GAS IN TRANSITION

BY THE INTERNATIONAL GAS UNION IGU

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INNOVATION FOR THE FUTURE

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FEATURES

INNOVATION IN EMISSIONS MANAGEMENT

From the Secretary General

"One thing is clear: **energy security is national security."**

While one conflict lingers, we are hopeful for long-term peace following the signing of the agreement that ended the most recent conflict. The closure of the Strait of Hormuz has had wide-ranging implications, well beyond energy. But as energy, particularly hydrocarbons and their derivatives, continues to fuel the world more than it did 20 years ago, the focus during the conflict was, understandably, almost entirely on disrupting energy flows.

One thing is clear: energy security is national security.

The implications for the Gas industry from these recent conflicts could have been far more severe if it were not for our tremendous and continual focus on innovation. These innovations extend far beyond traditional research and development, encompassing advances in efficient resource extraction, delivery systems, environmental, contracting, societal and digital.

Gas, critical not only to global energy and national security but, also, to food security, medicines and so much more, is essential to human progress and global growth. The industry's ability to innovate across our entire Gas value chain shines through in this June edition of our magazine.

For over 45 years, IGU has provided a platform for the industry to showcase and share its innovations and research at the triennial International Gas Research Conference (IGRC). We look forward to presenting the 18th edition of this event in May 2027, in the beautiful city of Budapest, Hungary. The Call for Abstracts closes on 30 June 2026. There is still time to join and share your work on the innovation file.

Menelaos (Mel) Ydreos
Secretary General
International Gas Union

From the editorial team

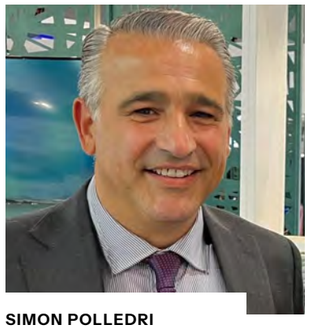
Behind every innovation in our industry there is a person; someone who **had an idea and dared to push the boundaries of "this cannot be done" or of "this wouldn't work".**

Innovation is a term that is intrinsic to the entire Gas value chain: from optimising natural gas extraction and processing, and all the way to commissioning Q-Max LNG tankers and identifying novel ways of monitoring methane emissions. Behind every innovation in our industry there is a person; someone who had an idea and dared to push the boundaries of "this cannot be done" or of "this wouldn't work". Innovation never happens in isolation, nor can it be expected if the investment to pilot it or take it to market is not there. Innovation needs regulatory support to take off and demonstrate its proof of concept. It also needs iteration to get it right.

This edition of our *Gas in Transition* magazine is dedicated to those who innovate, men and women across our global Gas industry, and organisations which constantly seek to challenge the possible. This edition is a tribute to them.

Ella Minty
Director, Communications
Senior Adviser to the Secretary General
International Gas Union

Events



SIMON POLLEDRI
Director, Flagship Events

IGRC2027 Call for Abstracts – Deadline Extended to June 30, 2026

Since its inception in 1980, the International Gas Research Conference (IGRC) has brought together the innovators, researchers, and industry leaders who are shaping the future of Gas. Born out of a global energy crisis, the first Conference (1980) helped drive the technical advances that made Gas more affordable, accessible and secure for communities around the world.

Today, our industry faces a new generation of challenges. As we work toward a low-emission future, we must balance energy security, affordability and environmental responsibility. Meeting these challenges will require fresh thinking, bold ideas and collaboration across technology, policy, regulation and commercial thinking.

Join the global Gas industry's brightest minds!

IGRC2027 is inviting technical abstracts from professionals, researchers, academics, innovators, regulators and start-ups who are helping to shape the future of energy. Whether your work focuses on breakthrough technologies, emissions reduction, digital transformation, policy innovation or emerging business models, your insights can help drive meaningful progress across the global Gas value chain.

Conference Themes

- New Age of Natural Gas and LNG
- Emissions Management, Carbon Capture and Gas Certification
- Renewable Gases
- Low Carbon Hydrogen
- AI and Digital Transformation
- Social, Regulatory and Policy Innovation

The IGRC2027 Call for Abstracts' extended deadline closes on June 30; details can be found at www.igrc2027.com

Be part of the conversation that will help deliver a cleaner, more secure and more affordable energy future.

MARCUS GURSKE
WGC2028 Conference Executive Director

WGC2028: Lead the Conversation. Build Connections. Shape the Future.

As we look ahead to the 30th World Gas Conference in London (WGC2028) in May 2028, I am reminded of the important role our industry plays in meeting the world's growing energy needs while navigating an increasingly complex and evolving landscape.

Around the world, governments, businesses, and communities are working to balance energy security, sustainability, affordability, and economic growth. Achieving this balance will require collaboration, innovation, and open dialogue across the Gas and energy value chain.

For decades, the World Gas Conference has provided a platform for meaningful dialogue between industry leaders, policymakers, technical experts, innovators, and investors. It is where ideas are exchanged, partnerships are formed, and conversations take place that help advance our industry.

WGC2028 represents the next chapter in that journey. As we prepare to gather in London May 15-18, 2028, we have a unique opportunity to bring together the organisations and individuals driving investment, technological development and progress across the global Gas and energy sectors.

What makes WGC unique is not only the quality of its conference programme, but also the connections it creates. The event provides a platform for businesses to engage with customers and partners, showcase new technologies, strengthen their market presence, exchange insights with industry peers, and contribute to the broader energy conversation. These interactions foster collaboration and create opportunities that extend well beyond the event itself.

I invite you to be part of WGC2028.
To explore sponsorship and exhibition opportunities, please contact exhibition@wgc2028.com.

INNOVATION IN EMISSIONS MANAGEMENT

From measurement to management: SOCAR's drive to cut methane emissions

SOCAR has moved from baseline measurement to a technology-driven management system, deploying satellites, drones and AI to bring fugitive methane under control across its upstream and midstream operations.

RICK GILL

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Methane emissions from oil and natural gas operations have become one of the most scrutinised dimensions of the industry's environmental performance – and for good reason. Methane is a potent greenhouse gas, and the upstream and midstream segments of the natural gas value chain are among its largest anthropogenic sources. For national oil companies operating legacy infrastructure in mature basins, the challenge of bringing those emissions under control is particularly acute. SOCAR has spent the past two years building the systems, partnerships, and measurement capabilities needed to meet that challenge head-on.

The company's methane reduction ambitions are anchored in a set of targets that are now among the most demanding in the national oil company peer group. At COP28 in late 2023, SOCAR signed the Oil & Gas Decarbonisation Charter (OGDC), co-founding the initiative alongside other major producers. Through the Charter, SOCAR aims to achieve near-zero upstream methane emissions – defined as below 0.2% methane intensity – by 2035, eliminating routine flaring across all its operational assets by 2030 and reaching net zero by 2050.

In 2024, SOCAR further reinforced those efforts by joining the Oil and Gas Methane Partnership 2.0 (OGMP 2.0), the UN Environment Programme's flagship framework for measurement-based, site-level methane reporting. In 2025, SOCAR submitted its first OGMP 2.0-aligned report, made possible in large part by a new AI-driven data platform called Methane AI, built in partnership with the Boston Consulting Group.

Building the baseline

Any credible methane management programme must begin with accurate measurement, and SOCAR has placed significant emphasis on building that foundation. The company operates a portfolio of assets that spans decades of development, including onshore fields, offshore platforms in the Caspian Sea, and a midstream local natural gas distribution network managed through its Azerigaz Production Union. Establishing a consistent, verifiable emissions baseline across such a varied asset base is technically and logistically demanding.

A notable early demonstration of this challenge – and of SOCAR's willingness to confront it – came with a large-scale Leak Detection and Repair (LDAR) project carried out at Oil Rocks, its historic offshore production unit in the Caspian Sea. Within the projects, up to 296,800 tonnes of CO_2-equivalent emissions were reduced.

Simultaneously, SOCAR has worked to improve the precision of its airborne measurement capabilities. Through cooperation with TotalEnergies, the company has deployed AUSEA – the Airborne Ultralight Spectrometer for Environmental Applications – at SOCAR-operated facilities. The technology, developed by TotalEnergies in partnership with France's National Centre for Scientific Research (CNRS) and the University of Reims Champagne-Ardenne, consists of a miniaturised dual sensor mounted on a drone that can detect and quantify methane and CO_2 emissions while simultaneously identifying the precise source of each leak. Its accuracy – capable of detecting emissions above 1 kg/hour – makes it one of the most precise tools currently available for industrial methane monitoring. Initial campaigns using AUSEA have been conducted across TotalEnergies-operated areas in the Caspian, with subsequent campaigns targeting SOCAR's own offshore assets.

> A distinctive feature of SOCAR's approach is its emphasis on **diffusing methane abatement capabilities beyond its own operations.**

In parallel, SOCAR has conducted a satellite imagery campaign under the framework of the Oil and Gas Climate Initiative (OGCI), targeting the identification of super-emitters – individual sources responsible for a disproportionate share of total emissions – that may not be readily visible through conventional ground-level monitoring. The initial campaign has been completed, with further collaboration under consideration. Its primary value has been as a top-down screening layer: where potential emission signals were identified, they were reviewed internally and followed up by the relevant asset teams. SOCAR treats satellite data as a detection and prioritisation tool rather than a standalone reporting basis, integrating its insights into the wider methane management system to strengthen source identification and support mitigation planning. These space-based observations, combined with ground-level instrumental measurements and drone surveys, are →

"Innovative technologies are transforming how we detect, measure, and abate methane emissions. At SOCAR, we are leveraging satellite data, advanced on-the-ground monitoring, and AI-driven platforms – such as Methane AI, developed in collaboration with BCG X – **to build a comprehensive methane management system that enhances transparency, improves efficiency, and delivers tangible emissions reductions."**

- SOCAR

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progressively being integrated into a single, unified picture of SOCAR's methane profile.

