Digital Platform for Leakage Analytics (DPLA)

Energy Innovation Summit

31st October – 1st November 2023

DPLA aims to significantly reduce gas network leaks and emissions in a cost-effective way

The background

The **Digital Platform for Leakage Analytics** (DPLA) project aims to develop and demonstrate a functional MVP for how data, analytics and models can be used to identify and locate gas leaks in the gas distribution network

The core functionality of the DPLA is **data-driven leakage modelling**, unlocking proactive leak detection capabilities, combined with testing the application of novel gas sensor technologies. Thus, creating opportunities to reduce the reliance on and cost of in-field specialised sensors

DPLA's mission is to reduce **carbon emissions**, realise **customer benefits** and **improve safety** in a cost-effective way

DPLA through the SIF Phases

Discovery

- March-April 2022
- Evaluated the **feasibility of the DPLA concept** from technological, conceptual, regulatory and economic perspectives

Alpha

- August 2022-February 2023
- Delivered a complete **system architecture and design** for the DPLA and recommendations for regulatory, technology, and commercial options

Beta

- August 2023, up to 5 years
- Will deliver a **functional MVP** & build confidence in the regulatory, operational, and commercial aspect

This project is an opportunity for improved leakage management and to mitigate the economic and environmental costs of gas shrinkage

Challenges

- **Increasing economic and environmental costs** due to the shrinkage and leakage of natural gas
- The **cost of gas leakage** from the GDNs reached **£115M in 2020/21** (up from £27M in 2019/20), this cost is socialised to gas consumers
- The GDNs **reported 2,330GWh of gas shrinkage in 2020/21**, which is equivalent to roughly 770,000 cars on the road
- **GDN shrinkage and leakage represents 4.5% of total methane emissions** and 1% of total GHG emissions **in the UK**, so this is an important area to tackle if the UK is to meet the Global Methane Pledge target of 30% methane emission reduction from 2020 to 2030

Objectives

- Significantly **improve our understanding, accuracy, and granularity** of where and how much our assets are leaking
- **Enable the optimization of our maintenance and repair** investment to accelerate the reduction of leakage, hence reducing harmful methane emissions and customer bills
- **Better track our emissions abatement efforts** through improved reporting and focus on the most **effective** measures

DPLA presents substantive financial, environmental, safety, and consumer benefits

- Financial benefits due to lower gas leakage volumes, achieved by targeting larger leaks sooner, leading to lower volumes of gas lost per year and lower shrinkage costs
- Financial benefits due to lower GHG emissions

Additional benefits include:

Accelerated Decarbonisation

Customer Benefits

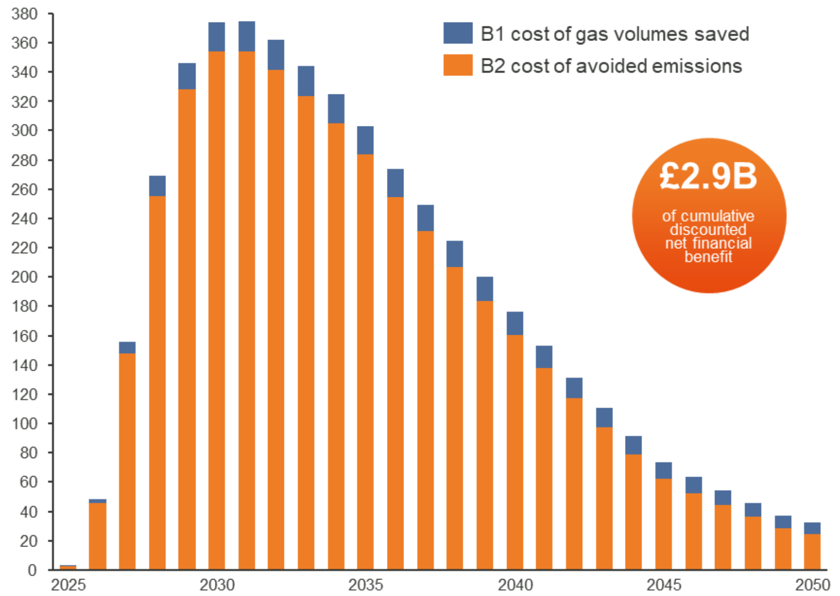
Reporting Benefits

Increased Accuracy

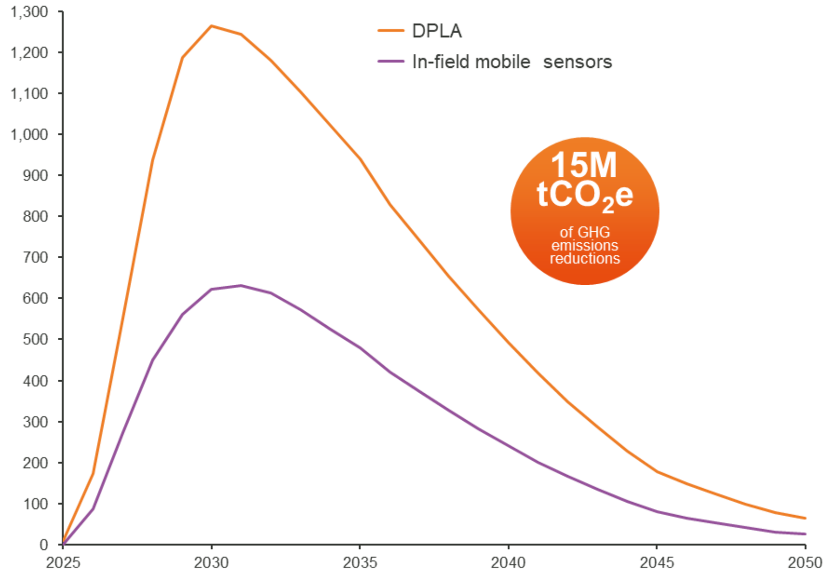
Real-time Inputs

Proactive Safety

Net Financial Benefits



Emissions Abatement Potential



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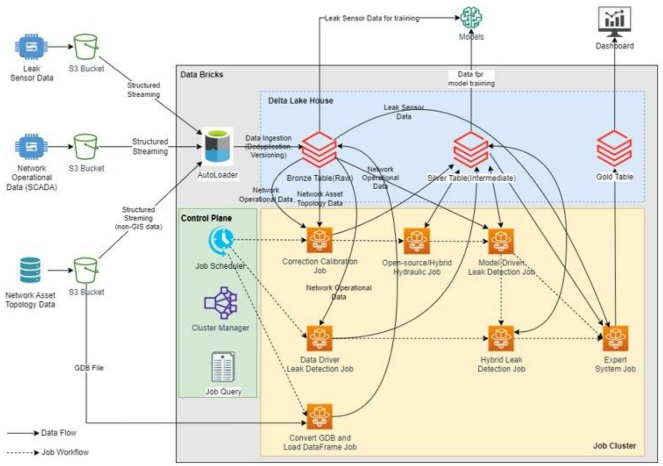


DPLA System Architecture & Design

The platform requirements, system architecture and model design were defined in preparation for the Beta phase MVP buildout. An RFI was completed to understand the range of vendors capable of building the platform and to benchmark costs for the Beta phase.

Technology Recommendations

A range of innovative, in-field leak detection technologies were analysed, including provider interviews and case studies with Picarro and OGE. Preferred commercial options were put forward for the shortlisted technologies.

Change Impact Assessment

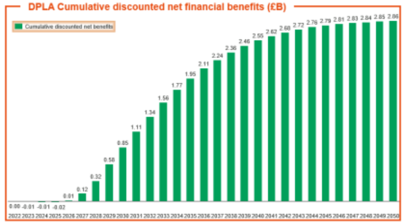
The expected level of impact and potential adaptation strategies was assessed across four dimensions of the gas networks: job roles, people & skills; processes; systems & tools; and behaviours & attitudes.

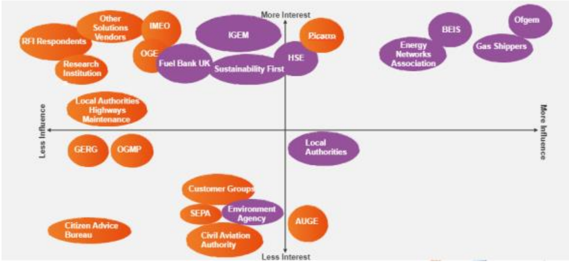
Regulatory Options

Cadent's regulatory team identified four impacted areas to the Regulatory Framework – Asset Management, Regulatory reporting and outputs and the Shrinkage and Leakage model. Through collaboration with Ofgem, these impacted areas will be evaluated and a plan will be developed to manage these re-considerations during the Beta phase.

Business Case

A cost benefit analysis was performed to determine the value of the DPLA and to compare the cost/benefit of different scenarios, including technologies deployed, timelines and leak reduction rates. The main scenario established that DPLA could deliver 12.4M $tCO2_e$ of avoided emissions and £2.9B of value by 2050.





