

SIF Alpha Project Registration

Date of Submission

Nov 2022

Project Reference Number

CAD_SIF0002

Project Registration

Project Title

Digital Platform for Leakage Analytics – Alpha Round 1

Project Reference Number

CAD_SIF0002

Project Licensee(s)

Cadent

Project Start

Aug 2022

Project Duration

6 Months

Nominated Project Contact(s)

Innovation@cadentgas.com

Project Budget

£495,134.00

Funding Mechanism

SIF Alpha - Round 1

SIF Funding

£445,571.00

Strategy Theme

Data and digitalisation

Challenge Area

Data and digitisation

Project Summary

Drastically reducing gas leakage across gas infrastructure is a global challenge that must be addressed to achieve the Global Methane Pledge and Net Zero targets by 2030 and 2050, respectively. This project aims to use the latest digital technology and data to provide a more accurate picture of gas network leakage, enabling more efficient operational and investment decisions to reduce leakage, improve network safety, and reduce customer bills. All UK GDNs are currently required to use the SLM for emissions reporting, but this only provides a static, theoretical value of total gas leakage, and cannot identify actual leak locations or volumes.

The DPLA is an innovative approach to measuring and utilising gas leakage data. In the Discovery phase, a range of technologies for methane detection was assessed. Satellite technology, which was expected to be a scalable, cost-effective solution, was found to be unsuitable, so the analysis refocused on drone/ aircraft/ vehicle-based monitoring methods. It was determined that a mix of technologies are needed to provide a whole system view, including handheld and drone mounted sensors for above ground installations (AGIs), vehicle and drone mounted sensors for urban pipelines, and vehicle, drone and aircraft mounted sensors for rural pipelines.

By overlaying data collected by these technologies with a hydraulic model, the DPLA could allow gas networks to locate and target highly emitting assets for maintenance and repair. It was found that super-emitters (high-rate leaks) represent 2-5% of all network leaks while accounting for 20-50% of total emissions. Prioritising these leaks will allow the networks to reduce emissions faster and more cost effectively.

The project meets the aims of the Data and Digitalisation SIF Challenge through the following:

It aims to deliver a novel digital platform, developed by the UK GDNs and National Transmission System (NTS), the output of which will also benefit Ofgem, gas shippers and others which could obtain relevant data from the platform.

It aims to accelerate progress towards a full digital twin of the gas networks (another challenge area arising from the increasing complexity of the energy transition), of which the DPLA could form a building block.

It aims to improve data monitoring, availability, quality, interoperability and access by increasing the breadth and depth of leakage data available to GDNs, regulators and shippers, and improve operational efficiency and resilience by reducing gas leakage and cost to consumers, while improving safety.

The project partners from the Discovery phase (Cadent, SGN, NGGT and Guidehouse) will be joined by NGN and WWU for the Alpha phase. The participation of all four UK GDNs as well as the NTS operator will enrich the project with a complete beach to meter view of national gas network emissions.

As lead partner, Cadent is responsible for the successful delivery of the project and brings a proven track record of delivering innovation projects and managing fugitive emissions. SGN, NGN and WWU will complement this, and ensure that the platform addresses the needs of all GDNs. Their involvement will also allow for alignment on potential regulatory proposals and build a strong case for change to present to Ofgem. NGGT brings the transmission perspective as a potential future user of the platform, and a decade of knowledge from their fugitive emissions programme. As key delivery partner, Guidehouse will bring its knowledge and expertise of regulated utilities, global gas networks and other sectors, which will be vital to determining optimal solutions for the UK. Managing gas network leakage is a key challenge in achieving net zero which extends beyond the UK, hence the learnings will also be valuable to international utilities operating gas infrastructure.

Project Description

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Add Preceding Projects

CAD_SIF001 - Digital Platform for Leakage Analytics – Discovery Phase

Nominated Contact Email Address(es)

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Project Approaches And Desired Outcomes

Innovation Justification

The cost of shrinkage and leakage gas across the UK GDNs was £30-70M per year over the last decade and grew to £130M in 2021 due to increased gas prices. This cost is socialised to UK gas consumers, as well as having an environmental cost representing roughly 1% of total UK GHG emissions. This problem must be solved quickly and cost effectively to deliver better consumer value and to meet Net Zero targets.

