



Dr Neil Bird, Chief Scientist, Fluenta, UK, discusses how to transform pipeline emissions monitoring.

Methane is pivotal to today's environmental challenges. Whilst there's limited scope for direct intervention with CO₂, the management of methane is altogether more realistic – and in many instances can become cost-neutral. Mitigating the loss of methane and, especially the productive use of methane rather than venting, flaring or even leaking is low-hanging fruit for regulators and governments seeking to achieve ambitious targets.

Methane, as a greenhouse gas with a global warming potential over 80 times greater than carbon dioxide over a 20 year period, has become an urgent priority. For the pipeline sector, the focus has shifted from basic compliance to proactive emissions monitoring and reduction, driven by a mix of regulatory changes, technological advancements, and growing public scrutiny.

THE METHANE CHALLENGE



Emerging control technologies, such as Fluenta's FlareSens, and open source projects like MethaneSat and Carbon Mapper, are driving a new narrative. Together, they not only redefine how methane is monitored but also create an expectation for pipeline operators to play a leading role in the energy transition.

Why methane matters

Methane accounts for nearly a quarter of the global warming observed today. It is released into the atmosphere through flaring, venting, leaks, and incomplete combustion in flaring operations, including pipelines. The traditional assumption was that flaring would combust around 98% of methane in all circumstances; however, new research and advanced satellite imagery reveal that this 'combustion efficiency' is a significant overestimate. Methane 'slip' – unburnt methane escaping during flaring – is now recognised as a significant and underreported problem.

The urgency to address methane emissions is particularly acute for the pipeline industry. Pipelines serve as critical infrastructure for natural gas transportation, yet leaks and operational inefficiencies contribute heavily to fugitive methane emissions. In regions like North America, where pipeline networks are vast, regulatory bodies such as the EPA and Canada's Environment Ministry are policing stricter methane management with increasing efforts. Around the world, various government's commitments under the Paris Agreement, as well as those operators who are signatories to OGMP 2.0 are under a strict time-line to implement robust emissions reduction measures across all energy sectors.

Revolutionising methane monitoring

Fluenta's newly-released FlareSens technology is leading a new wave of products applying recent advances in technology and the understanding of combustion to the metrology of not just the flare gas itself, but analysis of the processes and transport of gasses generally.

Housed in a 19 in. rack mount unit designed for safe area installation, FlareSens combines accurate volumetric flow data, with dynamic gas composition data to provide continuous emissions monitoring. Calculations for net heating value of both methane and other combustible elements help improve combustion efficiency of the flaring, but also enable precise emissions analysis and reporting for flare gas systems.

FlareSens has the potential throughout the energy industry to go much further and provide accurate analysis of each individual component of the exhaust or flare gas which, when analysed alongside an understanding of what the predicted and expected component gas volumes and masses 'should be', can provide an early warning system for fugitive emissions at various process stages.

FlareSens seamlessly integrates with a new generation of measurement instrumentation, enabling more accurate, real-time 'in situ' measurements compared to relying solely on calculated emissions values. As satellite data becomes publicly available, the self-regulation facilitated by FlareSens is critical – not just for compliance with tightening regulations, but for eliminating the alarmist 'Delta' between measured and

calculated emissions, and thus maintaining a strong public reputation in an era of intense environmental accountability.

What truly sets FlareSens apart is its potential to transform methane from a costly and environmentally damaging byproduct into a manageable and controllable aspect of pipeline operations. Through the provision of granular, real-time emissions data, FlareSens empowers operators to proactively manage methane emissions, optimise their operations, and contribute meaningfully to global efforts to combat climate change. This innovative technology underscores Fluenta's role as a leader in emissions measurement and its dedication to advancing sustainability in the energy sector.

The role of satellites in the new era of accountability

In case you might think this is alarmist, or an over-reaction to a small problem, MethaneSat, a project spearheaded by the Environmental Defense Fund (EDF), and Carbon Mapper are just two high-profile examples of a whole raft of new satellites measuring methane emissions from space with unprecedented resolution. Of course, there are lots of perfectly natural sources of methane, but the harsh reality of zooming in on a flare stack and seeing it correlate exactly to the presence of high levels of methane is now not just a possibility – it's extremely real.