Stakeholder Engagement

Identified and engaged with 4 key groups of stakeholders. 1) Customers: collected customer responses to the DPLA concept through a survey. 2) Industry: engaged with Ofgem on the regulatory aspect and with gas shippers to ensure the DPLA will meet their needs. 3) Customer stakeholders: such as Citizens Advice and Fuel Bank UK, to ensure DPLA will also benefit vulnerable customers. 4) Sustainability stakeholders: such as Sustainability First and the Environment Agency to bring them on board with DPLA's sustainability goals.

Commercial Recommendations

Commercial design options were identified and evaluated from three key perspectives: the party responsible for 1) building the platform 2) marketing the platform and 3) owning the platform. The beta phase should evaluate the shortlisted commercial design option in which a third party will be involved.

DPLA can also play a leading role in better understanding and quantifying in-field hydrogen leakage right from the start of its rollout

Hydrogen leakage remains poorly understood, but there is consensus that in-field detection is needed to better appreciate operational leakage rates

- Hydrogen is an **indirect greenhouse gas** which increases the atmospheric lifetime of methane. It's warming effects last only a few decades, meaning it has **historically been overlooked** by modelling which uses a Global Warming Potential of 100 years[1].
- Even at this timescale, a recent study for BEIS concluded that GWP of H_2 is **more than 100% than the previous consensus** (11 ± 5)[2]
- The **leakage rate** and **GWP timeframe** have a significant impact on the calculated climate benefits of green and blue H_2 usage[1,2]. **Leak minimisation** must be **priority** if H_2 adopted as major energy source[2]
- Current research base presents **varying views on likelihood and severity of hydrogen leakage**. For plastic pipes (expected across majority of GDN networks by 2030s), there is **consensus that hydrogen blends above 20% are more likely to permeate than natural gas**, but studies **differ on how severely**[3,4,5].
- Pipe connections, fittings, valves etc. **must be checked periodically** for hydrogen leak resistance[5]
- To **improve quantification** of hydrogen leakage rates, it has been recommended that technologies be developed that **accurately measure hydrogen emissions in-field at low detection thresholds** (down to ppb level)[1]

[1] Ocko & Hamburg, 2022; [2] Warwick et al., 2022; [3] CPUC; [4] HyDeploy; [5] Kneck & Iskov, 2021; [6] Detecting methane is sufficient in a blended scenario

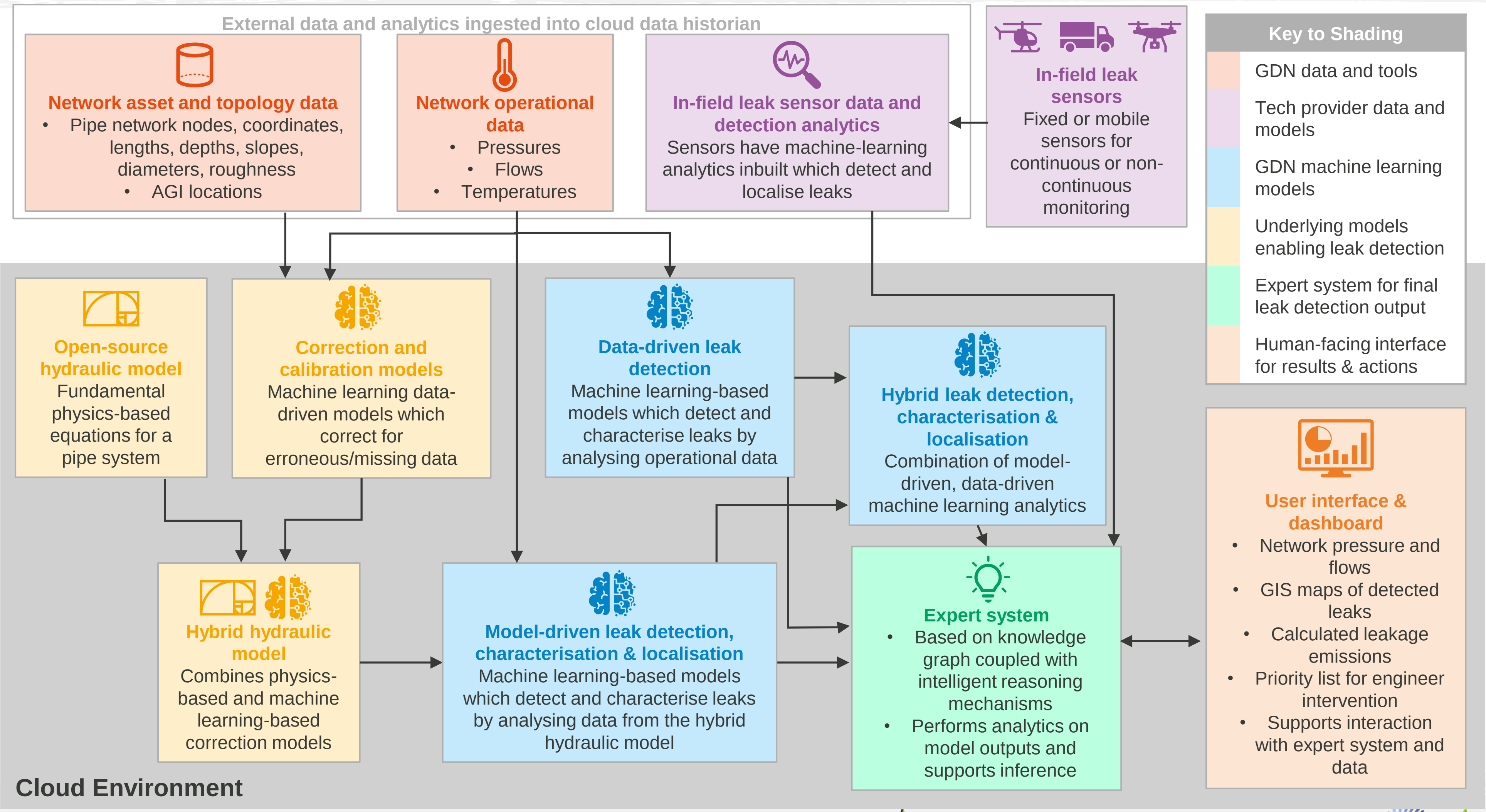
Limited current sensor technologies adapted to hydrogen detection. DPLA can be a catalyst for the recommended development of these capabilities