The Methane AI platform

Measurement at scale generates data at scale, and the challenge of processing and acting on that data has driven SOCAR toward a new digital infrastructure. Variations in measurement techniques, formats and reporting cycles across different assets were creating bottlenecks in analysis, delaying the identification of emissions trends and making it difficult to establish a consistent, organisation-wide baseline.

The response was the Methane AI platform, developed by SOCAR in collaboration with BCG X – the technology development unit of the Boston Consulting Group – and built within the frameworks of Caspian AI Institute. The platform serves as a centralised hub, consolidating data from multiple detection sources including ground measurements, bottom-up measurement campaigns, and aerial observations from satellites and drones. It enables the visualisation, tracking and analysis of emissions across SOCAR's upstream portfolio, and provides automated quantification engines to support the company's internal reporting processes and its annual OGMP 2.0 submissions.

Operators using the platform have access to heatmaps that identify critical leak points across an asset, while dashboards and abatement curves help teams prioritise interventions and allocate resources efficiently. The system also automates data ingestion and flags inconsistencies, enabling emissions reconciliation and faster decision-making in the field. The platform was expanded to midstream facilities in 2024, extending its reach from upstream production to the natural gas distribution network managed by Azerigaz.

The platform's most tangible organisational impact to date has been on data transparency and reporting. In 2025, SOCAR used Methane AI to prepare and submit its first OGMP 2.0-aligned report in full accordance with international standards – a milestone that would have been operationally unfeasible without a centralised system capable of ingesting and reconciling the diversity of data streams that feed into such a submission. The platform has also strengthened internal visibility of emission sources across assets, with verified emissions data and abatement performance disclosed through SOCAR's annual Sustainability Report, which is publicly available on SOCAR's website. Quantified findings from the platform are incorporated into that reporting cycle as they are validated, reflecting SOCAR's commitment to measurement-based disclosure rather than estimates.

Midstream: Reforming the Gas distribution network

While much of the attention in methane abatement focuses on upstream production, SOCAR's midstream natural gas distribution operations have also been the subject of significant reform. Azerigaz, the business unit responsible for Azerbaijan's domestic natural gas distribution network, has moved to the adoption of international best practices and launched several infrastructure modernisation and operational excellence initiatives, developing more than 20 digital products and processes targeting everything from metering upgrades to digital network management systems.

The commitment to midstream improvement has been further reinforced by a cooperation agreement with IntelliGrid – a joint venture of Esyasoft Holding and Presight from the UAE – signed at COP29 in November 2024 followed by execution of the contract in July 2025. The project, valued at $480mn, aims to implement an AI-driven smart Gas network management system across the Azerigaz distribution network, with an explicit focus on reducing Gas losses – including leaks – through advanced monitoring and control systems, while also enhancing overall customer experience.

Partnerships and knowledge transfer

A distinctive feature of SOCAR's approach is its emphasis on diffusing methane abatement capabilities beyond its own operations. The company's Advanced Global Methane Reduction (AGMR) project, conducted jointly with BP, has brought together SOCAR, BP, and a range of smaller Azerbaijani upstream operators to share knowledge and best practices in methane management. The project has offered smaller operators direct exposure to leak detection and repair techniques in a working industrial environment, as well as conferences at SOCAR's Eco-Park that have engaged international organisations and technology providers on topics ranging from satellite-based monitoring to the adoption of green technologies.

Additionally, SOCAR, together with Boston Consulting Group, launched the Caspian Methane Emissions Accelerator as a regional platform aimed at advancing methane emissions reduction efforts across the Caspian region through coordinated industry action. The initiative focuses on strengthening cooperation among regional operators, developing credible methane emissions baselines through standardised measurement approaches, supporting the deployment of methane abatement solutions and LDAR programmes, and promoting knowledge exchange and capacity building. KazMunayGas and Uzbekneftegaz are currently participating in the initiative, which is expected to expand further through the involvement of additional regional and international energy companies.

The road ahead

While SOCAR's methane management journey is still in its early stages, the company has made substantial progress in building the measurement infrastructure and digital systems needed to understand and manage its emissions. Translating that foundation into sustained, measurable reductions across a complex and ageing asset portfolio will require continued investment and operational discipline.

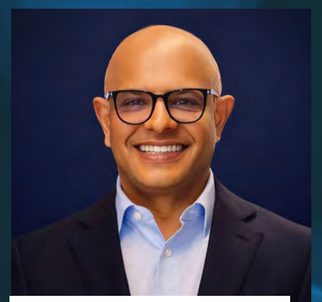
The Methane AI platform represents the most significant organisational step taken to date – a system that brings together satellite data, drone surveys and ground measurements into a single operational picture, enabling faster identification of leak sources and more targeted abatement action. When combined with the ongoing LDAR campaigns at upstream facilities, the large-scale pipeline rehabilitation programme at Azerigaz, and the knowledge-sharing infrastructure built through the AGMR initiative, it constitutes a materially more sophisticated approach to methane management than existed at SOCAR even two years ago.

Whether that progress will be sufficient to meet the ambition of near-zero upstream methane intensity by 2035 remains to be seen. Achieving that target will require SOCAR to extend the reach of its abatement programmes to assets that are still in earlier stages of measurement and baseline characterisation, to maintain the pace of midstream network improvement. The challenges are real, but so is the institutional commitment now behind the effort. ●

Strategic Capital: How venture investors are scaling Gas innovations

Accessing venture capital at various stages of their development is helping companies commercialise and scale up their innovative technology.

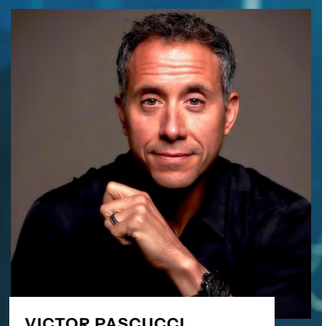
TOM YOUNG



ZAYED ALAMRI
Executive Managing Director, Aramco Ventures

GREG DOUGLAS
Programme Leader, CVC Programme, Williams

JOHN ADAMS
CEO, NGIF Capital



VICTOR PASCUCCI
Managing General Partner, Energy Capital Ventures

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> "At NGIF Capital, we look at capital as a full ecosystem. That means providing **capital, customer access, operational validation, regulatory alignment and helping companies secure government support alongside private funding."**
>
> - JOHN ADAMS, CEO, NGIF CAPITAL

Successfully financing startups in the natural gas ecosystem requires more than capital alone, with many investors now adopting a highly strategic approach.

The sector is asset-heavy, strictly regulated, and inherently risk-averse, meaning traditional venture capital (VC) models often struggle to bridge the gap between prototypes and industrial deployment.

As a VC firm backed by a single long-term capital provider, Aramco Ventures – the corporate venture capital (CVC) arm of Aramco – is able to invest with a longer time horizon than many traditional venture capital funds, as well as provide founders with access to a sophisticated operating environment.

"We view our role as extending beyond that of a financial investor," Zayed Alamri, Executive Managing Director of Aramco Ventures' Strategic Venturing Programme, tells *Gas in Transition (GiT)*. "We aim to be a long-term strategic partner, enabling founders to accelerate technology development, validate technology use cases, and unlock pathways to global scale through access to capital, expertise, and deployment opportunities."

The scale and operational footprint of Aramco Ventures parent company provides founders with a unique platform for testing and scaling technologies across a number of different applications.

Aramco Ventures operates four venturing programmes with differing mandates. The Strategic Venturing Program invests globally in startups and high-growth companies developing technology of strategic importance to Aramco, with a deployment mandate across its operations. The Diversified Venturing Program (Prosperity7) invests in startups for financial returns and diversification. The Domestic Venturing Program (Wa'ed Ventures) invests in local and regional startups to support innovation and economic diversification in Saudi Arabia, while also backing global companies with opportunities to localise operations in the Kingdom and the Late-Stage Venturing Program invests in mature technology companies to support scale-up and global deployment.

Like Aramco Ventures' Strategic Venturing Program, US energy infrastructure company Williams' CVC Program focuses on investing in firms that align with the priorities of its parent company.

"While financial returns matter, the primary objective is long-term strategic value for Williams as an energy infrastructure company," Programme Leader Greg Douglas says. "We're investing because we believe a company can solve a real operational need."

Williams' widespread US operations give founders practical insight into how technologies need to function in the field, as well as the chance to carry out pilot projects.

Williams also provides direct access to subject matter experts across the company – including engineers, operators and safety specialists – who can help startups refine products based on real-world operational concerns.

Hybrid models

However, direct corporate backing isn't the only way for startups to gain access to these critical testing spaces – other investment structures can offer similar opportunities.

NGIF Capital operates a hybrid model which falls between the CVC arm of an energy company and a traditional VC fund. NGIF has a number of limited partners (LPs) – companies that provide access to commercial infrastructure as well as capital for its fund.

This gives founders access to validated data, pilot partners and commercialisation pathways for their products, NGIF Capital CEO John Adams tells *GiT*.

"At NGIF Capital, we look at capital as a full ecosystem," he says. "That means providing capital, customer access, operational validation, regulatory alignment and helping companies secure government support alongside private funding."

LPs become the first customers for the startups that the fund invests in, and the data generated from →

pilots and demonstrations helps those companies win additional clients across the broader energy sector. Some of NGIF's LPs are also active internationally, creating pathways for startups into US and European markets.

Energy Capital Ventures takes a similar strategic approach, operating in collaboration with corporate partners, according to its Managing General Partner Victor Pascucci.

"Success depends on collaborating with existing utilities and industry participants, integrating into current infrastructure and aligning with market realities," he tells *GiT*. "Our strong corporate partnerships help us identify solutions that work within the system and can be adopted at scale."

ECV also focuses on a particular technology area, broadly defined as 'green molecules', which gives it a much more targeted remit than most VC funds.

"By focusing on a specific thesis and excluding everything else, we believe we can better attract, identify, select, and support the right companies to build strong enterprise value and generational, game-changing companies," Pascucci says.