As part of their licence condition, GDNs report their annual leakage emissions using the SLM, which is based on legacy methods from 1994 and 2002. Small improvements have been made over the years as the GDNs are obliged to review and try to improve the SLM. However, progress has been slow, and it has remained a static, theoretical approach which lacks the accuracy and granularity needed to inform a cost-effective, strategic emissions reduction plan. In addition, the SLM is not compatible with a hydrogen blended network, which is likely to be a major issue for all GDNs in future.

This project seeks to revolutionise the GDNs' approach to leakage by replacing the SLM with an innovative, dynamic approach. It will build on past leak detection projects such as NGN's "LeakVision", National Grid's "Monitoring of real-time fugitive emissions" and Cadent's "ThermalTrax", as well as global oil and gas leak detection projects like the Environment Defense Fund's "Methane Detectors Challenge". These projects developed and tested advanced leak detection technologies, but only for a narrow range of applications/assets. This project will go beyond this by looking at how such technologies can be combined to drive more actionable, whole system insights. This will be achieved by bringing together complementary technologies to measure leakage across GDNs and developing an analytical method and system architecture to overlay the data into useful information including leak volume, location, and intervention options.

The only emissions reductions levers in the SLM are system pressure management, MEG treatment and replacement of metal pipes with plastic. The GDNs have largely exhausted system pressure management opportunities and the impact of MEG is relatively small, therefore there will be no further incentives to reduce emissions once all metal mains have been replaced. Asset replacement is currently done based on age and convenience rather than leakage prioritisation. The SLM does not allow GDNs to benefit from reductions in AGI leakage or venting, while own use gas and theft of gas are fixed by a formula. Without this project, the GDNs will therefore have very limited scope to reduce emissions in the future. The DPLA will unlock new options for emissions reduction and allow the real value of such measures to be accurately measured.

This project requires SIF funding because GDNs aren't incentivised to push for large advancements in emissions monitoring as part of their BAU activities. The risks associated with developing such an ambitious concept are significant. Some of the technologies considered are not yet mature and new algorithms are likely to be needed to analyse the large quantities of data. The phased approach of the SIF will allow the GDNs to build confidence in the technology, the expected returns and that greater emission reductions can be achieved. Regulatory and policy risks, including uncertainty around regulation timelines and incentive durations, the future of hydrogen and whether the cost of carbon will be monetised, also mean that GDNs cannot justify this project as BAU.

The project team have considered whether NIA funding would be applicable, however concluded that it doesn't meet the NIA governance criteria. Specifically, the requirement to provide benefits to customers in vulnerable situations is not addressed in the DPLA project.

Benefits

This project will deliver benefits directly to consumers by decreasing the cost of shrinkage and leakage gas which is passed on from GDNs to consumers' bills. This is even more relevant as gas prices have increased by more than a factor of 5 from 2020 to 2021. It will also indirectly benefit consumers by reducing greenhouse gas emissions, and therefore the environmental impact, of the GDNs. Natural gas (methane) has a global warming potential of 25 kg CO₂e/ kg CH₄, significantly higher than carbon dioxide, and these emissions must be curbed rapidly. This project will also be important as GDNs begin to incorporate hydrogen into their networks, as hydrogen has been shown to leak more readily than natural gas (Fugitive hydrogen emissions in a future hydrogen economy, Frazer-Nash Consultancy, BEIS, March 2022) and to also contribute to the greenhouse effect with a global warming potential of approximately 11 kg CO₂e/ kgH₂ (Atmospheric implications of increased hydrogen use, University of Cambridge, University of Reading and NCAS, BEIS, April 2022).

