SIF Beta Project Registration

Date of Submission

Aug 2023

Project Reference Number

10063754

Project Registration

Project Title

Intelligent Gas Grid - Beta

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10063754

Project Licensee(s)

SGN

Project Start

Aug 2023

Project Duration

36 Months

Nominated Project Contact(s)

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Project Budget

£6,304,121.00

Funding Mechanism

SIF Beta - Round 1

SIF Funding

£6,072,524.00

Strategy Theme

Data and digitalisation

Challenge Area

Data and digitisation

Lead Sector

Gas Distribution

Other Related Sectors

Lead Funding Licensee

SGN - Southern England (inc South London)

Funding Licensees

Collaborating Networks

Cadent

Technology Areas

Asset Management, Maintenance & Inspections

Summary

The project's scope is tightly aligned with SIF's data and digitalisation challenge criteria:

- Automated pressure management software, and use of near real time data and machine-learning techniques, will contribute to better

coordination, planning and network optimisation.

- Increased injection of biomethane (and, in the future, hydrogen) into networks will enable progress towards net zero and enable strategic outcomes from other challenges e.g., decarbonisation of heat.

The project directly addresses two points in the challenge scope:

- Point 7: this project will use novel sensor technology to improve visibility of network infrastructure condition, and make data-driven decisions about that infrastructure
- Point 9: this project will use data, combined with machine-learning (ML) and artificial intelligence (AI) techniques, to improve the forecasting abilities of both demand on networks, and required maintenance and interventions.

The principal innovation underscoring the project is use of data-driven techniques, based on ML & AI technology, acting in combination with remote pressure control and network extremity monitoring equipment deployed to networks in a distributed digitalised architecture. The innovation evolved from Utonomy's current solution, which uses manually-generated schedules, to offer a novel method for UK gas distribution network management and digitalisation.
From Alpha to Beta, the project evolved by taking a tiered approach to eight opportunity areas reflecting Discovery phase feasibility study outputs. Opportunities were progressed through targeted user research and collection of operational data, and, for highest ranked opportunities, Alpha phase activities extended to bench-testing proof-of-concept models designed to de-risk development and implementation of solutions at Beta phase. In addition, Alpha activities included a further evaluation of opportunities' benefits and definition of field trial stages.
The project's perception of the problem evolved from Alpha to Beta via a series of user interviews with representatives of key SGN stakeholders: Network Planning, Maintenance, Operational Technology, Policy, and Innovation. Key learnings were;

- Opportunities to reduce methane leakage and create holistic management dashboards were the most mature.
- Prediction of escapes was important to stakeholders but a definitive link between pressure and escapes could not be established from the data available in Alpha.
- Factors that lead to low pressure incidents showed the most potential from the second tier of opportunities.
- That increasing biomethane injection had a clear need within SGN.

In Beta, core users of innovations will come from: Maintenance teams, who are looking for faster resolution of network problems and fewer truck rolls to manually adjust governors; Network Planning teams who are looking for lower methane emissions; and Biomethane teams who are looking for greater injection rates.
Utonomy will be the main project partner at Beta, continuing its successful history of collaboration with SGN. The Utonomy engineering team has capabilities in electronics design for hazardous areas, data science and machine learning, industrial IoT and digital communications technologies, cyber security, and cloud-hosted software applications. Utonomy has collaborated successfully with SGN and Wales & West Utilities on the development and trial of its remote pressure control and management solution. Utonomy has developed and carried out initial field trials of Intelligent Control software via an Innovate UK funded project completed in March 2022 and is in the process of trialling a medium pressure variant of its pressure control equipment with Northern Gas Networks and Wales & West Utilities.
Utonomy will use Faculty Science Limited as lead subcontractor. Faculty has the unique capability to deliver state-of-the-art AI solutions from teams formed from over 200 professionals comprising both technical and commercial experts. In delivering AI solutions, in-house developed AI Engines allow specialised techniques to be applied to customer problems and to optimise performance.
As a world-class engineering consultancy with a range of multi-discipline technical specialists, DNV will leverage further expertise from their pool of Gas Industry experts to provide third-party verification and specialist support services. Acting as independent assurers, using their industry-leading recommended practices, they will ensure that any new solutions developed will provide real benefits in their application.
Other network partners will bring oversight and stakeholder governance to the project by contributing to regular steering discussions and stage gates, reviewing deliverables, and providing feedback on proposed solutions. Solutions could be trialled on other network partner's sites, and additional test data could also be provided. Having all four UK gas distribution networks in the project will also ensure that solutions are rolled-out as quickly as possible to benefit UK gas consumers.

