

Leveraging digitalisation for fugitive emission detection, remediation

By: **Kiona Y. Meade** and **Gary W. Sams**, Schlumberger



Today's oil and gas industry faces a significant long-term challenge—continuously support society's current demand for energy produced from fossil fuels while simultaneously minimising the associated environmental impact. Both society and an increasingly environmentally conscious investment community are calling upon the industry to drive more sustainable operations, including a specific focus on minimising the carbon footprint associated with oil and gas operations. The implications of this call to action directly influence the industry's license to operate globally. Further compounding this challenge is the prevalent industry climate, defined by limited investment and a need to extract maximum value from existing assets.

Invariably, upstream, midstream, and downstream oil and gas operations release some Greenhouse Gas (GHG) emissions into the atmosphere. Methane, the main component of natural gas and a potent GHG, is the most common GHG associated with oil and gas operations¹. In comparison to carbon dioxide, methane is 86 times stronger in terms of global warming potential¹. Of total fossil methane emissions, the upstream, midstream

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and downstream oil and gas sectors² attribute 63 per cent. GHG emissions can be a result of vented or fugitive emissions. Vented emissions refer to intentional releases of gas into the atmosphere as part of normal operations. Fugitive emissions refer to unintentional gas releases resulting from leaks or malfunctioning or improperly maintained equipment. Collectively, the industry is committed to facing this challenge of reducing methane and other GHG emissions associated with oil and gas operations.

Directly addressing fugitive emissions via detection and remediation solutions provides a low-risk / high-yield opportunity to reduce environmental impact. Further, amidst an investment-limited climate, curbing fugitive emissions translates to ensuring more gas stays in the system, thus increasing profitability. While the industry is still adopting various fugitive emissions detectors and applying limited remediation strategies in recent years, to better address this challenge, the industry requires a myriad of innovative data-driven solutions that leverage the latest advances in digitalisation and digital enablement.



Figure 1: Thermal imaging used to identify GHG emissions at a production facility.

Data-driven approach

Current gas detection solutions are typically dependent upon fixed hardware and manual assessment to identify a leak. Recent developments are pointed and fragmented, covering facility screening (via satellite, airplane, etc.), component identification (such as drones), and permanent sensors (including cameras, point sensors, etc.). While useful in their own right, there is a significant opportunity to improve upon fugitive emission detection and remediation solutions for production networks and systems. Through dynamically integrated performance optimisation and emission control, these solutions will increase uptime and reduce OPEX.

Process Live* data-enriched performance service provides a fully integrated detection and remediation solution. It is specifically designed to help operators manage GHG emissions and optimise production networks' overall economic performance and process facilities from the point source to the enterprise level. The service employs



a data-driven approach to GHG emission management by leveraging a combination of intelligent Internet of Things (IIoT) hardware, edge computing, and cloud-based applications.

Process Live service provides continuous online monitoring data for asset integrity, inspection, diagnostics, and remediation. Data

acquired by IIoT-enabled field equipment, such as sensors or cameras, is streamed to a secure cloud-based data environment for real-time monitoring and control. Once data is ingested, actionable insights are derived utilising advanced machine learning and artificial intelligence applications, permitting



Figure 2: A plantwide, comprehensive emissions detection and analysis stems is integral to detecting and remediating fugitive emissions associated with oil and gas operations.

further action to be taken.

Additionally, the service can help reduce emissions, combining sensors and digital twins from single-point valve fugitive to plantwide comprehensive emission detection, systems, and analysis. Distributed and integrated IIoT sensors can detect various fugitive emissions from multiple sources, such as valves and storage tanks. Simultaneously, process modeling facilitates comprehensive emissions analysis, which enables rapid identification and mitigation processes. While helping to minimise methane emissions, the GHG management service option can also help manage emissions that can contribute to unplanned downtime, reduced profitability and environmental impact.

In addition to GHG management, the Process Live service further drives sustainability and profitability objectives by providing uptime assurance and prognostic health management. Through a combination of data science and original equipment manufacturer domain expertise, operators can derive operational insights related to equipment health. IIoT sensors can continuously monitor and predict critical valve health, potentially avoiding fugitive emission leaks. Once data acquired from the IIoT sensors is ingested in the data ecosystem, condition-based monitoring and prognostic health management algorithms provide actionable insights. The insights help operators limit environmental impact, reduce long-term costs by minimising expensive repairs

and replacements while improving profitability by ensuring high-value hydrocarbons remain in production, processing, transmission, and storage facilities. For example, the selection, installation, maintenance, and repair of low-emission valves ensures that the hardware meets evolving emission standards. The resulting online insights and alerts specific to valve integrity assist in planning maintenance, reducing downtime, and mitigating risks to people and the environment.

Securing the license to operate

When viewed holistically, a data-driven approach to fugitive gas detection and remediation provides an effective means to extract the most value from oil and gas operations while minimising environmental impact, thus helping to secure the industry's long-term license to operate. Through a combination of IIoT-enabled hardware, powerful edge computing, and secure cloud-based applications, operators can minimise fugitive emissions and optimise overall performance. Live monitoring and the ability to proactively identify equipment integrity and health via data-driven workflows enhance uptime performance. Integrated data- and physics-driven production models ensure overall process optimisation. Domain advisory insights for GHG management ensure that environmental impact is minimised.

***Mark of Schlumberger**

References:

1 Source: R B Jackson et al. 2020. Increasing anthropogenic methane emissions arise equally from agricultural and fossil fuel sources. *Environ. Res. Lett.* 15 071002. <https://iopscience.iop.org/article/10.1088/1748-9326/ab9ed2>

2 Source: M. Saunois et al., The Global Methane Budget 2000–2017. 2020. *Earth Syst. Sci. Data*, 12: 1561–1623, <https://doi.org/10.5194/essd-12-1561-2020>.