In the Discovery phase, a detailed cost benefit analysis was carried out. Two significant benefit streams were quantified assuming all UK GDNs were to implement the DPLA:

Avoided loss of natural gas and/or hydrogen (benefit to the end consumer) was found to be 7,831 GWh by 2050

Avoided greenhouse gas emissions (benefit to the environment and society) was found to be 10,790 kt CO₂eq by 2050. This amounts to net cumulative discounted financial benefits of £542 million by 2050, accounting for the total costs of deploying the solution and assuming a representative forecasted cost of natural gas/hydrogen and carbon dioxide equivalent (see Business Case Appendix for trends and full list of assumptions). The expected decrease in emissions from 2020 to 2030 was found to be greater than 30%, which supports the government priority to tackle methane emissions as a Participant of the Global Methane Pledge. The avoided loss of natural gas/hydrogen and avoided equivalent greenhouse gas emissions will continue to be used as the metrics to track benefits as the business case is further refined in the Alpha phase.

As well as these two significant benefits, several additional benefits were identified. These were not quantified in the Discovery phase to give a conservative estimate of benefits and to avoid overstating the economic value, but include:

Health & safety: reduces the risk of accidents by reducing the number of site visits required

Reputational: sends a strong message that GDNs are doing the right thing in terms of leakage and sets an example for other networks and even other countries to do the same, paves the way for best-in-class approaches to regulatory and operational methane emissions reduction

Operational: improved certainty on operating conditions and modelled outlooks

Reduced disruption: less noise and time taken when fixing leaks thanks to better localisation, improving public confidence and social acceptance

Leak prevention: in future, the platform could be developed to perform predictive leak prevention as well as leak detection

Fire hazard prevention: allow networks to take immediate action to prevent ignition by providing real-time alerts

Risks And Issues

Addressing our key risks

We have attached our detailed risk register that captures our current assessment of risks and planned mitigation actions. During the Alpha phase, the project will undertake activities and mitigation actions that aim to reduce the likelihood and impact of risks occurring. Broadly, during the Alpha phase, we aim to gain higher levels of confidence regarding; 1) the benefits achievable by the solution across GB networks, 2) the cost of implementing the digital platform and associated technologies, and 3) the ability to overcome regulatory changes that enable the roll out of the solution. We aim to mitigate these risks by; 1) identifying cases studies where the individual innovative technologies have achieved benefits in isolation, 2) engaging vendors through an RFI on costs for the platform and associated technologies, 3) engaging Ofgem about possible regulatory options that can support the roll-out of the solution. Additional risks and mitigation actions are detailed in the project risk register.

We don't foresee any immediate risks with management of intellectual property (IP). All project partners have agreed to adhere to IP clauses stipulated in the SIF governance documents. If in future, new vendors are onboarded for the Beta phase, we will highlight the IP requirements document in the governance and ensure that the commercial contracting arrangements are in the interest of all GB customers.

Our approach to managing and reporting risks and issues

Throughout the project, we will regularly assess our progress on mitigating risks and update the impact, likelihood, and mitigation actions accordingly. We will regularly review whether new risks should be considered and monitored. By including all UK GDNs as Project Partners and involving them in the Alpha phase, we ensure that our risk identification and mitigation approach is comprehensive and covers the needs of all GDNs.

In addition to engaging Project Partners on risks, we will engage with Ofgem to discuss our regulatory risks and mitigation actions. Furthermore, we will discuss risks associated with cost of implementation with external platform providers.

Where risks become issues that impact the ability of the project to successfully deliver the success criteria and learning outcomes, these will be raised with the Project Steering Committee as a first point of escalation. If no suitable actions can be undertaken to resolve the issue, we will raise this with the Project Officer, Ofgem, and Innovate to agree on appropriate next steps that ensure value for money for customers.

To ensure stakeholders benefit from the project, we will inform stakeholders about open and closed risks throughout our project in the project progress report and end of phase report. This approach ensures that stakeholders can consider learning and outputs from the DPLA project.