Solutions will be primarily used by two sets of users: Network and Maintenance teams who have responsibility for managing pressure and carrying out maintenance, will use the solutions to adjust governor pressures remotely and automatically to minimise leakage and optimise biomethane feed-in; they will also use solutions to diagnose, and ultimately resolve, network faults; and network planning teams will use the solutions to track KPIs such as leakage reduction or biomethane injection, and take strategic network decisions based on the analysis provided by the solutions.

Project Description

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

to market new digital technologies to address these challenges.

The current level of technology in the network, which includes significant manual intervention, is no longer sufficient to deliver the changes needed. Pressure management is critical to lower methane emissions. Pressures are being managed as low as possible with current technology, but new solutions are needed to bring pressures down still further minimising emissions.
The way the network is operated is also changing. In the past there were a small number of entry points for North Sea gas. But now there are multiple entry points for biomethane into lower pressure tiers in the network. The current manual pressure control of these networks can lead to biomethane plants being unable to feed in during certain times of the year. This can lead to wasteful flaring of the biomethane. Automated control of these networks is required to maximise the feed-in potential of these plants.
This project develops new applications using the data collected by the pressure management systems together with machine learning and AI to detect anomalies in the network such as water ingress, gas escapes, low pressure events, malfunctioning governors etc. Currently, these anomalies require manual intervention to diagnose and to resolve. Faster diagnosis and remote or automated resolution of the problem will lower operating costs and improve customer service.
The increased ability to intelligently monitor and control the networks will be an essential enabler for the conversion of the networks to hydrogen.
This project builds on the successful NIA project carried out by SGN and Utonomy to develop new pressure management and control systems. These systems are now being rolled out in SGN's Southern network.
Using Utonomy's remote control pressure management system as the enabling technology, the project will collect and use network data alongside external data such as weather to develop machine-learning and artificial intelligence applications that optimise network pressures for methane emissions reduction, increase biomethane injection capacity and diagnose and remotely resolve network anomalies. The project is highly innovative because the use of machine-learning, in conjunction with low-cost, scalable computing power enables a step-change in the monitoring and optimisation that is possible in the operation of gas distribution networks.

Add Preceding Projects

10037416 - Intelligent Gas Grid - Alpha

Nominated Contact Email Address(es)

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Project Description And Benefits

Applicants Location

Southern Gas Networks
St Lawrence House, Station Approach, Horley, England, RH6 9HJDNV
Utonomy
Epsilon House, Enterprise Road, University of Southampton Science Park, Southampton, SO16 7NS

Project Short Description

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.

Innovation Justification

For leakage reduction, the most relevant current technology is profiling; these systems take the preceding days' average network pressure response and apply this historic view to the day ahead; this causes problems during sudden cold snaps as pressures are too low resulting in multiple alarms. This project's solution is innovative because it uses machine-learning technology to predict changes to network demand response ahead of time using external predictive factors including the next day's weather forecast. It also optimises governor set-point pressures individually and considers multiple different network extremities, which are features not available in the current technology.
For anomaly detection, current practise is manual and reactionary, for example escapes are mostly detected by gas being smelt by members of the public, low pressure incidents by public reporting boiler or other domestic faults, and governor faults after downstream knock-on effects are investigated by maintenance teams. This project's solution is innovative because maintenance teams will be alerted autonomously to anomalies by machine-learning algorithms that are constantly monitoring network data for small signs of change: the potential is that causes of faults could be further investigated and mitigated, or even rectified, before consumers become aware.
For biomethane injection, the current state of the art is for manual seasonal adjustments to be made at medium pressure supply governors to facilitate contractual minimum injection rates. Adjustments require site visits, which are costly and time-consuming, and the timing of changes is sensitive to unseasonal weather in shoulder months. An alternative solution involving compression is likely to be extremely expensive compared to this project's solution. A further alternative solution using remote pressure control technology from a governor equipment manufacturer has been trialled within a UK distribution network, but not been used commercially; this solution was shown to offer relatively simple pressure control but has limited ability to work for varying demands and lacks intelligence to set optimum pressures, as well as only integrating with pilot valves from the same supplier. In contrast, this project's solution would retro-fit to existing pilot valve equipment and offer complex network pressure control accounting for multiple entry points using machine-learning algorithms.
Across all three solution areas, the project goes beyond incremental innovation because the use of machine-learning algorithms, in conjunction with low-cost, scalable computing power that enables the algorithms to be 'always on', will represent a step-change in the data monitoring and optimisation that is possible when operating distribution networks.
For leakage reduction, current and estimated IRLs are 3 and 7, and for CRLs are 5 and 8 respectively.
For anomaly detection, current and estimated IRLs are 2 and 7, and for CRLs are 3 and 8 respectively.
For biomethane injection, current and estimated IRLs are 2 and 7, and for CRLs are 3 and 7 respectively.
The scale of the proposed project is appropriate as it balances the needs to deliver value to UK consumers with the need to safely and adequately develop and prove the solutions to the network stakeholder community. Two of the project's solutions are intended to deliver innovative pressure control applications; field trial demonstrations of these solutions will rightly require a level of scrutiny on safety and security of supply, which will be managed via the networks' existing policies and management procedures for introducing new technologies and products on live networks. Costs and time durations for these elements of field trials largely reflect the number of sites the trials will take place on and the sequential nature of the solutions' proof points to demonstrate safety and security of supply before efficacy. For the anomaly detection solution, demonstrable outcomes will depend on deploying the field trial over a sufficiently large proportion of the network that detectable anomalous events actually take place during the timescales.
If the project were funded under business-as-usual activities or within the price control, it would take significantly longer, and the solutions would likely arrive too late to enable the transition to net zero.
The project will not undermine the development of competitive markets because the solutions will rely on raw data (e.g., pressure measurements) gathered from the networks on which they will be installed and operate; however, ownership of all such raw network data will be retained by networks. This data could be made available by networks to potential new market entrants, which could be further used with knowledge made available by the project in how to operate networks with the solutions installed, to develop competitive solutions.

