SIF Project Registration

Date of Submission

Jul 2022

Project Reference Number

CAD_SIF001

Project Registration

Project Title

Digital Platform for Leakage Analytics – Discovery Phase

Project Reference Number

CAD_SIF001

Project Licensee(s)

Cadent

Project Start

March 2022

Project Duration

2 Months

Nominated Project Contact(s)

Ann Ward

Project Budget

£125,328.00

Project Summary

Reducing gas leakage across gas infrastructure is a fundamentally important global challenge that needs to be addressed to achieve net zero targets. The project aims to use the latest digital technology and data to provide increased awareness of gas network leakage, thus enabling more accurate operational and investment planning decisions. The improvement in operational and investment planning decisions ultimately lead to reduced gas leakage, improved network safety, and reduced customer bills. Overall, the project aligns closely with Ofgem's SIF eight eligibility criteria listed in the SIF governance document. A project summary slide, and 'postcard from the future' are included as appendices to this response.

As the lead Project Partner, Cadent is responsible overall for the successful delivery of the project. As a gas distribution network operator, they are currently responsible for tracking and managing gas leakages on the gas network and adhering to their regulatory license conditions.

As Cadent's lead delivery partner for several work packages, Guidehouse brings global experts working with global gas utilities and other sectors on a day-to-day basis. This broad awareness and knowledge of global solutions and processes used to identify and address gas infrastructure leakages will be vital to determining optimal solutions in the UK.

SGN and NGGT have been identified as additional Project Partners for the Discovery phase. As peer gas distribution and transmission operators, they will play a vital role in the project by bringing additional insights on the topic and ensuring that any future solutions and learning can be applied to other gas network operators in the UK, meaning that all UK customers benefit from the project.

Currently, as per their regulatory license, all GDNs use the same approach to gas leak detection, therefore the digital platform is directly applicable to peer GDNs in the UK. Managing gas network leakage is a key challenge in achieving net zero and extends well beyond GDNs in the UK, therefore the learning will likely be valuable to international utilities that operate gas infrastructure.

A short overview video on Youtube is available using this link: https://youtu.be/QJYoEV9hq5g

Uploaded Cadent SIF Application - Postcard and Project on a Slide (003).pdf

Microsoft PowerPoint - Cadent - SIF Application - Postcard & Project on a Slide.pptx (apply-for-innovation-funding.service.gov.uk)

https://apply-for-innovation-funding.service.gov.uk/application/10027572/form/question/23419/forminput/59942/file/361093/downloadgov.uk)

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Problem Being Solved

GDNs in the UK carry out asset replacement of their mains pipelines regularly. This is primarily driven by the HSE to manage the safety risk of gas escapes. The volume of assets to be replaced is driven by a leakage model which does not provide an accurate view of leak volumes and locations. Legacy methods from 1994 & 2002 are still being used. The cost of gas lost from the Cadent network stands at £58m (2021/22).

The model currently used only considers mains pipes and transposes the rates across to AGIs. This is an inadequate approach and there is an opportunity to better model the whole network of assets including service governors, local transmission, NTS Offtakes and more. This will provide a whole network view of GHG emissions and performance.

A recent quantified commitment at COP26 detailed a 30% methane emissions reduction by 2030 compared to 2020 levels. It is likely that the UK will adopt this into legislation and specify improved emissions performance from the gas networks.

Problem

•The cost of methane losses from Cadent assets alone was £58m in 2021/22.

•This results in a significant overall quantity of gas lost through shrinkage, the costs of which are socialised to UK gas consumers.

•The value of lost gas will increase as gas networks transition from natural gas to hydrogen and other low carbon gases.

•Asset replacement is an expensive activity to reduce leakage and represents a large cost to consumers. This is currently done on a volume of mains replacement interventions rather than any location or asset type prioritisation.

•Inaccurate leak modelling leads to suboptimal network investment decisions, meaning reduced value to consumers.

Opportunity

It is proposed to address this problem by collating available data sets, identifying new data and technologies, and developing a digital platform to aggregate these and offer insights on leak type, location, volume and proactive intervention options. With the reduced cost of monitoring devices and technologies, it is anticipated that this is more feasible than has been the case in the past. Additionally, digitalisation is a key future focus of Ofgem for energy networks in the UK. Enhancing the digital capability of the gas network will offer benefits wider than the scope of this project, including the facilitation of a potential digital twin, live operational intelligence and more.