ECV will invest in just 9-10 companies per fund – significantly less than many other players in the VC space.

Shoulder to the wheel

These real-world operating environments – either those of CVC parent companies or VC LPs – give startups the opportunity to understand operational realities, deployment standards, safety cultures, and realistic implementation timelines.

These factors are key to success, as the established nature of the natural gas sector means that profitable innovation is harder to achieve than in more nascent sectors of the economy.

Much innovation in the sector happens through optimisation, integration, and digital enablement – rather than building entirely new systems from scratch, according to Williams' Douglas.

"Because safety and reliability are absolutely critical, the bar for deployment is extremely high," he says. "You can't simply deploy an unproven technology into field operations and hope it works."

Major energy companies can also move at a slower pace than firms in other sectors, and procurement timelines often have several layers of approval. That means technologies need to be safe, validated, bankable and operationally proven before adoption.

"The technologies that ultimately scale are the ones that solve real operational problems and can be deployed practically within the realities of the energy system," Adams says.

For Energy Capital Ventures and its focus on green molecules, a key evaluation metric is a startup's subsidy independence. Subsidies can improve margins, reduce capital intensity and accelerate adoption – but they should not be essential to a company's success, according to Pascucci.

"If a business only works because of a specific regulation or subsidy, that's not a risk we're willing to take," he says. "Our view is that successful investing in the Gas sector requires a fanatical focus on customer financial benefit. End customer value defines ultimate enterprise value."

Growth areas

While subsidies should not underpin any startup's financial model, government regulation – particularly around the energy evolution – represents one important factor guiding where funds are being allocated.

Emissions measurement and reduction technologies were mentioned as a growth area by a number of funds.

"That growth is being driven both by regulation and by operators prioritising emission reduction in their practices," Adams says.

He also references hydrogen, renewable natural gas (RNG) and modular CCS (carbon capture and storage) solutions as areas that remain attractive to investors.

Other areas of growth are next-generation gas-powered generation technologies to meet growing demand for AI data centres, as well as AI solution for the industry itself, according to Williams' Douglas.

"Energy infrastructure companies already generate enormous amounts of operational data," he says. "We're increasingly looking at how AI can combine and analyse those data streams to generate insights, improve efficiency, identify patterns, and support decision-making".

Aramco Ventures is also interested in this area. The platform has invested in SEEQ, a developer of AI-powered data analytics software designed to transform complex datasets into clear insights. The technology has been deployed across Aramco operations, allowing engineering teams to predict equipment failures, monitor emissions, and optimise production in real time, unlocking significant value.

"It has significantly reduced manual engineering time, improved operational efficiency, and driven measurable cost savings and efficiency gains across our parent company," Alamri says.

Aramco Ventures also recently announced that it is opening an office in Paris to expand its footprint in Europe, a region it believes is of growing importance as a global hub for innovation.

"France is an important innovation hub in Europe, combining world-class technical talent, leading research institutions, and a growing ecosystem across artificial intelligence, quantum computing, advanced digital infrastructure, and industrial innovation," he says.

Recipe for success

While industry expertise, operational testing, and innovative technology matter, a startup's ultimate success hinges on having a razor-sharp focus on the problem it is trying to solve.

Companies that succeed in getting their product to market tend to be those that have a deep understanding of this, according to Williams' Douglas.

"At the end of the day, customers want to know: if they spend money on your technology, what do they get back? More efficiency? Lower costs? More revenue? Better safety outcomes? You need to articulate that clearly," he says.

A common issue amongst new entrants is an over-emphasis on the value of the technology rather than the value to the customer.

"Founders often spend too much time describing the technology itself without clearly explaining the operational issues they are solving," Adams says.

Entrepreneurs also need to understand the VC business model, and avoid either approaching the wrong type of fund, or offering too little ownership of their company. It also helps to have an understanding of the long-term nature of the VC business model.

"We know we're going to be together for at least 10 years. And it will be harder than everyone thinks, and the amount of work we'll need to put in in order to get to a favourable outcome is extraordinary. Success requires long-term commitment and an understanding of the journey," Pascucci says. "It takes exceptional grit, intelligence, and determination to succeed."

The strongest founders tend to be those that treat their relationship with VC funders as a collaborative problem-solving exercise.

"They understand that scaling successful technologies requires building solutions together with the customer," Douglas says.

All of the VC funds emphasised the team within the startup as the one key element that is needed in order for the partnership to be successful.

At the stage where funds typically invest, startups are often transitioning from research teams into business operatives. This requires new competencies – including manufacturing, cost reduction, hiring, operations and commercial execution. Founders need to be able to adapt to this new reality.

"What we look for are founders who either have those capabilities or are self-aware enough to bring in the people they need. That willingness to evolve is critical," Douglas says. ●

Latin America

Luz Stella Murgas
President, Naturgas
Colombia

Innovation, Biogas and Energy Security: Latin America's next energy opportunity

As the global energy sector navigates an increasingly complex landscape marked by geopolitical uncertainty, growing electricity demand, and the urgent need to reduce emissions, Latin America and the Caribbean find themselves in a unique position.

The region possesses extraordinary natural resources, one of the cleanest electricity matrices in the world, vast agricultural potential, and a growing commitment to innovation. These advantages create an opportunity not only to strengthen energy security but also to accelerate the development of low-emission energy solutions that can drive economic growth and social progress.

Among those opportunities, biogas and biomethane stand out as some of the most promising and underutilised resources in the region.

For decades, natural gas has played a fundamental role in supporting economic development, expanding access to affordable energy, and improving environmental performance across Latin America. Today, the industry is entering a new phase – one in which innovation is enabling the integration of renewable and low-carbon gases into existing energy systems while leveraging the infrastructure, technical expertise, and market frameworks already developed around natural gas.

Biogas is a clear example of this transformation.

Produced from agricultural residues, livestock waste, wastewater treatment plants, municipal solid waste, and agro-industrial by-products, biogas converts environmental liabilities into valuable energy resources. When upgraded to biomethane, it becomes fully interchangeable with conventional natural gas and can be injected directly into existing Gas networks, transported through pipelines, or used in industrial, residential, power generation, and mobility applications.

Brazil and Colombia taking the lead

This represents a powerful opportunity for Latin America, a region with one of the largest agricultural sectors in the world.

Brazil has emerged as one of the leading examples. The country's vast agribusiness sector, particularly its sugarcane, livestock, and agricultural production chains, provides exceptional feedstock availability for biogas and biomethane projects. Over the last several years, Brazil has developed an increasingly robust ecosystem of producers, distributors, technology providers, and regulatory initiatives that position biomethane as a strategic component of its energy transition.

The development of biomethane in Brazil is particularly significant because it demonstrates how decarbonisation and competitiveness can advance together. By transforming agricultural waste into renewable gas, the country is simultaneously reducing methane emissions, creating new revenue streams for rural communities, strengthening domestic energy supply, and lowering the carbon footprint of hard-to-abate sectors.

Colombia is also making important progress.

The country has begun to build a regulatory framework that supports the injection of biomethane into natural gas networks and has seen growing interest from companies seeking to develop projects based on agricultural, livestock, urban, and industrial waste streams. Colombia's experience is especially relevant because it highlights the potential of renewable gases to complement existing natural gas infrastructure while contributing to circular economy objectives.

Regional trends

These examples reflect a broader regional trend.

Across Latin America and the Caribbean, governments and industry leaders increasingly recognise that achieving climate goals will require a diversified approach. Renewable electricity will continue to expand rapidly, but the decarbonisation of industrial processes, heavy transportation, and certain thermal applications will require additional solutions.

Renewable gases can help fill that gap.

At the same time, they contribute to another strategic priority that has gained renewed importance in recent years: energy security.

Across Latin America and the Caribbean, governments and industry leaders **increasingly recognise that achieving climate goals will require a diversified approach.**

The energy crises experienced across different regions of the world have demonstrated that affordability, reliability, and resilience remain essential pillars of sustainable energy systems. Countries need energy sources that can support economic activity, respond to fluctuations in demand, and reduce dependence on external supply disruptions.

This is where the natural gas industry is making an important contribution.

Across Latin America, companies are investing not only in expanding energy access and strengthening infrastructure but also in reducing methane emissions, improving operational efficiency, deploying carbon reduction technologies, and integrating renewable gases into their portfolios.

Innovation is crucial

The industry increasingly understands that its long-term success depends on its ability to innovate and evolve.

Innovation is no longer limited to exploration and production technologies. It now encompasses digitalisation, emissions monitoring, carbon management solutions, renewable gas development, hydrogen integration, and new business models capable of delivering cleaner and more flexible energy systems.

The recently launched report, Opportunities for Natural Gas Development in Latin America and the Caribbean, prepared by the International Gas Union (IGU), ARPEL, and OLADE, highlights that the region has a unique opportunity to combine its abundant natural gas resources with emerging low-emission gas solutions. Rather than viewing energy security and decarbonisation as competing objectives, Latin America can advance both simultaneously through pragmatic and technology-neutral policies.

The future energy system will not be built through a single solution.

It will require innovation, investment, infrastructure, and cooperation. It will require recognising the value of all technologies capable of reducing emissions while ensuring reliable and affordable energy for citizens and industries.

Biogas and biomethane are part of that future.

And Latin America has all the conditions necessary to become a global leader in their development.

The challenge now is to move from potential to implementation.

If governments, regulators, financial institutions, and industry stakeholders work together, renewable gases can become a powerful driver of sustainable development, emissions reduction, rural prosperity, and regional energy security for decades to come.

The opportunity is already here. The next step is to scale it. ●

GAS IN TRANSITION.JUNE 2026

A corporate venture capital perspective from Equinor Ventures

The Northern Lights receiving terminal
Source: Torstein Lund Eik © Equinor

The role of corporate venture capital in the energy transition.