Counterfactual solutions investigated included pressure response models that did not consider seasonal effects such as temperature. From the Alpha bench-testing, these were proven to be outperformed by models that did include such features.

Bench-testing also indicated the need for solutions to vary pressure constantly during the day (to reflect intra-day demand changes), thereby discounting a counterfactual solution that used static or rarely changing intra-day pressures.

Impacts and benefits

The expected impacts and benefits from the project are set out below. Benefits will be delivered progressively from 2026 onwards as the solution is rolled out as business as usual.

1. Cost reductions in operating the networks:

a) Reduction in gas escapes:

The LP (low pressure) pressure control solution being developed will automatically adjust pressures in line with demand. This will enable networks to operate at lower average pressures, especially in the winter. Without this solution, networks are either fixed or seasonally adjusted which means that they are set at conservatively high pressures. The reduction in pressure especially during the winter leads to a reduction in gas escapes reducing the cost of repairs from 2024 to 2035 by £42m.

b) Elimination of seasonal adjustment of governors:

Most of the governors in the network today are manually adjusted. Many of these governors are adjusted seasonally i.e. 4 times per year. This is labour intensive, tying up valuable engineering resources for several weeks each year. Sometimes winter settings may need to be reinstated because of a late cold snap. The average cost of a seasonal adjustment is £280/governor/annum. If the governors were controlled automatically, costs would be reduced by £14m from 2024 to 2035.

c) Greater cost efficiency of mains replacement:

Mains replacement can either be carried out using an open cut method or an insertion method where a pipe of smaller diameter is inserted inside the mains to be replaced. The open cut method costs approximately £280/m and the insertion method costs approximately £140/m. Sometimes, mains replacement projects are unable to use the insertion method as the smaller diameter pipe would create too great a head-loss between the governors and consumers. Using pressure management will enable some of the open cut projects to be switched to insertion creating savings of £140/m. This can be done firstly by using live pressure data from the pressure management system rather than using network models which are sometimes inaccurate. Secondly, because pressure management enables the pressure to be increased just to meet the high peak demand and then brought back down again. There are projects where it is unacceptable to maintain a high pressure in the network for long periods but where it would be acceptable to increase the pressure for a short period to cover these high peak demands. A 2%switch from open cut to insertion would save £59m from 2024 to 2032.

