Project Name	Funding Licensee	Initial Net Funding Requested (£)

A Holistic Hydrogen Approach to Heavy Duty Transport (H2H)	SP Transmission Plc	£401,864

Total SIF Funding requested by electricity Projects recommended for SIF Funding: £3,549,749.

7.2 Electricity Projects not Recommended for funding

Whole System Integration

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Asset Reuse and Recovery Collaboration (ARRC)	SP Transmission Plc	£422,935
SEGIL – Sustainable Electrical Gas Insulated Lines	National Grid Electricity Transmission	£413,028

Data and Digitalisation

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Virtual Energy System	National Grid Electricity System Operator Limited	£499,999

Heat

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Flexible Heat	SP Transmission Plc	£499,711

Zero Emission Transport

Project Name	Funding Licensee	Initial Net Funding Requested (£)
Resilient and Flexible Multi-Energy Hub Networks for Integrated Green Mobility	SP Transmission Plc	£499,999