KATHERINE PEACHEY
Head of Equinor Ventures

Financing innovation is a critical enabler of the energy transition. Many of the technologies required to decarbonise energy systems and develop new value chains are still emerging, and often require significant time, capital and industrial collaboration to reach commercial scale. In this context, corporate venture capital plays a distinct and complementary role alongside traditional financial investors.

Equinor Ventures, the corporate venture capital arm of Equinor, invests in early- and growth-stage companies developing technologies and business models relevant to the future energy system. Its objective is to generate both financial returns over time and strategic value for Equinor. This dual mandate shapes how innovation is financed – balancing commercial discipline with long-term industrial relevance.

Venture investments provide an efficient way to explore new opportunities in uncertain and rapidly evolving markets. By taking minority positions in a portfolio of companies, Equinor Ventures can build insight into emerging technologies, test potential new value chains, and create optionality for future business development. This approach enables exposure to innovation without requiring early full-scale commitments, while supporting the development of solutions that may complement or extend existing value chains.

Investment supports collaboration

As an industrial investor, the role extends beyond providing capital. Portfolio companies may benefit from access to technical expertise, commercial collaboration and real-world applications. This is particularly relevant in energy-related sectors, where technologies often need to be validated at scale before becoming commercially viable.

The contribution of corporate venture capital is especially visible when looking at how new value chains are financed and developed. One example is digital infrastructure supporting Gas markets. Through its investment in the French company Attributes, Equinor Ventures has gained exposure to a platform that enables traceability and documentation of energy products, including natural gas. The platform allows buyers to access verifiable data on the origin and greenhouse gas footprint of Gas deliveries through so-called "sustainability qualities." This type of solution is increasingly relevant as customers demand greater transparency and documentation of emissions. It also supports commercial arrangements where such data is integrated into Gas sales agreements, strengthening the link between digital innovation and core business activities.

Supporting carbon capture

Another example is Inherit Carbon Solutions, a Norwegian startup working within carbon management. The company facilitates the capture and transport of biogenic CO_2 from urban sources, such as wastewater treatment in Oslo, for permanent storage through Northern Lights. This illustrates how venture investments can help establish new value chains by connecting capture, transport and storage infrastructure. For industrial emitters and municipalities, such solutions can enable access to carbon storage even when direct links to large-scale infrastructure are not available.

These types of investments highlight how financing innovation is not only about supporting individual technologies, but also about enabling system-level developments. Carbon management, digital traceability and emerging energy materials are all areas where innovation requires coordination across value chains, along with capital and industrial engagement.

Managing risk

Financing innovation in these sectors also requires an understanding of the inherent risk profile of venture investing. The transition from a promising technology to commercially viable operations is often long and complex, particularly in capital-intensive industries. Venture portfolios are therefore built on the expectation that outcomes will vary widely between individual investments.

Historically, a substantial share of venture investments do not deliver positive financial returns, with overall performance driven by a smaller number of successful companies. This underscores the importance of diversification and a long-term perspective when allocating capital to innovation. At the same time, financial performance remains a core objective. For Equinor Ventures, historical returns on realised investments have exceeded 8%, with expectations of stronger returns as the current portfolio matures.

Historically, a substantial share of venture investments do not deliver positive financial returns, with overall performance driven by a smaller number of successful companies. **This underscores the importance of diversification and a long-term perspective when allocating capital to innovation.**

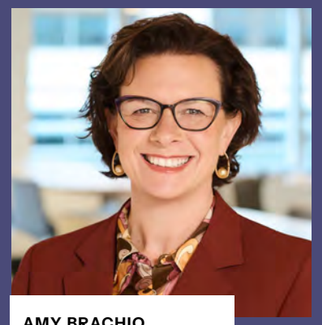
However, financial return is only part of the overall value creation. Venture investments can provide early access to technologies, strengthen competencies, and support the development of new business areas. This strategic value is particularly important in the context of the energy transition, where timing, partnerships and technological insight can be critical success factors.

Looking ahead, the need for effective financing mechanisms for innovation is expected to increase. Delivering the solutions required for a lower-carbon energy system will depend on continued collaboration between startups, financial investors and industrial players. Corporate venture capital can play an important role in this landscape – not only by providing funding, but by enabling the connections and pathways needed to take innovation from concept to commercial scale.

You can read more about Equinor Ventures at Equinor Ventures - Equinor ●

The case for investment-grade carbon data in the energy sector

In conversation with *Gas in Transition*, Amy Brachio, CEO of Carbon Measures, says Carbon Measures is building the framework to make carbon intensity a fourth dimension of market competition, unlocking new opportunities for innovation, differentiation, and emissions reduction at scale. For the oil and Gas sector, the opportunity to shape and benefit from this transition is particularly significant.



AMY BRACHIO
CEO, Carbon Measures

GAS IN TRANSITION.JUNE 2026

What is Carbon Measures, why was it founded, and what problem is it trying to solve?

Despite the good work already underway, emissions continue to rise. Carbon Measures was founded because we need a fundamental shift that turns reducing carbon emissions into a competitive advantage. The key to changing the emissions curve is unlocking demand for lower-carbon products, aligning market incentives to the actions we need to take to address climate change. To unlock that demand, markets need reliable data and effective policy measures.

Markets depend on investment-grade data, yet companies currently lack a consistent way to differentiate the carbon intensity of their products across markets and supply chains, even as many are investing significantly in lower-carbon production and operational improvements. At the same time, governments often lack the robust and comparable data needed to underpin policies.

That's why Carbon Measures is pursuing a dual-track agenda: developing a product-level carbon accounting framework that can function across companies, jurisdictions, and global value chains, while also encouraging governments to establish standards for the carbon intensity of certain products that drive the majority of global emissions.

The goal is to provide governments, companies, and buyers with the data needed to compare products, make informed decisions, and drive durable market demand for lower-carbon products. In turn, the data could support policies that establish product-level carbon intensity.

Many of the largest heavy-industry companies are members of Carbon Measures, including ADNOC, Air Liquide, EQT Corporation, ExxonMobil, TotalEnergies, and others. What is the business rationale for these players to be involved? Are only heavy industries welcome in your coalition?

Our focus starts with 10 product categories, including electricity, fuels, steel, and cement, that together account for approximately 70% of global energy-related emissions, and sit at the start of nearly every supply chain. To meet the goal of reducing emissions at the scale and pace required, it's crucial that the companies producing those products are part of the solution.

Our members recognise that global markets are increasingly focused on emissions performance, but it remains difficult to compare products →

consistently on carbon intensity across supply chains and jurisdictions. In addition, many are making significant investments in lower-carbon production, operational improvements, and new technologies, but are not seeing the clear market signals or consistent frameworks that allow those efforts to be differentiated and rewarded at scale.

That is precisely why these companies are at the table. They recognise their role in scaling emissions reductions, and they are actively working to ensure the investments they are making in lower-carbon production translate into real market signals, both for their own businesses and for the broader ecosystem. We need market participation, so the final solutions work in the real world and are broadly adopted.

At the end of the day, this is not about one sector. It is about building a practical framework that can support more informed decisions by producers, buyers, investors, and policymakers alike. All are welcome as part of Carbon Measures as we look to drive systemic change.

Carbon Measures often emphasises "investment-grade" product-level carbon emissions data. What does that mean in practice, and why is it important for industry and policymakers?

"Investment-grade" means data that is accurate, verifiable, and comparable enough to support real-world decision making across markets and companies, and can withstand legal scrutiny. Today, procurement, contracting, infrastructure, financing, and policy decisions are increasingly tied to emissions performance, but the underlying data is often difficult to compare consistently at the product level. S&P Global Commodity Insights recently emphasised that if markets are going to incorporate carbon emissions into real business decisions, participants need greater confidence around the quality of the underlying data itself.

In many ways, we think product-level carbon accounting should function more like financial accounting: markets need confidence that information is being measured consistently and can be used credibly across supply chains and transactions. Simply put, you need to be able to confidently compare one product to another and have the values flow across the value chain in a rational way.

For policymakers, increased comparability in product-level data will support more durable and workable policies. For industry, it helps create clearer demand signals that allow companies to differentiate products and investments based on emissions performance. Ultimately, the goal is to make carbon accounting more useful for real-world decisions across the economy.

Methane has become an increasingly important issue for the oil and Gas sector, both from a policy and market perspective, particularly as buyers and regulators place greater emphasis on operational emissions and transparency. How do you see methane fitting into the broader conversation around competitiveness, credibility, and low-emission energy systems?

Methane is one of the clearest examples of how operational performance can influence the carbon intensity of energy products. As buyers, investors, and policymakers place greater focus on emissions performance, there is increasing interest in understanding not just what product is being produced, but how it is being produced.

That has important implications for competitiveness and credibility across the oil and Gas sector. Companies investing in methane monitoring, mitigation, and operational improvements want those efforts to be visible and reflected in the marketplace. More comparable product-level emissions data can help support that differentiation more credibly and consistently.

More broadly, if the industry is to continue meeting growing global energy demand while reducing emissions, transparency and comparability around operational emissions will become increasingly important. Methane is one critical part of that broader evolution.

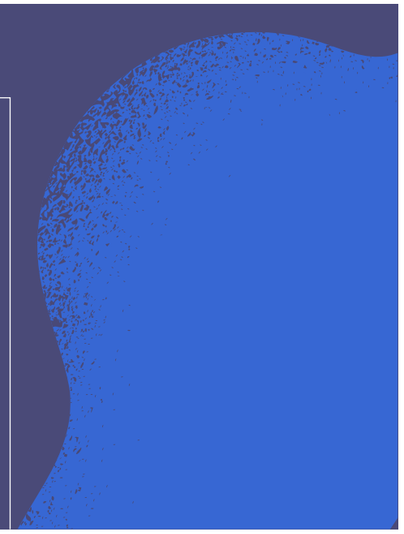
Many energy companies operate across multiple reporting systems, standards, and jurisdictions globally. Is your goal to replace these systems?