[DPLA Risk Register.pdf](#) (opens in a new window)

Project Plans And Milestones

Project Plans And Milestones

Project Plan: The project timeline is six months from August 2022 through February 2023. There are six work packages planned throughout the phase: commercial, digital platform & analytics design, technical options, selection & feasibility, change, stakeholder engagement & knowledge dissemination, and project management. More details including a description of each work package, key deliverables, milestones, success criteria, timelines, costs, payment schedule, and resources can be found in the attachment to this section.

Resources: To address the technical challenges, we will rely on the expertise of Guidehouse, Cadent, and Project Partners. Guidehouse will provide several resources that are experienced in the operation of gas networks, and the development of digital tools/platforms. Guidehouse Digital (previously Dovel Technologies), has over 15 years of agile software development experience, data management and integration expertise, and successful enterprise scale DevOps implementations, therefore, will be well placed to support the agile design of the DPLA platform. Cadent and the Project Partners, will provide experienced resources to support the solution design.

Main Success Criteria:

Establishment of new leakage incentive for different interventions -- To be validated by comparing regulatory framework from Ofgem as compared to recommendations

Demonstrably accelerate leakage reduction programme -- To be validated via case studies in UK and other countries, which are likely transferrable

UK GDNs adoption of these advanced methods and UK regulatory framework to incentivise this are seen as world class and drive European and global change in methane reduction programmes -- To be validated by interest from other countries to adopt selected method

Project Management Processes: Our project management processes will be grounded in the Project Management Institute's Project Management Body of Knowledge methodology, agile methodology, and our collective team's vast experience delivering projects and programmes. The project will be led by a Cadent project manager (PM) from the Innovation Team and supported by the Guidehouse PM. Together they will implement the project management processes for governance, schedule, finance, risk, quality & knowledge management, and change & stakeholder management.

Governance: We will develop a project charter and stand-up project governance, including Steering Committee membership, meeting cadences for project status (likely fortnightly for a status meeting across all work packages, and a monthly Steering Committee meeting) and reporting expectations. The attachment to this section provides our initial view on project governance.

Schedule: We will develop more detailed plans for each work packages—noting that additional activities will be defined as we go and that the approach will have to be continually aligned and iterated following an agile approach.

Finance: We will ensure no less than monthly reporting on actual spend vs. budgeted and regular invoicing to promote transparency and cost-effectiveness.

Risk: Addressed in Question 5.

Quality & Knowledge Management: Quality assurance process will incorporate oversight of the programme activities related to SIF requirements.

Change & Stakeholder Management: We will proactively engage internal and external stakeholders and plan activities in a regularly updated stakeholder engagement plan.

Changes to the team from discovery phase: The team is remaining largely consistent to capitalize on the benefits that come from continuity. However, NGN and WWU have come onboard due to their keen interest in shaping the platform and potential regulatory changes as UK GDNs. This will help to ensure that all UK GDNs are aligned on the future of emissions monitoring and reporting. Additionally, Cadent is expanding their project team to include network code and information system specialists which will be key to the detailed platform system architecture design. To this end, Guidehouse are also bringing on board a team of digital experts to lead this design.

Uploaded Alpha Skills and Expertise.pdf

[Alpha Skills and Expertise.pdf](#) (opens in a new window).

[Alpha Phase Project Plan_submitted.pdf](#) (opens in a new window).

Regulatory Barriers (Not scored)

As regulated monopolies, GDNs must have a licence to operate, which requires them to estimate and report shrinkage and leakage

emissions to Ofgem annually. Since shrinkage and leakage are not physically measured, GDNs use an Ofgem approved Shrinkage & Leakage Model (SLM) to estimate these. Ofgem mandates that GDNs must collaborate and consult with industry stakeholders on an annual basis on how to improve the SLM. Current uncertainty in future gas network regulation presents a risk to GDNs investing in innovative technologies that may not provide expected returns if network regulation changes.

Any changes to the approach for measuring & reporting shrinkage and leakage will require approvals from Ofgem before implementation. Several regulatory options to drive improvements in measurement and reporting of leakage have been considered in the Discovery phase of this project. Although these regulatory options will require changes to licence conditions and regulations, we don't envisage that these are 'showstoppers' in the successful deployment of the DPLA solutions.