Project Approaches And Desired Outcomes

The Big Idea

With the advancement of digital technology e.g., IoT sensors, advanced metering infrastructure, satellite imagery etc., increasing datasets are becoming available to gas distribution network operators. These datasets can be consolidated and analysed in digital platforms that provide detailed insights to support operational and planning decision-making. Cadent's Digital Platform for Leakage Analytics project aims to develop a digital platform that uses a range of the latest available data to determine locations, volumes, and likelihood of gas leakage on the distribution network.

The transition from a static leak location model, as described in our response Q2, to a dynamic approach that uses a range of asset, monitoring, and third-party data will improve our understanding and confidence of leakage volumes and locations. In turn, this enables more optimal operational and investment planning decisions to the made, which ultimately lead to increased consumer value.

Although the Discovery phase will be used to conduct a holistic scan of available technology and data options, we anticipate the following technology and data to be considered:

1)Existing asset data from GIS systems, hydraulic modelling data, historic leak notifications mapped in GIS systems;

2)Existing monitoring data and smart metering data;

3)Lidar and satellite data; and

4)Handheld and drone mounted imaging and monitoring/detection devices.

The technology and associated datasets above vary from high maturity existing available data sets currently used in the static leakage model, to innovative handheld and drone mounted imaging and monitoring/detection devices.

Each of the above data sets will provide complementary and valuable inputs that when analysed holistically in the digital platform provide improved accuracy and confidence in leak locations and volumes. The digital platform will ingest the selected data sources based on user configurations and provide functionality for users to interrogate and configure the outputs in a visual.

Over recent years, we have seen the advancement of digital twin modelling and advanced analytics platforms, however there are currently no mature BaU solutions available on the market that have demonstrated the holistic approach, therefore we consider this a novel solution.

The design of the digital platform will consider open data and agile design principles to ensure the adaptability and scalability to additional data sources, and applicability to other gas distribution and transmission network companies. We currently don't foresee any IP issues impacting the delivery or scaling of the platform, however, will consider the IP arrangements for the platform during the Discovery phase.

Innovation Justification

The proposed digital twin platform will demonstrate a centralised combination of leak detection technologies of various maturities for the first time, optimising their roll-out and providing enhanced analytics via cross-verification of findings.

This platform would build on a swathe of leak detection projects testing the suitability of individual automated monitoring and data collection technologies, which have delivered key learnings. For instance, Cadent's novel fitted Methane Alarm and robotic ThermalTrax detection sensor projects have enabled an average 3% annual leakage reduction.

Key learnings from wider innovation trials include:

-Planes and satellites can identify high-level leakage but cannot pinpoint the source.

-Drone sensors have proven versatile at detecting leakage at different spatial resolutions, but methane quantification accuracy requires refinement.

-In situ sensors provide the highest temporal resolution via continuous sensing but limited spatial resolution.

-Handheld sensors provide versatile spatial resolution but are time-consuming and cannot quantify total emissions.

-AI-based models can be used in combination with imaging and sensors to detect leaks at low costs.

The critical learning is that, with technologies offering varied resolutions and quantification accuracy, a combined approach can overcome individual shortcomings to offer holistic leak detection with higher precision.

Indeed, the Environmental Defence Fund's (EDF) 'digital methane maturity continuum' for gas operators (see appendix) peaks with stage 3, which includes advanced analytics via combinatorial technology application amongst its characteristics. EDF concluded that no gas companies have reached stage 3, corroborated by initial research indicating that no holistic digital platforms are being utilised nationally or internationally for pipeline leakage

As such, GDNs should explore how digital solutions can facilitate detection methods and leakage fixes, building on NGN's digital twin model of its gas distribution network, plus other projects detailed further in the accompanying appendix. This platform will be the first to fulfil this advanced combinatory analytics characteristic, making it a truly innovative endeavour. The only comparable effort is by European utility GRTgaz, who aim to build by 2030 a platform combining multiple detection technologies to develop an integrated approach to reduce methane emissions.

Demonstrating an approach combining novel and mature technologies and leveraging multiple data sources will require R&D to determine the full value that can be achieved. Uncertain deployment costs for leak detection improvements and digitization, current regulatory incentives, and license conditions leave GDNs unlikely to pursue this initiative without dedicated innovation funding which enables them to explore and address these uncertainties.