Tech type	Modes	Providers (on final shortlist)	Detection threshold	H_2 adaptability
OGI		TELEDYNE FLIR	0.0004 kg/hr	Yes (with tracer gas)
LIDAR		OGE	0.04-0.1 kg/hr	No
CEAS		PICARRO	0.0002-0.2 kg/hr	No
MPS		QUBE	0.1 kg/hr	No
TDLAS		sensors; PROJECT CANARY	0.001-0.1 kg/hr	No

- Of the technology types considered, **only OGI could currently be used to detect H_2 in 100% pipelines via a tracer gas[6]**
- However, *Sensors* suggested they would develop a H_2 compatible measurement device if market demand existed
- Therefore, DPLA should be **alive to advances** in hydrogen leak detection **in the event of H_2 blending and 100% H_2 scenarios**
- Beyond the sensor technologies, the **modelling elements** of DPLA (hybrid hydraulic and leak detection & localisation models) **can be adapted to operate for both blended and 100% H_2 scenarios**

DPLA can therefore be a leader in the deployment of in-field H_2 leakage quantification to enable issues to be identified at the outset of hydrogen network operation. This should be explored further in Beta

DPLA combines the innovation of novel sensing technologies, machine learning, and hydraulic modeling techniques



Beta Work Packages Overview

WP1 - Programme Management & Business Case

- Continued coordination of the project across work packages
- Proactive risk and issue management
- Ensure the management of project finances and the business case

WP2 - Models, Analytics & Data Development

- Prepare and develop all relevant data, build all the required models, and deploy necessary remote sensor technologies to enable DPLA functionality
- Build the expert system which enables analytics for GDNs, and prepare scale-up of platform for BaU rollout across GDNs

WP3 - Physical Sensor Trials & Deployment

- Select, trial and assess multiple in-field leak sensing technologies.

WP4 - IS System Architecture Design & Integration

- Collaboratively develop a solution architecture and data population approach
- Configure the architecture of the Data Lake
- Configure the tool to ensure that the IS System is fully integrated into Cadent's systems

WP5 - Business Change Management & BAU transition

- Prepare Cadent for BAU operational changes through the establishment of interim and to-be process maps identified through change impact assessments
- Development of a BAU Training Plan through the execution of a training needs analysis and curriculum.

WP6 - Regulatory Reporting, Policy, License, & Network Code Change

- Identify, refine, and enact the necessary changes required to regulatory reporting, policies, licenses and network codes to enable DPLA to be rolled out across all networks
- Ensure DPLA is considered within RIIO-3 business plans and regulatory assessment frameworks

WP7 - Internal and External Communications & Knowledge Dissemination

- Develop and undertake knowledge dissemination processes to ensure sharing of DPLA key learnings
- Knowledge sharing material and approaches to be tailored to external and internal audiences
- Briefings with stakeholder groups executed throughout.

WP8 - Open data, Interoperability, Emerging trends and Technologies

- Identification of technology and market trends to enhance the design of the DPLA solution
- Development and approval of an open framework to standardise data sharing, optimising the dissemination of knowledge

Business delivery team *IT delivery team* *Deep dive in the following slides*

Thank you

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