No, and I think that's a very important point. We believe our approach is complementary to what already exists.

Existing frameworks have played an essential role in advancing climate entity disclosure, evaluating risk, and defining how emissions are calculated and reported. We're trying to solve for a different need: producing investment-grade, product-level data that can function consistently across global value chains and transactions.

Our view is product-level accounting systems can be interoperable and support a variety of reporting formats and policy applications. We have also taken steps to ensure transparency across efforts so that

At the end of the day, this is not about one sector. **It is about building a practical framework that can support more informed decisions by producers, buyers, investors, and policymakers alike.**



we can put interoperability front and centre. For example, we recently received approval for our liaison status with ISO so that we will have visibility into the work being done by ISO/GHGP on the product-level standards.

There is growing discussion globally around carbon-intensity standards and product-level requirements in sectors like fuels and energy products, particularly as buyers and policymakers place greater emphasis on emissions performance. Why are you advocating for them, and what role do you think those kinds of product-level standards and market signals could play in driving emissions reductions?

Reporting alone won't change outcomes. Existing systems have helped advance transparency and disclosure, but markets also need durable demand signals and mechanisms that connect emissions reductions to real economic incentives. Buyers and policymakers increasingly want to differentiate products by carbon intensity, but that only works if the underlying data is accurate, verifiable, and comparable. A recent issue brief from Resources for the Future reinforces this point, examining the current challenges with accounting for carbon pricing across jurisdictions and demonstrating the growing need for interoperable and comparable product-level emissions data that functions seamlessly across global value chains.

This further highlights the overarching issue: today, products transact and compete on the basis of price, quality, and speed to market. We believe there should be a fourth dimension of competition: emissions performance. That's where product-level carbon intensity standards can play an important role. These would be government-mandated standards that apply equally across producers selling into a market, creating a level playing field that allows companies to compete on carbon intensity while giving them clearer incentives to invest in lower-carbon production and operational improvements.

We've seen this work before: IMO 2020 reduced sulfur emissions in marine and motor fuels, and the Montreal Protocol phased out ozone-depleting chemicals. We believe product-level intensity standards can do the same for reducing carbon emissions.

Looking ahead, what are the next milestones for Carbon Measures, and what do you think will determine whether markets for lower-carbon products succeed over the next decade?

We're still in the early stages, but our work is moving quickly. Since launch, we've increased our membership by more than 37%. We continue to grow intentionally, ensuring our coalition reflects the full breadth of industries and geographies needed to make this framework work in real-world supply chains. Our Technical Expert Panel, which we co-convened with the International Chamber of Commerce, is now actively developing the carbon accounting framework that will anchor our work going forward. We've also begun deepening our engagement with policymakers around the role product-level carbon intensity standards will play in driving emissions reductions. We're excited to continue making progress and share more about our work in the months ahead. ●

GAS IN TRANSITION.JUNE 2026

Accelerating innovation through collaboration

These are defining times for the role of Gas in the global economy.

DUNCAN ROBINSON
VP Commercialisation, GTI Energy

Across markets and regions, energy systems are being tested by rising demand, geopolitical pressure, and price volatility, while expectations for reliability, affordability, and resilience continue to grow. Energy is not only essential to economic stability but increasingly central to digital infrastructure, industrial competitiveness, and quality of life.

At the same time, the pathway forward is becoming more complex. Regulatory frameworks are evolving, investment conditions are shifting, and long-term planning must now account for greater uncertainty. Meanwhile, global energy demand continues to expand, driven by digital transformation and rising living standards across emerging economies.

This is not a temporary challenge. It represents a structural shift in how energy systems must operate. Meeting this demand will require both new infrastructure and more efficient, integrated use of existing assets across the global Gas value chain.

Against this backdrop, a fundamental question emerges: how can the industry accelerate progress while managing increasing levels of risk, complexity, and interdependence?

Why collaboration matters more than ever

The answer increasingly lies in collaboration, but not in a generic sense. The role of collaboration in energy innovation is more nuanced than it is often presented, particularly within the global Gas value chain.

Innovation is frequently framed around breakthrough ideas: new technologies, new processes, and entirely new solutions. These breakthroughs are essential, and there will always be a place for true invention. By its nature, invention is often a more focused and competitive pursuit – driven within organisations or small teams where differentiation, speed, and intellectual property play a defining role.

Applying and scaling innovation across Gas-based energy systems demands visibility across technologies, coordination across stakeholders, and a shared understanding of how different components interact. **No single organisation typically holds all of that perspective.**

But invention alone does not transform energy systems.

Across the global Gas system, many of the most impactful outcomes come from how ideas are applied, adapted, and extended: what might be described as “step-out” applications. A concept proven in one domain can unlock entirely new value when deployed in another. Technologies that are mature in isolation can deliver significantly greater impact when applied in combination or at scale.

These advances are not secondary to invention – they are equally important. And they require a different model to succeed.

Applying and scaling innovation across Gas-based energy systems demands visibility across technologies, coordination across stakeholders, and a shared understanding of how different components interact. No single organisation typically holds all of that perspective.

At the same time, organisations operate within incentive structures that prioritise differentiation, intellectual property protection, and speed to market. These forces are essential – they drive performance, investment, and growth. But they can also make early-stage collaboration more complex, particularly when value lies not in a single proprietary solution, but in how multiple capabilities are brought together to solve system-level challenges.

Structured, pre-competitive collaboration helps bridge that gap. It creates an environment where participants can explore how ideas can be applied, test how technologies perform in new contexts, and build a more complete understanding of how systems behave in practice. In doing so, it reduces duplication, accelerates learning, and improves both technical and commercial decision-making.

As solutions mature, the role of competition becomes more pronounced. Organisations differentiate, optimise, and scale what works. Both invention and competition remain critical throughout this phase. But their effectiveness is often shaped by the quality of collaboration that came before it, particularly in enabling ideas to move beyond concept and into integrated, operational systems.

The challenge for the industry is not choosing between invention, collaboration, or competition. It is ensuring that each is applied at the right time. When that balance is achieved, both breakthrough ideas and practical applications can advance more efficiently, delivering meaningful impact across the global Gas value chain.

A platform for system-level progress

This is where GTI Energy plays a distinct role across the Gas ecosystem.

For decades, GTI Energy has developed and operated collaborative platforms designed to bring together utilities, operators, technology developers, policymakers, researchers, and other stakeholders in structured, neutral environments. These platforms are specifically designed to address the phase of innovation where collaboration is most valuable but least likely to occur organically.

In these environments, participants work together to test technologies, validate operational approaches, share data, and exchange insights across organisational boundaries. By doing so, they reduce duplication, manage risk more effectively, and improve the speed and quality of innovation outcomes.

Today, these platforms support work across many of the most pressing priorities facing Gas-based energy systems. These include methane measurement and emissions transparency, hydrogen deployment, infrastructure optimization, workforce readiness, and the integration of lower-emission energy pathways.

Examples include Veritas and the Open Hydrogen Initiative, which are advancing science-based approaches to emissions measurement and reporting, and GTI’s RAISE, (Reliable Affordable Infrastructure for Secure Energy), which is examining how existing infrastructure can evolve to support future energy systems. GTI Energy also administers long-standing, utility-directed collaborative R&D programs such as UTD (Utilization Technology Development) and OTD (Operations Technology Development), which bring industry participants together around shared priorities across the natural →

The existing network of pipelines, storage facilities, and transmission systems represents **decades of investment and remains a critical foundation for future energy systems.**

gas and LNG value chain.

The value of these collaborative environments becomes particularly clear when considering two defining realities for the future of Gas-based energy systems: the continued importance of infrastructure and the increasing need for credible, consistent emissions measurement.

Enabling the evolution of Gas-based energy systems

Across global energy systems, gaseous fuels will continue to play a central role in delivering reliable and affordable energy. The existing network of pipelines, storage facilities, and transmission systems represents decades of investment and remains a critical foundation for future energy systems.

The question is not whether these assets will continue to play a role, but how they will evolve. Integrating new fuels, improving system interoperability, and maximising asset utilisation all require coordination across the global Gas value chain. RAISE was developed to help address these questions, bringing together expertise to examine the technical, commercial, and strategic pathways required to modernise infrastructure at scale while maintaining operational reliability.

At the same time, as Gas-based energy systems become more complex, transparency and trust become increasingly important. Methane emissions remain a critical focus area, but meaningful progress depends on more than commitments. It requires credible data, consistent methodologies, and the ability to compare performance across organisations and regions.

Through Veritas, industry participants are working collaboratively to establish and deploy science-based protocols for methane measurement that improve consistency and transparency. These efforts strengthen confidence in emissions data and help translate measurements into actionable insights, supporting both operational improvements and informed decision-making.

In both cases, the underlying principle is the same: certain system-level challenges cannot be addressed effectively through competition alone. They require shared frameworks, aligned methodologies, and collective action.

Moving forward together

Energy has always been a foundation for economic and social progress. From industrialisation to electrification to digital transformation, it has enabled growth, connectivity, and opportunity.

Today, the global energy system is entering a new phase, one defined by greater complexity, higher expectations, and accelerating technological change. Meeting these challenges will require more than innovation in isolation. It will require coordination across the global Gas value chain, where knowledge is shared, efforts are aligned, and solutions are developed with the broader system in mind.

At GTI Energy, we play a role in enabling that coordination, providing the platforms, the data, and the partnerships needed to translate innovation into practical, scalable impact.

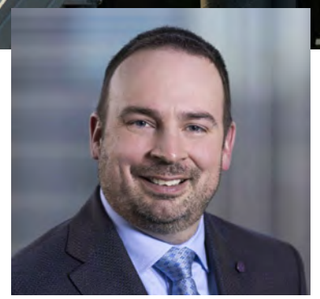
Because while competition will always drive performance, it is collaboration – applied at the right time and in the right way – that enables the system-level progress the energy transition demands.