Project Plans And Milestones

Project Plans, Milestones & Risks

The project will be structured in 9 work packages (WPs).
WPs 1 and 2 will be led by Utonomy and focus on iterative development and field trial validation of the intelligent control solution for methane leakage reduction in low-pressure networks. Success criteria for WP1 are formal product approval for the minimum viable product solution to move to business-as-usual on four initial trial networks. Success criteria for WP2 are formal product approval for the product extension release of the solution to move to business-as-usual for wide-scale deployment to GB networks, as validated by field trial results from two larger and more complex networks. SIF funding required is £1,385,901 and £1,545,711 respectively.
WPs 3, 4, and 5 will be led by Faculty and focus on iterative development and field trial validation of the anomaly-detection solution. Success criteria for WP3 are that additional data collection and user research activities have established the technical feasibility of the solution, evidenced by prototype models being validated against test datasets. Before progressing to WP4, a stage gate will consider the WP3 success criteria, and progress from the Digital Platform for Leakage Analytics (DPLA) SIF project: while this project shares some common high-level objectives related to leak detection, the proposed methods are sufficiently different that specific activities in early Beta phases will not be duplicated and DLPA's objectives do not extend to the other network anomalies (such as governor faults or other causes of low pressure incidents).
The two projects will share test datasets to accelerate progress in both projects. Success criteria for WP4 are formal product approval for a minimum viable anomaly-detection product solution as validated by results from field trials. Before progressing to WP5, a further stage gate will review the WP4 success criteria, and progress from the DPLA project. Success criteria for WP5 are formal product approval for the product extension release to move to business-as-usual for wide-scale deployment to GB networks, as validated by results from more extensive field trials. SIF funding required is £516,354, £553,347 and £326,120 respectively.

WPs 6 and 7 relate to the biomethane injection solution and will be led by Faculty and Utonomy respectively. Success criteria for WP6 are that additional data collection and user research activities have established the technical feasibility of the solution, evidenced by prototype models being validated against test datasets. Before progressing to WP7, a stage gate will consider the WP6 success criteria and results from field trials of Utonomy's underlying pressure control technology for medium pressure networks with NGN, SGN and Wales & West Utilities. Success criteria for WP7 are formal product approval for the minimum viable biomethane injection product solution. SIF funding required is £581,768 and
£377,022 respectively.
In addition to the product approvals, deliverables from WPs 2, 4, 5 and 7 will include the products themselves, and production-ready documentation and collateral ready to initiate commercialisation activities.
WP8 will be led by Utonomy and includes: technical engineering management within Utonomy across all three solution areas; overall project and risk management; stakeholder engagement (including with the supporting network partners); knowledge dissemination with other relevant SIF projects (e.g. DPLA); and all UKRI reporting commitments. Deliverables will include annual project reports; URKI reporting collateral; project summary videos; presentations for SIF community events; and the project close-down report. SIF funding required is
£716,749.
WP9 will be led by Utonomy, and will focus on commercialisation preparation activities. Success criteria for WP9 are documented commercial roll-out and exploitation plans, targeting GB and international markets. SIF funding required is£69,552.
Main project delivery risks are: unacceptable security of supply risk identified by network risk assessment activities (e.g. from the system communications architecture); delays to field trials from equipment manufacturing delays, duration of policy approvals and risk assessment activities, and availability of field crews; and delays to modelling activities associated with difficulties in accessing datasets with sufficient breadth and sample data. Mitigations include the early installation and validation of network extremity protection technology, and risk assessment activities specific to pressure control; early scheduling of data collection and associated user research; and realistic activity durations and stage gates built-in to the project plan.
Risk management will be the responsibility of the project's steering group comprised of stakeholders from each project partner. New risks will be identified as early as possible by technical and commercial working groups, and raised via the day-to-day project management structure. The steering group will ensure that key project stakeholders maintain awareness of project risks, and that impact and likelihood assessments are updated at regular intervals. As such, new mitigations can be put in place if required, or the project plan adapted accordingly.

The risk to national roll-out of the solutions from regulatory uncertainty relating to cyber-security requirements will be monitored by the ongoing discussion between Utonomy's CISO and personnel from SGN's Information/Operation Technology teams.

Regulatory Barriers

The regulatory area that is most likely to represent uncertainty to the Beta phase project, and/or the transition of the innovations to

