Picarro

Emissions Based Mains Replacement

Cadent Lane Rental Industry Publication

TRANSPORT FOR LONDON

Cadent operates and maintains the largest Gas Distribution Network (GDN) in the UK, with 20,000 kilometres located in North London. First introduced in the 1800s, manufactured gas has served London's population for many years, with some mains still in service.

Since 2002, a vast amount of work has been done to replace this ageing pipe network, which historically, has been planned based on a combination of factors, including customer reported gas leaks, traffic sensitivity and algorithms which calculate the remaining lifespan of the asset. This work is hugely important, as natural gas is mainly methane, a powerful greenhouse gas approximately 21 times more powerful than CO2. Identifying and stopping emission hotspots is vital in the gas industry's combined effort to reduce climate change.

Cadent is required to replace all the old cast iron gas mains up to 8 inches diameter, within 30m of properties by 2032, equating to approximately 330km of gas main each year across the GDN. The ability to select and target leakage across the GDN for mains replacement is therefore essential, while reducing the number of reactive works carried out on the road network.
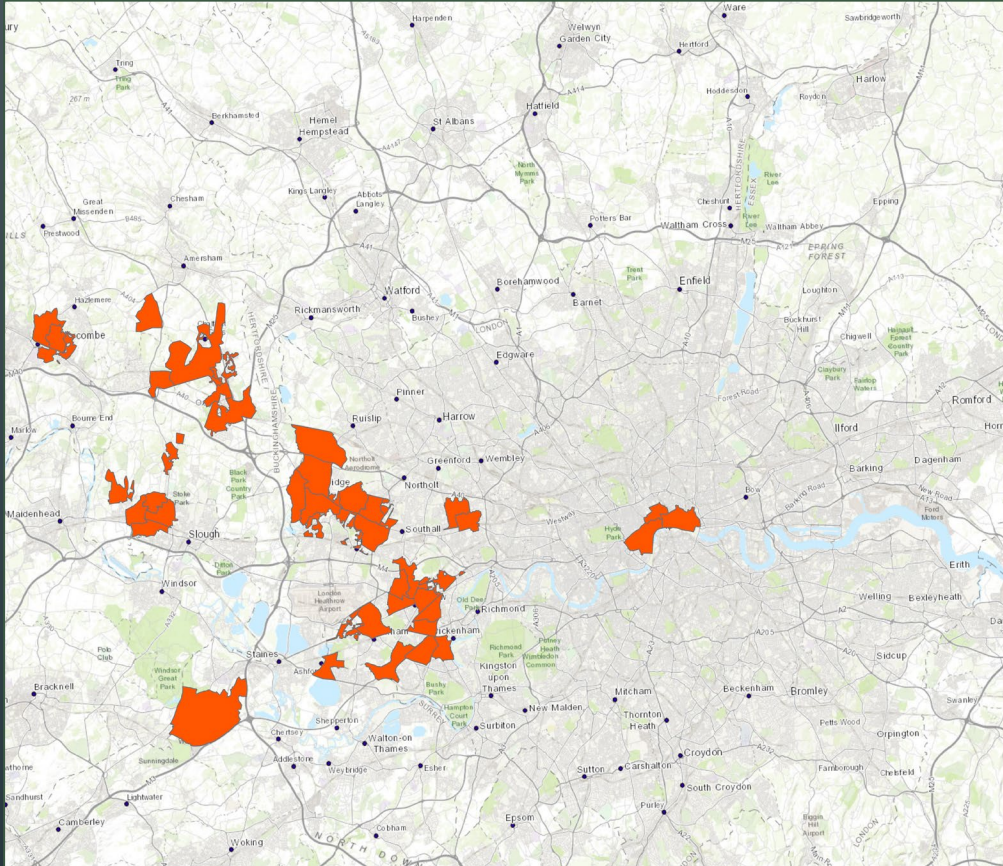
To improve on current practices, Cadent undertook a trial of the Picarro technology, highly sensitive atmosphere analysis equipment, which can be attached to a vehicle and collect gas readings, as low as 'parts per billion' in concentration, to better facilitate decision-making.

Introduction

The Trial

In accordance with the UK's commitment to reach net zero by 2050, GDNs use Ofgem's approved shrinkage and leakage model, to calculate methane estimates to track reduction. Shrinkage accounts for most of GDN's carbon footprint and makes up 1% of UK emissions. The majority of shrinkage is made up by leakage (95%).

Being able to measure emissions at asset level could target hotspots and create an opportunity to accelerate this reduction. Therefore, the trial had two drivers:

Reduce disruption from street works: Targeting replacement of mains with the greatest emissions would limit the number of reactive repairs, reduce disruption on London's road network

Reduce emissions: Having a more accurate picture of actual leakage on the network would enable a targeted approach to gas main replacement, again accelerating the reduction of greenhouse gas emissions, faster than existing methods.

