# SIF Project Registration

### Date of Submission

Apr 2022

### Project Reference Number

10027183

## Project Registration

### Project Title

Intelligent Gas Grid

### Project Reference Number

10027183

### Project Licensee(s)

SGN

### Project Start

March 2022

### Project Duration

2 Months

### Nominated Project Contact(s)

stuart.sherlock@sgn.co.uk

### Project Budget

£116,401.00

### Project Summary

Although the project has relevance to the challenges on whole system integration and heat, its scope is most clearly associated with the challenge for data and digitalisation:

- Automated pressure management software, and the use of near real time data and machine-learning techniques, will contribute to better coordination, planning and network optimisation
- Increased injection of biomethane and hydrogen into the network will:
- Enable progress towards net zero
- Enable strategic outcomes from other challenges e.g. decarbonisation of heat

The project directly addresses as its primary focus points 7 and 9 in the challenge scope definition:
Point 7: this project will use novel sensor technology in order to improve visibility of the condition of network infrastructure, and make data-driven decisions about that infrastructure
Point 9: this project will use of data, combined with machine-learning and AI techniques, to improve the forecasting abilities of both demand on the network, and required maintenance and interventions.
Utonomy employs a multi-disciplinary engineering team, with specialist technical 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. These skills have been demonstrated in the successfully completed Pressure Management and Control NIA.
SGN and Utonomy have developed a successful and innovative partnership over several years via a collaborative NIA-funded project. Through this NIA project, Utonomy has built considerable understanding of the operation and management of gas networks. Likewise, SGN have continued to gain understanding of this technology's wider potential application across its networks. This combined understanding provides a firm R&D partnership from which to launch this project. Before this SIF project's Discovery phase, Utonomy will have completed two relevant Innovate UK projects - Biomethane Feed-in and Intelligent Gas Grid Control (IGGC). Both projects will also positively inform this project.
The potential users of the innovation include the network, planning, maintenance and operational teams within GDNs in the UK and worldwide. These users' needs include maintaining network safety, ensuring security of the
gas supply, providing operational efficiency & reducing maintenance opex, reducing reinforcement capex, reducing environmental

impact, and providing value for money for consumers and stakeholders.

## Third Party Collaborators

Utonomy

## Nominated Contact Email Address(es)

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## Problem Being Solved

Gas distribution networks today use a mixture of pressure control techniques, many of which are still manual in nature. Many governors are adjusted seasonally, consuming valuable engineering resources and using conservatively high pressures. At this stage in UK gas network evolution, significant steps are being taken by GDNs to lower carbon footprints, including effective use of green gas, however there is more work to be done: there are still occasions where biomethane plants lose gas through wasteful flaring if unable to feed into the grid. If alternative greener gases such as biomethane or blended hydrogen are not managed efficiently, there is potential for further 'imbalance'.
Proven via a recently completed NIA-funded project, Utonomy's remote pressure control technology can be used as the foundation on which to build towards full network digitalisation and create smarter networks. It will enable pressures to be automatically optimised across the network, leading to greater network efficiencies and increased capacity for injection of biomethane and hydrogen, all contributing to the transition to net zero.
If comprehensive network performance data can be readily collected and analysed in near real time, this will enable unexpected network occurrences such as gas escapes, water ingress, extreme cold weather and subsequent demand peaks to be detected, diagnosed and actioned earlier. This will increase overall network resilience and ultimately help to reduce costs.
Proposed innovations are aimed at solving:

1. Increased need for feed-in capacity of biomethane and hydrogen
2. Methane leakage from older networks
3. Need for more comprehensive and accurate near real time data on asset and network performance and condition
4. Need for faster detection and diagnosis of network excursions
5. Need for improved operational efficiency

The opportunities:

1. Increased injection of renewable gas
2. Reduced methane leakage
3. Lower costs for consumers
4. Reduced number of reported escapes
5. Use of flow and pressure data to detect and diagnose network anomalies and faults
6. Monitoring and analysis of governor data enabling preventative maintenance and early warning of failure
7. Reduced reinforcement capex and asset maintenance costs
8. Increased percentage of Repex via insertion
9. Dashboards and near real time reporting of KPIs
10. Network digitalisation: integration and standardisation of existing and future asset management and telemetry systems
11. End-to-end autonomous management of gas networks combining predictive and reactive technology concepts

# Project Approaches And Desired Outcomes

## The Big Idea

The idea is to collect network data, principally flow and pressure, and other data such as weather, and develop machine-learning and AI models and applications:

- Optimise pressure in low pressure networks to reduce leakage;
- Optimise pressure in medium pressure networks to enable the feed-in of biomethane and hydrogen;
- Provide early warning and diagnosis of network excursions and events such as water ingress, governor obsolescence or gas escapes; this will lower costs and increase network resilience;
- Interactive and intuitive dashboards will allow network planners and operators to monitor KPIs and alarms in near real time.