business-as-usual, is cyber-security. This is likely most relevant to the two solution areas of the project that intend to develop innovative pressure control technologies that will control the pressures of live gas networks. Systems, networks, and equipment considered to be part of Critical National Infrastructure (CNI) attract more onerous security requirements and regulatory controls than other systems, most specifically the EU Network and Information Systems (NIS) Directive.
The NIS Directive and the National Cyber Security Centre (NCSC) Cyber Assessment Framework (CAF) apply to the Operators of Essential Services (OES) as a whole, and the CAF guidance applies particularly where issues could impact more than 250,000 consumers, which is the case with both low pressure and medium pressure gas distribution networks (which are the target environments for the two pressure control solutions). The project team understand that Ofgem are treating the CAF as non-prescriptive, with the onus being placed on each gas distribution network (as an OES) independently to manage their risk appropriately using the CAF as guidance. Changes in regulation in this area and/or how it applies to gas distribution networks cannot be ruled out over the lifetime of the proposed solutions.
It is not expected that delivery of the project will require any derogations, licence exemptions or regulatory sandboxes.
Utonomy and the SGN Information/Operation Technology team have engaged in a highly constructive conversation throughout the NIA pressure control and management project, and of the resultant SGN-approved UtonomyOne remote pressure control product as it moves into business-as-usual across 270 governor sites in SGN's South region. The product uses a data management platform that acts as the centralised software component, which is hosted in the public cloud using a customised version of Software AG's Cumulocity IoT product. The innovations proposed by this project would be extensions to this architecture, potentially involving the deployment of additional cloud-hosted services. Continuing the dialog, SGN Information/Operation Technology personnel have played an active role as part of the 'core' project team throughout Discovery and Alpha, and this is expected to continue into Beta.
It is expected that the primary vehicle for engaging with the issue of cyber-security as it affects the pressure control innovations is via the gas distribution networks' management procedures and policies, especially those that relate to the introduction of new technology and products onto the networks. For SGN, key policies and procedures are likely to include SGN/PM/G/23 (Management Procedure for the Approval of New Products, Equipment and Techniques) that will act as the overarching procedure for the project, SGN/PM/PS/5 (Management Procedure for managing new works modifications and repairs, which is SGN's interpretation and extension of the IGEM/GL/5 industry documentation) that will govern equipment installations within the field, and HAZOP studies, chaired by DNV acting in their role as an assessor independent from SGN and Utonomy. The latter will likely constitute the mechanism by which risks associated with cyber-security (and other intentional and accidental risks) are assessed within the context of the specific pressure control system design and its functional and procedural mitigations. The project will continue to work closely with SGN's own Policy team at all stages at Beta.
Medium- and longer-term policy considerations that may also affect the project include the decisions relating to the introduction of hydrogen into the distribution networks, and the wider energy network industry policy towards digitalisation and open data standards.

Business As Usual

SGN and Utonomy have a successful track record of incorporating significant innovations into business-as-usual. Utonomy's pressure control and management system was developed and trialled as part of an NIA project. Following SGN product approvals, this was subsequently released by Utonomy as a commercial product. SGN are now rolling this technology out across their Southern network.
Regular communication with, and 'buy-in' from, business stakeholders will be key to business-as-usual adoption. The project team will achieve this by both holding regular project steering discussions with these stakeholders that will update and showcase the project's progress and sharing outputs as each milestone is accomplished. Stakeholders will share in the responsibility of setting the overall project direction, including changes of approach if deemed necessary, recognising their status as eventual owners and users of the solutions. Steering discussions will include regular validation of the benefits and more detailed solution CBAs, ensuring that when the solutions are functionally proven there are no commercial barriers to wide-scale adoption.
SGN's innovation team, with support from the dedicated SGN innovation project manager, will initially be responsible for the implementation of the innovations. SGN's innovation team are an established team within SGN's business, who, through working continuously with NIA and NIC projects over several years, have developed a capable and broad knowledge of SGN's business activities, as well as the wider energy network industry in the UK. They are well placed to support the transition from innovation to business as usual and to facilitate an effective hand-over to the relevant business teams within SGN. It is expected that the networks' innovation teams will liaise closely with, and ultimately handover to, stakeholders from maintenance, network planning/strategy and IT teams to complete business implementation.
The following senior managers at SGN will champion and be responsible for the implementation of the innovation:

- Network and Safety Director
- Head of Network Management
- Network Planning Manager (responsible for meeting leakage targets Biomethane
- Connections Manager

This is the team with responsibility for the operation and management of SGN's network. The support at this senior level within SGN will enable the project output to be adopted rapidly.

The Beta phase of the project will include Cadent, Wales & West Utilities, and Northern Gas Networks, demonstrating that interest in the outcomes of the project is shared across all GB GDNs. Through their participation in the project, representatives of all the GDNs will have direct access to the project's learnings including implementation. In addition, the project will make available to all GDNs the necessary knowledge and know-how needed to implement the technology developed on their own networks. This will be done through workshops, seminars and training.

SGN's and the other distribution network licensees' funding strategies for adopting the innovations proven by this project will be incorporated into the Business Plans for RIIO-GD3.

Implementation of the innovations will be via commercial products made available by Utonomy to the GDNs for purchase. Utonomy will require additional investment to enable it to complete commercial versions of the products, to provide customer support for implementation and operation of the products and to provide additional working capital. Utonomy will raise this additional investment from existing and new shareholders. Utonomy has a good track record of raising investment from venture capitalists and other private investors. Its participation in the SIF project and the opportunity to commercialise the resulting technology will make it still more attractive to investors.