MethaneSat has already demonstrated its potential by identifying significant methane leaks and flaring inefficiencies worldwide. In some cases, they are publishing data showing four to five times the amount of measured methane compared with standard calculated values using assumed combustion efficiency. This transparency is set to reshape the industry, as independent verification of emissions data will place additional pressure on operators to adopt much more rigorous monitoring practices.

For pipeline companies, MethaneSat presents a dual reality – one that combines both significant challenges and exciting opportunities in the evolving landscape of methane emissions management.

On the challenging side, the ability to deliver high-resolution, publicly accessible data on methane emissions creates a new level of transparency. This means that emissions hotspots along pipeline networks, which may have previously gone unnoticed or underreported, will now be visible to regulators, environmental watchdogs, and the public. Such visibility places companies under increased scrutiny, exposing those who fail to adopt proactive measures to monitor and mitigate emissions. This heightened accountability could lead to reputational damage, regulatory penalties, and increased pressure from stakeholders demanding concrete environmental action.

However, for companies willing to embrace innovation and adopt advanced solutions, this also represents a transformative opportunity. The satellite's precise, independent data can serve as a valuable tool to validate on-the-ground emissions monitoring efforts, reinforcing a company's commitment to environmental stewardship. By demonstrating measurable progress in reducing methane emissions, operators can not only meet but exceed regulatory requirements, strengthening their position as leaders in sustainability. MethaneSat's global reach also offers the potential for companies to showcase their

emissions reduction efforts on an international stage, gaining recognition from industry peers, investors, and governments.

This dual role of challenge and opportunity underscores the need for pipeline operators to act decisively. MethaneSat's data will reshape the expectations placed on companies, making it clear that the era of unverifiable or outdated emissions reporting is over. Those who integrate technologies like FlareSens into their operations will not only mitigate risks but also seize the chance to differentiate themselves in a competitive and environmentally conscious market. In doing so, they can turn transparency into a strategic advantage, using MethaneSat's insights to build trust and drive positive environmental outcomes.

The integration of these creates a transformative synergy for pipeline operators seeking to address methane emissions with precision and accountability. Combining real-time, ground-based measurements with advanced satellite capabilities, operators gain a comprehensive, multi-dimensional view of their emissions profile, enabling a level of oversight previously unattainable. This integration empowers operators to monitor methane emissions continuously, detecting leaks or inefficiencies as they occur. With FlareSens, operators can act swiftly to reduce flaring inefficiencies and unintentional methane slip, ensuring that emissions are mitigated in real time and operations are optimised for both environmental and economic outcomes.

As regulatory landscapes evolve globally, operators equipped with these integrated technologies are better prepared to meet or exceed compliance requirements. Governments and industry

watchdogs are adopting a more data-driven approach to enforcement, and the availability of accurate, validated emissions data positions operators to stay ahead of the curve. This preparedness not only mitigates the risk of fines or penalties but also demonstrates a proactive commitment to environmental stewardship.

Methane reduction as an industry priority

The drive to reduce methane emissions is not just an environmental imperative; it is an economic and reputational necessity for the pipeline sector. With satellites shining a spotlight on emissions from space, the delta between measured and assumed methane emissions is extremely obvious. Technologies like Fluenta's FlareSens close that gap and provide a wealth of other information to improve both commercial and environmental outcomes. The tools to address this challenge are now readily available. What remains is the will to act.

As *World Pipelines* readers well know, the pipeline industry has always been at the forefront of innovation. Embracing these advanced methane measurement technologies can set a new standard for environmental stewardship, operational efficiency, and industry leadership.

Fluenta's expertise offers a clear pathway for operators to reduce methane emissions, protect the environment, and secure a sustainable future for the pipeline industry. The time to act is now. 