The project vision is to autonomously and intelligently monitor, control and optimise networks, in terms of pressure management and operational "planning & maintenance", using data-driven algorithms and decision-making.
State of readiness:

- The preceding NIA-funded project developed a means of remotely controlling governor pressures. This will facilitate the idea by providing the means of control plus much of the necessary data.
- Predictive machine-learning solution, Intelligent Gas Grid Control (IGGC) (TRL 4) -- proof-of-concept stage via Utonomy project funded by Innovate UK, due to complete next year.

This solution aims to optimise and automatically control network pressures. To date lab testing on simulated networks has indicated the approach is viable.

- Biomethane injection (TRL 4) -- higher force variants of Utonomy's Actuator, suitable for use on medium pressure networks: developed and tested in the lab. Trials on live gas networks with Northern Gas Networks and Wales & West Utilities scheduled for next year, testing remote manual pressure adjustments. This project is funded by Innovate UK.
- Flow measurement (TRL 3) -- in a proof-of-concept lab test, Utonomy have demonstrated correlation between governor pressures and diaphragm position measured with a low-cost sensor, to model flow rate.
- Alternative communications power sources (TRL 2/3) -- variants of the Utonomy communications system cabinet that are powered by: mains electricity; and rechargeable VRLA batteries without solar panels.
- Low-point monitoring system (TRL 2/3) -- variants of the Utonomy components that act as logging and alarm systems for critical network low-points or extremities.
- Other project ideas -- early stages of problem definition and solution identification (TRL 1/2).
- On the basis that outputs from this project will not generate IPR until later Alpha and Beta phases, the project partners agree to the standard terms and will work on a distinct work package during the Discovery phase to deal with Commercialisation in later Alpha and Beta phases.

## Innovation Justification

Drawing on multiple years of collaborative innovation with SGN, and through Utonomy's engagement with other GDNs, equipment suppliers and industry experts, both in UK and internationally, Utonomy is confident that the proposed idea is sufficiently unique and innovative to meet the application requirements of SIF.
During early development of its core remote control pressure technology, Utonomy filed a patent; this process included patent searches which uncovered no competing technology.
At the outset of the preceding NIA-funded innovation project, SGN launched a competitive tender process to assess potential suppliers of pressure control and management technology, through which Utonomy was selected. This process confirmed that there were no other suppliers suitably placed to provide similar technology, and also that the project met the conditions for NIA funding as prescribed by OFGEM including recognition that the scope lay outside business as- usual activities. Utonomy have also become familiar with SGN's other NIA project work, including Real Time Networks and Oxford Flow for example; learnings have shown that this project's scope would be complementary to those projects.
Utonomy has also expanded its knowledge of the UK gas industry via the initiation of the biomethane feed-in projects with Northern Gas Networks and Wales & West Utilities, and through planning new pilot deployments of the NIA-proven technology on Cadent networks. Discussions on pilot projects have also taken place with various European GDNs. These engagements have provided additional confidence in the uniqueness of the Utonomy concept.
Utonomy has undertaken a research project with the Gas Technology Institute (GTI) organisation based in the US. This organisation is a consortium of North American gas utility companies that researches innovative technology outside North America for the purpose of assessing the benefits of deploying those technologies to their networks. The project included a global market study of technologies

similar to the Utonomy concept and concluded that none were available. This first project recognised the unique potential that the Utonomy solution could bring to US gas utilities, and a follow-up project leading to USbased field trials is now in discussion. Learnings from the first project with GTI included potential synergies with the US gas market in terms of: the proportion of networks with similar aging low-pressure distribution networks; the growing importance of safety, as exhibited by recent legislative changes, and its impact on automation and telemetry; and visibility of bespoke SCADA based remote