And in an increasingly interconnected world, that progress will not be built alone. ●

Tourmaline partners with SMEs and others on methane mitigation technologies

Canada's largest natural gas producer has taken a leading role in monitoring, measuring and mitigating methane emissions across the Gas value chain

MONTE STEWART



SCOTT VOLK
Director of Emissions and Innovation, Tourmaline

Canadian energy producer Tourmaline is playing a leading role in developing new technologies that help detect and reduce methane at natural gas production sites, helping reduce emissions locally, nationally and globally.

The efforts not only benefit Calgary-based Tourmaline, but the global energy sector as a whole and other industries. The company is collaborating with partners that include small-and-medium-sized enterprises (SMEs) on both sides of the Canada-US border, the University of Calgary, and the Alberta and Canadian governments. Tourmaline has invested in the technologies directly and indirectly through government and academic programs while also supporting testing efforts at the Emissions Testing Centre (ETC) near Edson, Alberta, and in the field. The efforts have helped the SMEs market technologies that Tourmaline helped them commercialise to customers in various countries. In return, the producer has earned global recognition for its methane-mitigation efforts.

In a notable hometown partnership, Tourmaline works closely with Calgary-based Qube on the development of the SME's methane-detection technology, now in commercial use in the oil and natural gas, biogas, landfill and mining sectors. Tourmaline has helped Qube grow from the SME's earliest days of being based in a small downtown Calgary office to the point where it is now "one of the known continuous-monitoring companies," Scott Volk, Tourmaline's director of emissions and innovation, tells *Gas in Transition (GiT).*

In a cross-border venture, Tourmaline has helped US-based Bridger Photonics develop and upgrade its technologies, expand the business and serve international customers.

Tourmaline uses both Qube and Bridger technologies and services in the field to help detect, pinpoint and repair methane leaks in real time.

With Qube, the producer uses newer and older versions of the SME's sensors to reduce the duration of a methane leak.

"Qube sensors are running continuously in order to be like a smoke detector or smoke alarm that tells you if you have a leak or something that you're not aware of," Volk says.

The Qube technology is powered through solar energy.

"So, you don't have to be invasive and wired into the system," says Volk. "It's monitoring the environment and, the wind brings methane to the sensor, it's measuring essentially whether there's [methane] at that sensor."

Tourmaline uses the original, larger version of the sensor at the fence line and a smaller, newer and more cost-effective versions near natural gas production equipment.

"[The newer versions] have an electrical classification that allows you to put them closer to the tanks and sources of methane," Volk says. "Between the combination of the old sensors and the new sensors, you get a better total picture of what's going on."

Qube's detection system includes a software platform. Each sensor has "essentially a telephone" that communicates back to the software platform.

"And then inside that software platform, [the system] is using the wind direction and the methane concentration in order to predict both the plume-like source, where the emission came from, and what the rate of methane is at that source.

"It uses a solid-oxide sensor right inside the machine. But really the crux of it is, it's measuring the methane in the environment and the wind direction in order to tell you where you might have a leak."

Leading certification acceptance

Tourmaline's long-term partnerships with Qube and Bridger helped the producer become the first company in the world to have its integrated natural gas production system certified under MiQ's methane-emission standard. Tourmaline earned a Grade A rating for methane performance.

With Qube and Bridger's help, Tourmaline tabulated the certifiable methane-performance results at the ETC facility in Edson with GHD Limited providing independent verification of their authenticity. Announcing the certification, MiQ said the certification covers 1.6bn ft^3/day of MiQ Grade A natural gas and incorporates a "unique combination" of methane monitoring technologies designed to ensure robust, independently verified measurement across large-scale operations – even in challenging Canadian winter conditions.

As Canada's largest natural gas producer, Tourmaline has also set a new benchmark for low-emission Gas production and positioned the company as a first mover when buyers, regulators and investors demand transparent evidence of methane performance alongside "ongoing regulatory developments."

"Tourmaline's achievement represents a significant milestone for methane performance in the Canadian natural gas sector," MiQ CEO Georges Tijbosch said in a news release. "By certifying an integrated natural-gas production system, Tourmaline is demonstrating the level of transparency and accountability that global Gas markets are increasingly demanding, underlying the growing importance of independently verified methane-performance data for international buyers."

The MiQ certification covers all of Tourmaline's production in the BC portion of the Montney natural gas play within the Western Canadian Sedimentary Basin.

"About 21% of all of BC's [natural gas] production is verified via our certification," Volk says.

That equates to about 9% of Canada's total natural gas production and 19% of the country's total natural gas exports, he adds.

"So, it's a very large volume of natural gas, at least for Canada. It's about just over half of [Tourmaline's] total natural gas production."

To achieve the certification, Tourmaline had to demonstrate multiple ways in which the company detects and repairs methane leaks, Volk notes.

"You have to do bottom-up analysis and then top-down analysis," he says. "You do bottom-up in order to know your numbers; you do top-down in order to have a second verification of where your quantification is."

GHD is a global firm whose North American headquarters are located in Waterloo, Ont. The service provider completes validations and verifications in accordance with ISO 14064-Part 3 for programs under ANAB oversight, and other programs and registries that follow the ISO 14064-Part 3 standard or other standards.

The company's Greenhouse Gas Assurances Services (GGAS) Group is in charge of projects conducted under ISO 14064-Part 3.

"They have to verify that we're actually doing all the different things to this reasonable assurance standard, which is a much higher standard than most verifications," Volk says.

Most independent verifications are based on a limited-assurance model, he adds.

As part of the certification process, Tourmaline also deployed Bridger to detect and locate fugitive →

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Emissions Testing Centre at Tourmaline's West Wolf Lake natural gas plant.
Source: Tourmaline

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methane emissions. Bridger was spun out of Montana State University in Bozeman, Montana, where the company is based, by three graduate students in 2006. Tourmaline has invested in Bridger and utilises the company's aerial-mapping service.

"Bridger [technology] is [placed] on an aircraft," Volk says. "It's a reasonably small aircraft, like a Cessna, that flies pretty low. And then it runs a laser.

"[Bridger's technology] is called Gas Mapping LiDAR. As it's flying over, it is like a laser that's moving around in a circle, and then it bounces down off the ground and rebounds up. And as it does that, that laser is sensitive to methane.

"So, that laser will be blocked by the methane that's in the air. So then, as it flies over top of the site, it can essentially map the scene. You've probably heard of LiDAR being used in order to see trees and ground. This is the same thing, except the laser's tuned to methane.

"So, it knows exactly in space where the methane's at, and it knows exactly what the concentration of methane is. And then it gives us a map of what the methane concentration is across our sites. [Bridger] will fly it in one time, and then they'll fly it in a second time. And then with the combination of those two flights, it'll essentially make a triangle that goes right to the source of the methane. So, they'll be able to get a concentration map of the plume. And with the two different flight times, you're actually able to see where exactly it came from.

"Their ability to measure the amount of methane that's in the air is just incredible."

Tourmaline deploys Bridger's service at all of its natural gas facilities once per year, in spring when drier weather offers optimal results. In the past, Bridger's technology has been quite sensitive to snow, distorting results, Volk notes. But the company has upgraded it to the point where it can detect leaks even if snow is on the ground.

Real-world technology validation

Tourmaline quantified its MiQ rating while working with Qube and Bridger at the ETC, located at the firm's West Wolf Lake natural gas plant near Edson. Both Qube and Bridger tested their products when they were at their early stage at the ETC, and the two SMEs' methane-detection technologies continue to evolve through further research, development and testing at the ETC and West Wolf Lake. For example, Qube tests its devices in a live setting at West Wolf Lake.

"Nobody ever leaves Edson," Volk says, referring to the ETC. "They've both been there for a large part of our journey. We've done controlled releases with Bridger where we're helping them test to validate so that it works in the snow. We've [also] done some work with Bridger to help them test and validate their ability to measure hot methane and exhaust and things like that. So, we've done lots of work there [with Bridger.] And then we've been working with Qube through all their different product offerings over the years."

Tourmaline, the Canadian government, through its Natural Gas Innovation and Green Innovation funds, and the University of Calgary operate the ETC as a consortium.

"We offer a free service where these companies will come and test and validate their technologies," Volk says. "Tourmaline operates the full field portion of that.

"That involves our central location at West Wolf. We have a controlled release site that we have just a little bit from West Wolf that our entire Alberta operations will use for testing things like well site facilities or other facilities or drilling and completions. And then we have a mobile lab trailer that we can move around that can be used for testing and validation of methane slip.

"The University of Calgary offers some lab space."

The ETC opened in 2021. To get the facility up and running, funds were provided by federal and provincial agencies and programmes, including the Natural Gas Innovation Fund (NGIF), National Research Council, PrairiesCan, and Alberta Innovates.

Today, the Alberta government fully funds the ETC, providing CAD15mn (US$10.8mn) over five years, while Tourmaline covers the cost of running the testing facility.

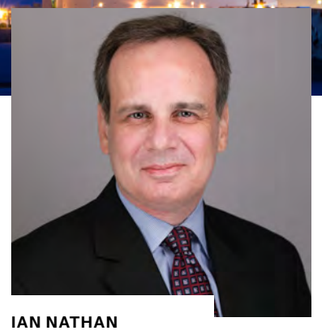
"Really, all those [Tourmaline] dollars go to testing and validating the methane technologies," Volk says.

Meanwhile, NGIF helps fund the ETC users' projects and technologies through grants and equity investments, often enabling companies to leverage other funding programs. NGIF is largely funded through industry contributors, including Tourmaline.

In addition to working with Qube and Bridger at the ETC, Tourmaline has collaborated there with all of Canada's major energy firms, along with several other organisations. Over the years, Tourmaline has tested and validated approximately 120 clean technologies at the ETC, Volk says, adding he expects that total to keep increasing. ●

Innovative Capital: Speeding LNG to market

Increasing volatility in global LNG markets and uncertainty about future demand has led to innovative new financing models for many world-scale projects.