To increase the likelihood of successful adoption of the DPLA solution across all GDNs, we have secured support from all UK GDNs to participate as Project Partners in the Alpha phase. This will ensure that the solution designed in applicable to all GDNs, therefore benefitting all UK customers.

We will engage Ofgem during the Alpha phase to discuss regulatory options that enable the deployment of DPLA and achievement of the associated benefits. We recognise that regulatory changes will only be necessary following a successful live trial in the Beta phase but recommend aligning with Ofgem on proposed plan as early as possible to avoid any potential delays in roll out and enable the recommendations to be considered in the RII0 GD3 regulatory framework. As Ofgem have a strong track record of successfully incentivising GDNs to improve on shrinkage and leakage emissions reduction, we are optimistic of the opportunity to collaborate to further this.

Business As Usual

Emissions reporting in the UK distribution network is a regulated process with an approved methodology adopted by each of the distribution network licensees. Within the Alpha phase submission all the UK distribution networks will be represented as either lead or partner organisations. Harnessing this collective distribution network expertise, and understanding the available technologies, different ways of working and the infrastructure landscapes unique to each distribution network will allow a single, well thought out, solution to be implemented.

The rollout of the solution will require coordination and collaboration with Ofgem to ensure appropriate funding or incentivisation is available to justify the investment. Performance measures to reduce shrinkage that directly correlate to customer and environmental benefits will be required in future regulatory periods. These performance measures will need to reflect the cost and value of achieving shrinkage reductions and be future proofed for blended networks or full Hydrogen deployment.

The outcome of this process could be the adoption of a new, more accurate and granular emissions reporting methodology that could form the backbone of a UK wide, and international, platform. This work coincides with EU legislation requirements for reform and meets UK industry requirements and Licence requirements for improving estimation accuracy. More concise reporting would ensure that unallocated gas is better apportioned and customer bills better reflect shipper and transportation responsibility.

The mechanics of changing the methodology and detailed requirements and design of the platform will be undertaken in the Alpha stage with demonstration occurring in the Beta stage. Within the Licence the sentiment of incremental or large improvement is encouraged and details for promoting potential changes are laid out. There is currently a requirement for 28-day consultation, specialist industry review and final Ofgem approval. The project could lead to a large-scale change, with impacts on emissions volumes unknown, there is a certainty that the ability to understand at a more granular level the emissions locations would allow Distribution Network operators the opportunity to target specific assets for remediation or replacement.

The implications of changing the methodology could require Licence and network code changes, these will need to be understood and managed prior to the implementation.

Secondary to the emission reporting are the opportunities to change operational direction using the DPLA. With granular detail of, for example, specific pipe leakage volumes at certain localities this could facilitate changes to mains replacement selection criteria. This would require HSE engagement and potentially additional funded replacement lengths or replacement in different tiers outside of the Iron Mains Replacement Programme.

Commercials

Commercialisation

The Project Partners (Guidehouse and all of the UK GDNs) are entering into this project with the view that if successful there are genuine commercial opportunities here in Great Britain and potentially internationally as well. This platform for gas leakage analytics is something of a world first however with the focus from COP26 on gas leakage other countries will also be seeking to innovate in this

respect. Primary customers are expected to be gas networks however this could potentially expand to include gas producers, regulators and policy makers who may seek information and reporting from the platform beyond the actual gas leakage measurement.

As the only non-network partner in the project, Guidehouse is actively supporting development of the opportunity, including leverage of its Guidehouse Digital team, its technical experts with knowledge of gas leakage solutions and team members with experience of gas networks and the GB market situation. Guidehouse is committed to running a competitive procurement process for key aspects of the eventual platform solution, so the process to commercialisation will be transparent and based on best practice and rigorous scrutiny of options by all partners.