Transport for London suggested a vehicle with zero emissions be utilised, so a hydrogen fuelled Hyundai Nexo was selected and modified to accommodate a gas analyser, GPS and wind speed sensor for data collection. Driven at night to avoid disruption to traffic, the vehicle navigated roads where the gas network lay beneath, providing a rich picture of leakage and the highest (below-ground) leak densities which could be prioritised for replacement.

The trial covered approx. 1,600km of the GDN, equating to 15% of the metallic network. The survey, data analysis and predicted outcomes took 8 months due to challenges with obtaining hydrogen fuel for the vehicle.

Outcomes

The data was compared to that from the shrinkage and leakage model, with the following outcomes:

- **Reduce disruption from street works**

Decreased disruption is expected in the medium to long term, although it was too early to measure the full magnitude. Italgas in Italy, uses the technology and have found a proactive approach reduces the number of reported gas escapes, seeing activity spread out across the year, rather than seasonally. Further investigations are required to quantify this.

- **Reduce emissions**

Having a more accurate picture of leakage would enable a faster reduction in greenhouse gas emissions. Based on analysis, significant savings on methane reduction could be realised as early as 2032 solely due to better sequencing of pipe replacement works.

A survey using this technology for the whole of the North London GDN, is now being investigated.
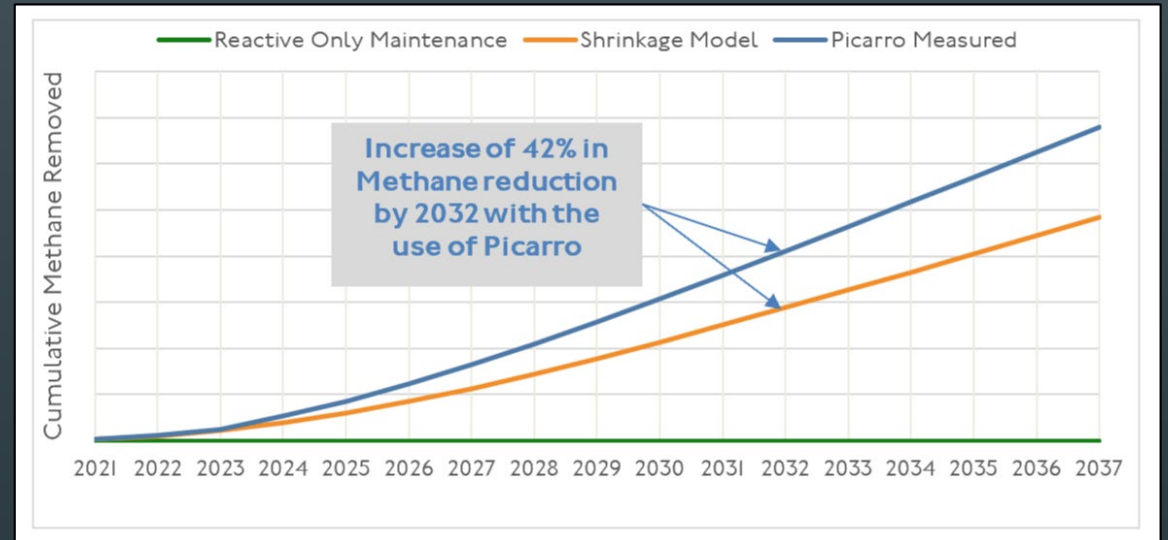
Graph showing potential reductions in Methane with the use of Picarro

Lessons Learnt

The learnings from this trial include the below:

1. Surveying emissions from pipes at asset/street level is possible

2. The largest risk to the delivery of surveys was the unavailability of Hydrogen as a fuel. The use of other zero emission vehicles would be considered to progress this technology instead, while the supply chain for Hydrogen develops.

3. Several other use case opportunities were identified and will be explored as part of next steps:

   • Survey North London's GDN network's metallic assets.

   • Target repairs in emission hot spots to reduce environmental damage and congestion.

   • Build a model to estimate risk associated with each emission found.

   • Improve quality in the repair process.

4. Using Picarro data to drive a significant change in how gas escapes are managed across the network

Conclusion

/Recommendations

The Emissions Based Mains Replacement project delivered its objectives, demonstrating that the re-prioritisation of Cadent's mains replacement programme in North London could yield a benefit of several million pounds per year and support the Mayor's ambitious net zero target. Based on this project, Cadent's intention is to expand the use of Picarro's technology in London. This will allow for the identification and repair of emissions hot spots which will help the environment and reduce disruption on road networks in the medium term. Furthermore, Cadent will re-prioritise and re-sequence their mains replacement programme to maximise the benefits of that investment for all of London's stakeholders.

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Scheme

Optimising customer journeys through the
delivery of safer, innovative and sustainable
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