Microsoft Word - Cadent - SIF Application - Q5 Appendix v0.2.docx (apply-for-innovation-funding.service.gov.uk)

Project Plans And Milestones

Project Plan And Milestones

The Discovery phase of the project will consist of five work packages that will be delivered during the project period 1st March 2022 and 31st April 2022. Appendix X provides an overview of work packages (WP), planned activities, timelines, outputs, and risks to the project. The planned activities for the Discovery phase aim to de-risk current uncertainties regarding the availability and maturity of digital technology and data, costs of technology and data, benefits to consumers, and market and regulatory changes to delivering a digital platform for leakage analytics. The five work packages are described below:

WP 1 -- Technology and data assessment

WP 1 will be led by Guidehouse. Guidehouse will conduct a global assessment of available technology and data that informs locations and volumes of gas leakage on the distribution network. Using a range of assessment criteria e.g. accuracy, availability, cost to acquire, Guidehouse will develop a prioritised list of technologies and data sources that should be considered in the digital platform.

WP 2 -- Conceptual digital platform design

WP 2 will be led by Guidehouse. Guidehouse will work collaboratively with Cadent and the Project Partners (NGGT and SGN) to define a future vision for the digital leak management platform. In addition, Guidehouse will conduct workshops to identify key use cases and requirements for the platform. The requirements will be prioritised to determine appropriate use cases and requirements for a minimum viable product (MVP).

WP 3 -- Regulatory and market considerations

WP 3 will be led by Cadent. Cadent will, with support from Guidehouse, conduct a detailed assessment of regulatory and market conditions that may influence the successful deployment and implementation of a digital platform. In addition, Cadent will develop a roadmap for overcoming any previously identified issues.

WP 4 -- Commercial viability and consumer value

WP 4 will be led by Guidehouse. Using the outputs from WP 1 & 2, Guidehouse will identify and quantify costs to develop the digital platform and estimate benefits that can be derived by using the platform.

WP 5 Project management and knowledge dissemination WP 5 will be led by Cadent, with support from Guidehouse. This work package will set out robust processes to ensure that the Discovery phase is delivered to scope, budget, and plan. Furthermore, the work package will ensure that the project ambition and associated learning from the Discovery phase are disseminated at the project launch and close down events.

Microsoft PowerPoint - Cadent - SIF Application - Q7 Appendix Project Plan & Risk Matrix.pptx (apply-for-innovation-funding.service.gov.uk)

Route To Market

The challenges identified by Cadent in this project submission are applicable to gas infrastructure owners in the UK and globally. Commitments at COP26 have reinforced the importance of tackling these challenges to achieve net zero.

During the Discovery phase we are involving SGN and NGGT in developing the vision and requirements for the digital leakage analytics platform. This involvement will ensure the platform is readily adaptable to different user requirements and won't require extensive rework to scale beyond the application to Cadent. We recognise that the agility of the platform will be vital to ensure future datasets can be considered as they become more widely available.

When developing the digital leakage analytics platform with a vendor in the Alpha or Beta phase, Cadent will consider appropriate commercial models that maximise value to customers and align with IP requirements listed in the SIF governance.

If the Beta phase demonstrates that the digital leakage analytics platform delivers benefits to customers, it can be scaled beyond Cadent's networks to other UK GDNs. If successful, the solutions demonstrated in the project will likely lead to the introduction of a new reporting mechanism for Shrinkage emissions that will benefit from widespread rollout. This rollout across all UK GDNs will ensure consistent methods of reporting on shrinkage.

The rollout of the solution will require coordination and collaboration with Ofgem to ensure appropriate performance measures to reduce shrinkage are implemented in future regulatory periods. These performance measures will need to reflect the cost and value of achieving shrinkage reductions.

The learning from the Discover, Alpha and Beta phases, are likely to be applicable to and international audience, that are facing similar challenges and targets for achieving reductions in methane leakage. Cadent will share learning with international gas community through a range of international forums. The detailed knowledge and dissemination activities (local and international) will be considered at various stages (Discovery, Alpha, Beta) of project delivery.

Uploaded Cadent SIF Application - Investment Needs Executive Summary Template (Guidehouse).pdf

Microsoft Word - Investment Needs Executive Summary Template (Guidehouse).docx (apply-for-innovation-funding.service.gov.uk)

Costs

Total Project Costs

125328

SIF Funding

125328

This project has been approved by a senior member of staff

☑ Yes