It is our view that there are clear benefits to consumers with value from more efficient network maintenance, from reduced loss of gas as well as environmental benefits for society. These benefits apply in Great Britain but apply equally well in other countries with significant gas networks. Section 10 of this application spells out benefits more clearly, building on the work in our Discovery Phase.

The need for additional partnerships for route-to-market has not been determined at this point however the Alpha Phase will bring additional clarity to this. A commercial construct involving all of the current partners is currently viewed as feasible and with all GB gas networks participating there is the ability for a single complete solution to apply in this country at least.

Uploaded Alpha Investment Needs Summary Template 001.pdf

[Alpha Investment Needs Summary Template 001.pdf](#) (opens in a new window).

Intellectual Property Rights (Not scored)

All Project Partners have reviewed the SIF Governance and confirm compliance with this, including that Foreground IP created by this project will be shared in accordance with clause 9.7 of the Governance document. Currently the only non-network Project Partner is Guidehouse. From an IP perspective, Background IP is at this point only in the form of knowledge and expertise rather than any specific existing platform or application owned by any Partner. This keeps options open in the detailed design phase to consider a complete range of technology and platform approaches.

Costs and Value for Money

The total project costs are £495,134 however as a result of contributions from Cadent the funding requested is £443,971. The balance of funding will be delivered through additional time and resource commitment from the lead partner Cadent.

Cadent is committed to the successful delivery of this project. As such £75,990 of expertise and resource is committed across multiple areas of the business and across all 6 work packages. This includes experts who have participated in the North London methane emissions reduction trials, the Director of Asset Investment, gas emission specialists and business change specialists.

The four gas network partners, NGGT, SGN, WWU, NGN will contribute 10 days each of a gas emissions specialist's time across the project at broadly similar costs. This will ensure that the project benefits from the full breadth of UK gas emissions expertise concentrated over a short period of time to ensure the best outcome and value for money.

3 alternative approaches were considered:

Do Nothing: The impacts of doing nothing have been demonstrated in the discovery phase to be counter-productive to delivering on the UK's COP26 commitment of 30% reductions on methane emissions by 2030 and maintain the high costs to consumers through continued gas escape from the UK gas distribution systems. This is considered unacceptable.

GDN's to bear the same costs to deliver this innovation: GDN's are not currently incentivised to bear the costs of change and risk of innovation to deliver the outcome of this concept.

A reduced funding request with lower supplier costs: The scale, breadth and depth of change necessary to deliver and co-ordinate change across 5 gas networks the £542m of consumer benefit defined in the discovery phase necessitates a central independent role. As such a reduced funding request would not deliver on the scope required to effectively justify a beta phase of this work.

The primary delivery partner in the Alpha phase is Guidehouse. Guidehouse are critical to the successful delivery of this project:

Guidehouse have global subject matter expertise on leading practices around methane leakage monitoring and reduction techniques and delivered the successful outcome of the discovery phase. Thus, continuity of expertise through Alpha is important.

Guidehouse's digital team will play a core role in defining the functional requirements and detailed design of the conceptual digital analytics platform.

As 5 gas networks are partnering in this project and a 'beach to meter' approach is being taken, a central independent partner is necessary to successfully manage the change required and engage stakeholders across all 5 UK gas networks.

Guidehouse's expertise will continue to complement the UK GDN expertise on what is locally possible and desirable from a regulatory perspective. Direct and accelerated collaboration across the 5 networks on this issue would not be considered a business as usual activity and as such Guidehouse's role here is crucial.

Day rates for typical Guidehouse assignments with Cadent are £1400 and the discovery phase day rate was discounted from this to £1296. As a demonstration of commitment to efficient project delivery and value for money, the Alpha phase blended day rate for the Guidehouse team will be reduced by ~£100 to £1195.

Supporting Documents

Documents Uploaded Where Applicable

Yes

Documents:

SIF Alpha Project Registration 2022-11-04 2_31

CAD_SIF0002 SIF Alpha Close Down Report 2023-04-20 12_22

SIF Alpha Project Registration 2024-02-20 11_02

This project has been approved by a senior member of staff

Yes