IAN NATHAN
Gas and LNG Research,
Energy Intelligence

Over the past decade and a half, growing challenges for both LNG buyers and sellers have illuminated the peril of industry cyclicality. This volatility focused the industry's attention to financing's critical role in moving projects from concept to delivery. What started as a necessity but has evolved into a strategic choice, the broad shift away from restrictive project finance debt has proven to be a vital development catalyst at a time when supply is urgent and speed is essential. Greater use of equity to fund project development, positioning the US at the epicentre of the financing revolution, may be the pivotal financing innovation that sustains the LNG trade's longevity.

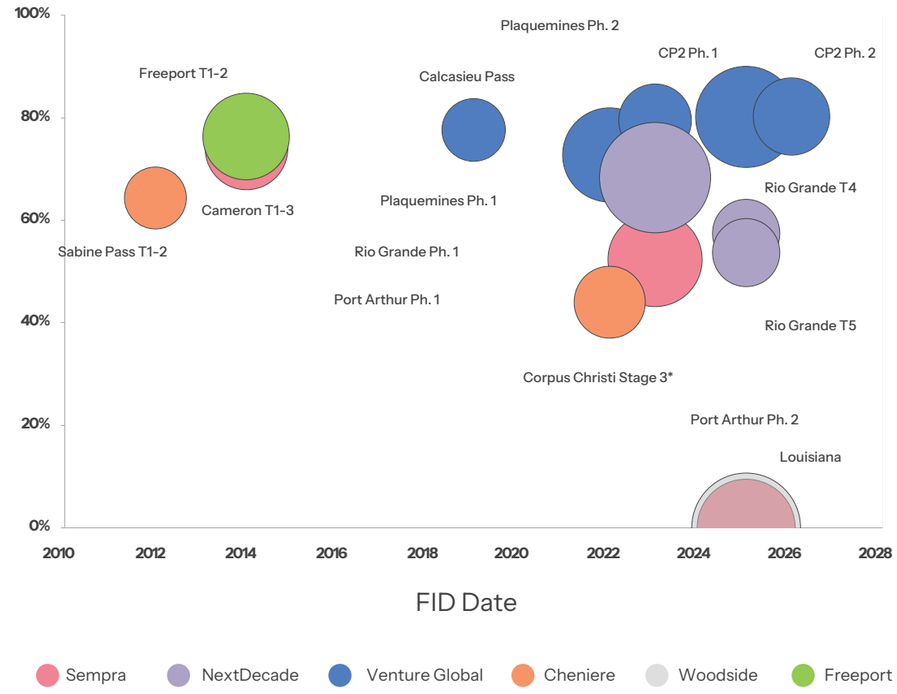
Changing industry erodes traditional LNG development financing

Evolving LNG buyer appetite in the 2010s challenged traditional liquefaction development. Mid-decade price misalignment and late-decade oversupply, combined with a surge in market flexibility and liquidity, revealed more attractive supply options. Liberalisation, shifting demand requirements, and severe market cycles drove increased buyer-seller tension in the traditional long-term contracting model. It exposed the peril of developer reliance on long-term supply agreements to support non-recourse project finance debt to finance projects.

The 2020s only amplified LNG market deficiencies and drawbacks in the model. Supply challenges re-emerged, catalysed by post-pandemic recovery against a dearth of new liquefaction – a lingering effect of the previous decade's market downturn. Rapidly rising costs ensured an increasingly complicated development environment. Moreover, declining Russian natural gas to Europe, a Gas supply crisis sparked by Russia's invasion of Ukraine, and this year's Mideast Gulf disruption reinforced how LNG development needed to move faster.

Speed became critical in a race to lock in costs, generate supply, and secure market share. However,

US LNG: Select Projects' Non-Recourse Project Debt Share of Capital Stack (%)



*Corpus Christi Stage 3 non-recourse project debt reflected at FID but drawn later. Bubble size = estimated capital stack.
Source: Energy Intelligence Gas and LNG Research, companies, banks, regulatory filings, law firms

the traditional requirement to spend years marketing a project's capacity to creditworthy offtakers to satisfy lenders undermined that speed. Instead, massive Chinese and portfolio player supply commitments provided much of the needed commercial backing, driven by increasingly prominent energy security and portfolio strategies.

Market developments eroded lender appetite for risk as well, to the point where sale and purchase agreements alone were no longer enough to secure financing. Traditional frameworks yielded to growing lender discomfort about market volatility, buyer exposure, reticence about contract sanctity, climate pressures, supply chain bottlenecks, and cost inflation. All signs pointed to developers' need to commit more of their own capital. This tension, balancing supply competition, inflationary pressures, and lender demands for higher liquefaction fees, lengthened pre-FID timelines already plagued by confidence-eroding regulatory, legal and market headwinds.

The LNG trade has plenty of experience with construction delays and cost escalation. But expansions, along with modular technology advancements (including floating liquefaction), are bright spots for de-risking projects and supporting faster post-FID project execution. Lower overall risk favorably alters a project's capital stack, making it easier to secure needed financing and shortening the road from project announcement to FID.

Shifting Model

Greater financing agility is a critical path to faster project execution. For most developers, this means relying on less external non-recourse debt and better use of other options – particularly equity. The timing of lender pullback, necessity of alternative financing, and the urgent need for speed aligned perfectly.

In the earlier days of this shift, a higher equity share was necessary to keep project development from stalling. But in a supply-constrained environment, capital stack diversification became a vital strategic tool to accelerate projects that are still highly likely to suffer from outside delays. Even when the market sees an outlook for abundance, speed remains essential for success in an increasingly competitive landscape. Either way, faster project execution softens the sharp edges of market cyclicality, helping →

to keep prices in check.

Early, first-wave US ventures followed a more traditional financing playbook. This era was characterised by classic project finance, backed by several development banks and export credit agencies, along with baseline equity investments. Cheniere Energy, which led the Lower 48 LNG boom, demonstrated the evolution away from this model. It relied on traditional project finance for its early ventures and increasingly turned to its own balance sheet for subsequent train developments, funding equity in part through its own cash flow.

Equity investment, particularly through external strategic capital, emerged as a potent force after the pandemic. Developer necessity and widespread exuberance about LNG's future, which was reflected in tight market conditions and sky-high prices, drove this uptick. Circumventing overreliance on restrictive non-recourse project finance debt unlocked cascading benefits that accelerated the timeline to FID, even if at greater upfront cost.

Greater reliance on balance-sheet financing (using a mix of internal equity and debt facilities) gives developers more control, even if it carries greater sponsor risk. Capital injections from strategic partners further de-risk the project by supporting lender confidence in what becomes a smaller debt package – while providing greater operational flexibility, including the ability to offer shorter supply agreements. This equity-heavy model, featuring major infrastructure and sovereign wealth funds including KKR, Blackstone, Stonepeak, Adia and Mubadala, anchored several key post-pandemic FIDs. Even more recent pairings combining strategic equity with offtake commitments add still more de-risking benefit, with partners like ConocoPhillips, TotalEnergies, and Adnoc leading the way.

Sempra is among the more visible practitioners of the post-pandemic equity boost to accelerate project development. Port Arthur Phase 1 reached FID only four months after its first SPA, propelled by both sponsor- and project-level equity investments, alongside strategic partner ConocoPhillips' significant offtake commitment. Equity, paired with an additional Conoco offtake agreement, similarly boosted Phase 2. This allowed the project to proceed without non-recourse project debt. Similarly, Woodside Energy's acquisition of Tellurian rescued an advanced but languishing venture. Woodside accelerated the timeline from buyout to strategic 40% farm-out to FID to around six months, even with most of its 16.5 mn metric tons (mt)/year uncommitted.

NextDecade's Rio Grande development also highlighted the benefits of a stronger equity position, but in a slightly different way. The company still needed heavyweight strategic investors (and a tight global market) to push its massive project finance debt across the finish line – despite securing long-term supply agreements for around 92% of its Phase 1 capacity. Trains 4 and 5 required smaller project finance packages. Venture Global's initial Calcasieu Pass project followed a similar financing path before the company opted for a much different route for its subsequent ventures.

Venture Global is the exception that proves the rule. Competitors embraced equity to reduce non-recourse debt, but this company leaned into the traditional model. For Plaquemines, the company utilised its own equity upfront to accelerate project construction before officially declaring FID and closing its non-recourse debt package the following year. CP2 avoided external equity entirely. The company utilised its de-risked model featuring a modular approach and proven track record to secure standard non-recourse project finance. The approach reduced sponsor risk and equity dilution while lowering overall financing costs. This strategy enables Venture Global to move more rapidly, but other ventures to date have been unwilling (or unable) to replicate this method.

Notably, exogenous project delays are indifferent to how a developer structures its capital stack. If anything, these risks make any mechanism that accelerates project execution more vital. Golden Pass, despite being a first-wave venture backed by its sponsors' massive balance sheets, could not escape a decade of relentless hurdles. The project encountered a barrage of disruptions, including shifting market dynamics, internal marketing challenges, pandemic delays, and a contractor bankruptcy.

Accelerating LNG supply development will be critical for smoothing out price volatility **– and the industry's long-term growth may depend on it.**

Securing LNG's Future

Accelerating LNG supply development will be critical for smoothing out price volatility – and the industry's long-term growth may depend on it. High baseline LNG prices relative to competing fuels have always been a challenge for demand to meet its full potential in baseload power generation, which is a significant growth headwind. Boom-bust price cycles and erratic project development have been unhelpful in supporting the case for greater LNG adoption. Recent years have exposed the severity of key market reliance on, and overexposure to, spot volumes. Buyers, which should be locking in long-term LNG for both energy security and price stability, continue to favor somewhat shorter commitments. Portfolio players and traders are reaping the benefits from this trade.

Moreover, utility-scale alternative generation is becoming increasingly cost-competitive, permitting buyers to chip away at LNG demand. Both Vietnam and the Philippines, which initially developed robust plans to import growing LNG volumes to meet soaring electricity needs and offset domestic Gas supply, are now progressing with efforts to contain demand through supportive renewables policies.