# Project Plans And Milestones

## Project Plan And Milestones

Project Plan And Milestones (15000-word limit)
WP1 (SGN / Utonomy):

- Project kick-off

Success criteria: agreement of project timetables, scope, and required personnel

WP2 (SGN / Utonomy):

- Initial high-level assessment and definition of project problems in scope:
- (WP3) Increase feed-in capacity of biomethane and hydrogen
- (WP4) Reduce methane leakage from older networks
- (WP5) Reduce reported escapes; predict escape distributions
- (WP6) Better understanding of network asset performance and condition using near real-time data
- (WP7) Improve Repex efficiency through insertion
- (WP8) Improve reinforcement Capex efficiency
- (WP9) Faster detection and diagnosis of network excursions
- (WP10) Determine KPIs and dashboards needed to more effectively manage network
- Success criteria: agreed list of problems to progress in remaining Discovery phase (which may vary or expand on those shown above)

For each problem agreed as in-scope from WP2, the following project structure will be followed as distinct Work Packages (as indexed above) (SGN / Utonomy):

- Refined definition of problem
- Value to GDNs of solving problem (Benefits)
- Identification of potential solution(s)
- Solution(s) cost estimation (Costs)
- Initial draft CBA

Sources and quality of data

- Identification of constraints
- Feasibility report approved by key stakeholder departments within SGN,
- Network Planning, Innovation, Policy, Maintenance

Completion of the Feasibility report including above outputs will constitute success criteria.
In addition, for WP4, project plans will also be produced for additional field trials of the IGGC solution:

- Romsey (target Alpha phase)
- South London (target data collection in Alpha phase; field trial in Beta phase)

WP11 (IPR):

- Propose IPR treatment for commercialisation in later Alpha and Beta phases
- Success criteria: IPR agreement

WP12 (SGN / Utonomy):

- Project management and reporting; preparation for Alpha phase
- Success criteria: deliverables completed on time and within budget; SIF
- Discovery phase summary report; preliminary project planning for Alpha phase
- agreed

Project risks & mitigations:

- Lack of or reduced availability of key project partner stakeholders; key personnel to be identified and assigned to project in

preparation for Discovery phase to reduce likelihood of risk

- Operational staff required to work on safety critical / unplanned network activities; as risk relates to emergency / unplanned work it may be difficult to reduce likelihood; mitigation actions are therefore to reduce impact, e.g. assigning multiple personnel from specific teams to allow colleagues to deputise accordingly.
- Unavailable or incomplete operational network data; preliminary work in advance of Discovery phase to assess likely data types and availability

Constraints:

- No major constraints to the project have been identified

## Route To Market

If the idea is proven to be viable during the Beta phase, Utonomy will develop commercial products that will be available to SGN and other networks in the UK and internationally.

The commercial products will comprise hardware and software. SGN and other networks will be able to purchase the required hardware from Utonomy and install it on their networks. The software is likely to be hosted in the cloud and will be licenced to SGN and other GDNs by Utonomy. Utonomy already works with a large manufacturing partner that has the capacity to deliver hardware at scale to SGN and other networks.
The Beta phase of the project will involve field trials, facilitated by SGN's existing management procedures that will also include a detailed HAZOP analysis. SGN would expect to share data from the trials and the approvals process with other UK GDNs to enable them to implement the solutions without the need for extensive trialling themselves.
The commercial products that result from the idea are expected to be modular, meaning they can be implemented progressively, i.e. it won't be necessary for GDNs to wait until all the products are fully implemented to start seeing benefits.
Utonomy has strong traction for its current pressure management and control products with gas utilities in the US and EU. Utonomy believes that there will also be strong interest from these utilities for the idea being developed as they face many of the same issues that have been identified by SGN and Wales & West Utilities. Utonomy works through local partners to access these international markets.
SGN and Utonomy have a successful track record of implementing innovation into business as usual. This was demonstrated through the successful NIA project that developed an innovative pressure management and control solution for the UK gas industry and beyond. This project was completed in the last quarter of 2021 and is in the process of being rolled out in the UK.
Utonomy is planning to raise significant funding in March 2022 to support commercialisation of its pressure management and control product, as well as supporting ongoing R&D. There will be additional fundraising in 2023 to support international expansion.

## Costs

### Total Project Costs

116401

### SIF Funding

116401

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

☑ Yes