Cadent has expressed strong interest in all the solutions being developed under SIF. They have expressed a need for more advanced pressure control technology to further reduce their methane emissions. They have expressed particular interest in the use of AI and machine learning to further optimise pressure. A further use case strongly emphasised by Cadent is the ability to use intelligent pressure control to increase the proportion of Repex carried out by insertion vs open cut. Cadent has also expressed interest in anomaly detection using AI and machine learning. Utonomy has held multiple meetings at senior level to discuss the technologies being developed in the SIF. These have been with the COO, the network directors from three of the networks as well as senior engineering teams from each of the five Cadent networks.

All the GDNs in GB have the same urgent problem of insufficient biomethane injection capacity in their networks. Utonomy is due to start trials at Wales & West Utilities and NGN in April 2023. Utonomy has also been asked for proposals by Cadent and SGN. The solutions being discussed would provide remote control which is an enabling technology for the solutions being developed under the SIF.

Commercials

Consumer interaction and engagement

The project's innovations are targeted at users solely within the gas distribution network operators to improve business outcomes that are already tightly regulated and measured, for example by reducing methane leakage, lowering the costs associated with maintaining the networks, meeting escape response times, and increasing the amount of biomethane that is injected. Performance against these outcomes is already included in annual reporting from the networks, so this public reporting is the primary vehicle through which energy consumers could be informed about the benefits that will be realised by the project, including the progress that is being made during the Beta phase.

The project will look to engage with energy consumers via: the publication of the project summary videos at the key stages in the project; by attending the SIF community forum events in person and promoting the project activities, progress and deliverables; by considering publishing key updates about the project on partners' public facing websites and social media channels (such as LinkedIn); and by participating in the public show-and-tell webinars at the start and end of the projects.

The project is not expected to have any impact on existing or future energy consumers or their premises in relation to charging or contractual arrangements.

It is not expected that the project will require any supply interruptions at any stage of the Beta project, or as the solutions are rolled-out to business-as-usual.

As demonstrated by the completed pressure control and management NIA project, it is possible to deploy Utonomy's remote pressure management equipment to governor station sites without any interruptions to supply, and no change to the installation process is required by this project.

During the field trial stages of the project, additional monitoring equipment will be fitted to network extremities; the installation of this equipment is expected to follow similar installation process used already by the networks to deploy validation loggers, which are also understood to require no supply interruptions.

Two of the solutions being proposed by the project will include novel pressure management strategies, which will inherently and by design affect the downstream network pressures (as is the case with all pressure control technologies). As such, the Beta phase project has been designed with a series of field trial stages such that, at each stage, an appropriate risk assessment methodology is followed that considers the network policies and management procedures. Safety, and security of supply, are the primary aims at all stages of the field trials, before proving solution efficacy. DNV will act as an independent reviewer and approver of these procedures using their considerable gas network expertise and prior experience in acting in these roles.

The network extremity monitors that are being developed and tested in this project form a fundamental component of a low-point protection system, which will operate independently of the machine-learning algorithms. A review of the component architecture of the end-to-end solution was conducted at Alpha by the project team including DNV and SGN Policy team, including the low-point protection system methodology.

Supply shortages and interruptions

It is not expected that the project will require any supply shortages or interruptions at any stage of the Beta project, or as the solutions are rolled-out to business-as-usual.

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The network extremity monitors that are being developed and tested in this project form a fundamental component of a low-point protection system, which will operate independently of the machine-learning algorithms. A review of the component architecture of the end-to-end solution was conducted at Alpha by the management procedures and policies, especially those that relate to the introduction of new technology and products onto the networks. For SGN, key policies and procedures are likely to include SGN/PM/G/23 (Management Procedure for the Approval of New Products, Equipment and Techniques) that will act as the overarching procedure for the project, SGN/PM/PS/5 (Management Procedure for managing new works modifications and repairs, which is SGN's

interpretation and extension of the IGEM/GL/5 industry documentation) that will govern equipment installations within the field, and HAZOP studies, chaired by DNV acting in their role as an assessor independent from SGN and Utonomy. The latter will likely constitute the mechanism by which risks associated with cyber-security (and other intentional and accidental risks) are assessed within the context of the specific pressure control system design and its functional and procedural mitigations. The project will continue to work closely with SGN's own Policy team at all stages at Beta.
Medium- and longer-term policy considerations that may also affect the project include the decisions relating to the introduction of hydrogen into the distribution networks, and the wider energy network industry policy towards digitalisation and open data standards.

Commercialisation

The customer segment for the commercial products that result from these innovations will be operators of gas distribution networks in the UK and internationally.
In the UK, this includes all four GB GDNs: SGN, Cadent, WWU and NGN.
GTI Energy, a US research organisation, is managing a project to trial and adapt Utonomy's current pressure management products for the US market. The project is being sponsored by 13 US networks including: National Grid, American Public Gas Association, ConEd, Duke Energy, National Fuel, NiSource, New York Service Electric and Gas, Rochester Gas and Electric, Peoples Gas (Chicago), OneGas, Southwest Gas, SoCal Gas, Washington Gas. One of the reasons for their interest in trialling Utonomy's current pressure management products is that they are an enabler for the products that would be developed as part of the SIF.
Utonomy has had detailed discussions with leading European networks including Engie (France), Italgas (Italy), Naturgy (Spain) and Liander (Netherlands). All of these network operators have smart grid strategies and/or plans to digitalise their networks. They have all expressed strong interest in the technologies being developed by this project.
The customer value proposition includes the following:
Reduction in methane emissions: gas networks are already subject to or are expecting be subject to methane emissions legislation and regulation following COP26 and the Global Methane Pledge -- over 50 countries have now developed methane emissions reduction plans.

Increasing biomethane injection capacity: the number of biomethane plants is growing rapidly in most markets. In the UK, the number of plants is expected to grow from 105 to 150 by 2025. The EU goal is to replace 20% of pre-war natural gas imports from Russia with biomethane by 2030 which means doubling their production target to 35 billion m3 pa.
Reduction in operating costs and manual interventions on site: there is a shortage of skilled technicians and engineers, particularly in the UK. More remote monitoring and automation will reduce the necessity for manual intervention such as manually adjusting district governors. It will also lower the cost of operating the networks.
Anomaly detection and prevention: the early detection and diagnosis of network faults such as water ingress, gas escapes, governor malfunction will improve customer experience and increase the integrity of the network while also reducing the cost of maintaining the network.
Utonomy will commercialise the products resulting from the technology developed in this project.
In the UK, Utonomy will market the products directly to the GDNs and provide support and training via its own staff.
Outside the UK, Utonomy will work with partners who already have the necessary sales and customer support infrastructure in place as well as established customer relationships. An example of such a partner is Honeywell who is a leading supplier of complementary products to the networks such as governors and with whom Utonomy already has a marketing agreement.
Utonomy will require further investment to complete the commercialisation of the products being developed in the project, to invest in sales and marketing, customer support and additional working capital. It estimates this further investment at £5m.
The solutions have a very high degree of readiness to be scaled across the GB networks.
The solution requires networks to be fitted with hardware at the governor stations and low points. The governor station hardware can be installed by a two-man team in under a day. The low points take less than half a day. In neither case, is it necessary to interrupt the gas supply. The actuators installed at the governor station require adaptation to individual governor types. This adaptation has been completed for the majority of UK installed governors. Further adaptations will be required for international markets.
With 40 teams working across the GB GDNs, it would be possible to install the hardware within two years. This includes a 6-month ramp-up period for the supply chain.

Intellectual Property Rights

The IPR arrangements follow those set out in Chapter 9 of the SIF Governance Document.
Foreground IP will comprise Relevant Foreground IPR needed for the implementation of the learnings from this project by other UK network operators (compliant with 9.4 and 9.13). This will include the sharing of relevant data and knowledge gained by the funding party with respect to their learning in how to operate a network with Utonomy technology installed. Utonomy confirms that it will give all network licensees the right to use Relevant Foreground IPR within their network royalty free.
Relevant Foreground IPR does not include developments and improvements that are made to Utonomy's commercial products (compliant with 9.14). Such developments are commercially sensitive for Utonomy and must remain owned and controlled by Utonomy to ensure its future business success.

As a result, all IP generated during the project that is solely related to Utonomy's products and services, including hardware and software, will remain owned and controlled by Utonomy (compliant with 9.7) and will be available for network operators to purchase for use in the UK on an arm's length basis (compliant with 9.14). Without prejudice and subject to contractual terms, Utonomy will make its products and services available for purchase by any network operator within the UK, including products and services that incorporate foreground IP.
Ultimately, Utonomy's products and services are reliant on raw data (e.g. pressure measurements) gathered from the distribution networks on which they will be installed and operate; however, ownership of all such raw network data will be retained by the distribution network. This network data could be made available by the distribution networks to potential new market entrants, which could be further used with the Relevant Foreground IPR, specifically the knowledge gained with respect to their learning in how to operate a network with the developed technologies installed, to develop competitive solutions. Standardisation of data shared between distribution networks would further accelerate innovation.

Costs and Value for Money

The total project costs are £6,304,121.
Across all partners, contributions will total £669,984, representing over 10% of total project costs. Contributions comprise: a contribution in kind of £423,324 from Utonomy, by supplying enabling products at a 45% discount to the contractual pricing agreed with SGN from its open tender and procurement process to select solutions for its Remote Pressure Management RIIO-2 PCD; a contribution of
£231,597 from DNV; and a contribution in kind of £15,063 from SGN.
Across the project partners, the balance of costs and required funding is:
Utonomy: costs: £4,434,538 (70.3%); and funds £4,434,538 (73.0%); these costs are primarily comprised of R&D activities, field trial support, and the technical and commercial project and product management activities required to develop, test, trial and release the proposed innovations. The two largest cost components are: labour (£2,638,888) and subcontract (£1,630,000).
DNV: costs: £1,129,597 (17.9%); and funds: £898,000 (14.8%); all project costs are from labour.
SGN: costs: £668,019 (10.6%); and funds: £668,019 (11.0%); of the costs,
£517,395 is materials, from the purchase of the enabling remote pressure control products required for field trial sites to progress the innovations, and the remainder is from labour.
The other network partners have costs: £71,967 (1.1%); and funds: £71,967
(1.2%) in proportion to project sponsors' roles.
As in Discovery and Alpha, Utonomy will use subcontract services from Faculty, which has unique capabilities to deliver state-of-the-art AI solutions from teams formed from over 200 professionals comprising both technical and commercial experts. On each project, multifaceted teams are provided that combine industry and commercial expertise with data scientists and engineers, to provide fully end-to-end offerings. In delivering AI solutions, in-house developed engines allow specialised techniques to be applied to problems and to optimise performance. Combined with expertise in AI safety, this allows actionable and explainable insights to be provided, enabling improved business decision-making. These skills, and Faculty's experience of this project from Discovery and Alpha phases, make the company best-placed to continue Beta progress by assisting Utonomy with aspects of machine-learning and AI technology development including data collection and exploration; user research; proof-of-concept modelling; solution development including machine-learning operations and integration with customer systems; and analysing data and user feedback from trials. Faculty will lead anomaly detection work packages (WPs 3, 4 and 5) and the first work package
(WP6) on the biomethane injection solution.
The project team believe that delivering the innovations via the proposed Beta project plan will represent significant value for money for gas consumers given the potential impacts expressed in the CBA. The project will benefit from an expanded array of stakeholders from all four gas distribution networks and independent gas network expertise from DNV and complement this industry-specific focus with targeted and highly innovative product approaches from Utonomy and Faculty teams. SGN and Utonomy have a proven track record in collaborating to deliver new products to the gas industry and intend to continue and expand that record via this project. The project plan is ambitious in terms of duration, given the number of networks involved in field trials and the parallel activity on the three solution areas, but this is appropriately balanced with the needs to give due precedence to network policy and management procedures, to adequately prove the solutions' efficacy in sufficient depth, and to deliver project value to consumers.
The project team further believe that all subcontract fees are priced competitively against normal industry rates given the capabilities, experience, and skills of the teams. The project plan has been designed with stage gates in the anomaly detection and biomethane injection workstreams, which contain the bulk of subcontractor costs: services will only be contracted by successfully meeting preceding stage gate criteria, providing the ability to re-validate the necessity and value of scoped activities during the project.
Compared to previous phases, the project consortia has expanded and changed: at Beta, DNV's role is a project partner, as compared with subcontractor at Alpha, representing their expanded role in assuring and independently assessing project outputs to act in accordance with safety, security of supply, and AI policies and best practise; and Cadent, Northern Gas Networks and Wales & West Utilities have also joined SGN and NGGT licensees within the project, reflecting its applicability across the GB distribution networks. In comparison to Alpha, the proportion of total project costs incurred from subcontractors has dropped from over 75% to approximately 26% and is now significantly less than half the labour costs. Approximately 10% of the project's costs and funds required

are related to the purchase and installation of the enabling remote pressure management technology on which the proposed innovations are based. These products will be retained on SGN's networks at the end of the project and can therefore offer proven value to gas consumers regardless of the outcomes of the project.

Document upload

Documents Uploaded Where Applicable

Yes

Documents:

SIF Beta Project Registration 2023-08-23 11_37

This project has been approved by a senior member of staff

☑ Yes