Five years of market upheaval – including record-high LNG spot prices in 2022 and more recent Mideast Gulf disruption – have undermined confidence in LNG. Ironically, the next supply wave was expected to be a meaningful demand growth driver before the Mideast disruption. This reality is particularly problematic for price-sensitive buyers already dependent on LNG to offset declining indigenous Gas resources and fuel rapidly growing economies.

Ultimately, a less restrictive financing scheme – one that steers developers away from rigid lender terms and leans into equity investment and alternative capital – frees them to enhance competitiveness through agility and speed, while smoothing out cyclical volatility. This agility is essential for buyer planning as well, as global market fundamentals exercise growing influence on LNG price discovery. Abundant, low-cost supply though advantaged, execution-friendly ventures will be essential to stabilising prices and securing long-term LNG demand growth. ●

GAS IN TRANSITION.JUNE 2026

Waiting in the wings: e-fuels can close the carbon loop

Recognising the whole system benefits of e-fuels should provide the motivation for a policy framework which incentivises and derisks investment in the sector. The reason: e-fuels close the carbon loop without the enormous cost of reinventing the global energy system. However, at present, e-fuels are an expensive means to a desirable end, but that could change.

ROSS MCCRACKEN

GAS IN TRANSITION.JUNE 2026

Synthetic hydrocarbons draw their component parts – hydrogen and carbon – from the environment using renewable energy before returning them post-use. From an environmental perspective, they are not perfect, but very nearly so.

According to the study *E-fuels: a techno-economic assessment of European domestic production and imports towards 2050 by Munich-based consultancy Roland Berger and updated in May 2025*, e-fuel pathways result in greenhouse gas (GHG) reductions of more than 92% on a cradle-to-grave basis versus the fossil fuel equivalent, assuming renewable power is used. This is significantly higher than the 70% limit set in the EU's Renewable Energy Directive II for renewable fuels of non-biological origin.

The study also found that not all e-fuels are equal.

E-methane is chemically identical to natural methane, comprising a single carbon atom bonded to four hydrogen atoms – CH4. Its simplicity is a major advantage. "The reduction in efficiency from shorter to longer carbon chains is not proportional," the Roland Berger study shows. "The energy efficiency of the simplest fuel containing a carbon atom, e-methane, is 52% when produced from air captured CO_2, but it drops to 42% for more complex molecules like FT (Fischer-Tropsch) e-diesel or FT e-kerosene."

Moreover, according to a separate study by Dutch network operator Gasunie, if e-methane is used in an end-use application equipped with carbon capture and storage, cradle-to-grave emissions would be negative.

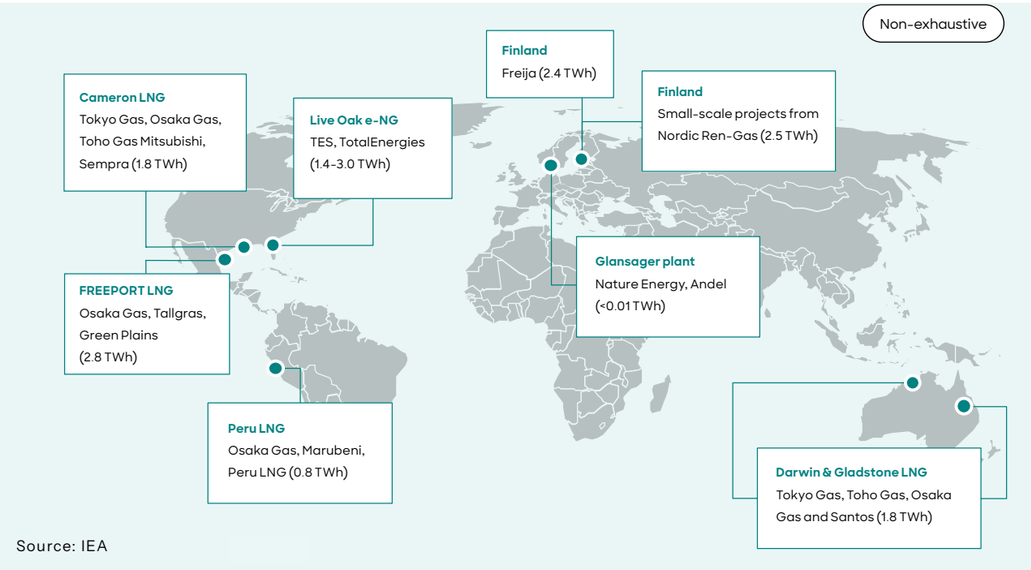
Drop-in fuel advantages

E-fuels can be dropped seamlessly into the existing energy system. This represents a financial saving running literally into the trillions of dollars. This is because while e-fuels depend on the production of hydrogen they avoid the need to develop a hydrogen transportation system on the same or larger scale than exists today for natural gas and other fuels, and they avoid the need to develop all kinds of end use equipment capable of running on hydrogen.

According to Global Energy Monitor, there are 1mn km of Gas transmission lines globally. There is at least this number of smaller distribution lines. All are supported by natural gas terminals, processing plants and substations. In addition to this, there are more than 700 LNG carriers ferrying LNG from producing to consuming regions. In total, this represents a vast investment in infrastructure, built up over decades, capable last year of supplying just over 25% of the world's total energy supply.

Repurposing for hydrogen use is neither simple nor cheap. Hydrogen is a more diffusive Gas than →

Global e-methane production could potentially exceed 10 TWh by the year 2030 [TWh]



Source: IEA

methane and causes the embrittlement of steel, requiring special alloys or coatings to prevent degradation and leakage. Repurposing existing natural gas infrastructure comes with a significant cost and may, in many cases, not be practical, requiring new hydrogen-specific infrastructure to be developed.

A focus on e-fuels would allow the energy sector to target capital towards a single key element of the hydrogen economy – green hydrogen production – which, in practice, means building more renewable power capacity. The question of time is also pertinent. The deadline is 2050. It will take decades to build a full, global hydrogen value chain capable of delivering what natural gas infrastructure can deliver now.

Long-term sustainability

E-fuels' environmental credentials come from the sources of their component parts, hydrogen and carbon.

Green hydrogen is sourced via electrolysis, using renewable power. As a result, e-methane, and e-fuels in general, are effectively a sub-group within the hydrogen economy, an area of the energy transition where interest and ambition are high, but the practical realities are challenging.

Carbon is captured from the air using direct air capture (DAC) and returned via combustion of the synthetic fuel, effectively closing the carbon loop.

With hydrogen and carbon in hand, the next step is synthesis – binding the hydrogen and carbon atoms together. To produce e-methane, methanation is required, typically using metal-based catalysts at high temperatures and pressures to produce CH_4 and water, from which hydrogen can later be recovered.

E-fuel production costs hinge on cheap renewable power

Techno-economic analyses of e-methane show that the largest cost factor, accounting for more than 60% of the total, is the price of the renewable electricity required to power the electrolysers. The cost of producing e-methane varies considerably depending on the price of renewable energy in a particular region. Green hydrogen production costs currently range from $3.50/kg to $9.30/kg, according to a recent report by accountants PWC, depending on the source of the renewable energy and the electrolysis technology employed.

A recent study, *GHG Emissions and Economic Analysis of e-methane in Japan and China*, published in April 2025 by Japan's Ritsumeikan University in Osaka, put the levelised cost of e-methane in Japan at $4,489/metric ton (mt) in its base case of 2021, falling to $2,842/mt in 2030 and $1,674/mt in 2050. In contrast, the costs for production in China were $2,450/mt, $1,505/mt and $1,082/mt respectively.

DAC represents the second largest cost element. Estimates for DAC vary significantly from $500/mt to $1,000/mt. DAC costs are high because carbon only exists in the atmosphere in very low concentrations, which, in turn, means large amounts of energy and materials are required to extract significant quantities of carbon.

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Scaling up is a major component in reducing unit costs. E-fuels should eventually benefit from **lower renewable energy costs from dedicated generation, reduced carbon sourcing costs and improvements in the economics of methanation.**

In announcing its Generation 3 DAC technology, Swiss-based company Climeworks said it aimed to achieve costs of $250/mt to $350/mt captured and total costs of $400/mt to $600/mt net removal by 2030, a 50% reduction on current costs. The goal of DAC specialists is $100/mt, as an economically viable point at which the sector could begin to scale up, although whether this can be achieved is debatable. In reality, the $100/mt target is a moveable feast – it needs adjustment for inflation and for future increases in the price of emissions allowances.

Both hydrogen production via electrolysis and DAC are relatively new technologies. The largest operating green hydrogen plant, run by China's Ningxia Baofeng Energy Group, has a capacity of 200 MW and production of 27,000 mt/yr. The next generation of plants targeted for 2030 envisage capacities in the tens of GWs producing millions of metric tons of hydrogen each year. The step change in size and learning should bring economies of scale, reducing the per unit cost.

Nonetheless, the bottom line is the cost of renewable power. The study, *Techno-Economic Analysis of Hydrogen Production: Costs, Policies, and Scalability in the Transition to Net-Zero*, published in the International Journal of Hydrogen Energy in May 2025, says that "renewable electricity costs below $20-$30/MWh are essential for green hydrogen to achieve cost parity with fossil-based hydrogen." An earlier study by consultants Wood Mackenzie came to a similar conclusion that renewable energy costs had to fall below $30/MWh by 2030 to be competitive with fossil fuel-based hydrogen.

Sub-$30/MWh for any form of power generation is a big ask. Lazard Bank's 2025 Levelized Cost of Energy study says onshore wind and utility-scale solar PV are the cheapest forms of electricity generation, but even at the lowest end of the ranges the cost is $37/MWh and $38/MWh respectively.

Policy, however, can have a big impact. In the US, the Production Tax Credit, for example, brings the low end of the range down to $20/MWh for utility-scale solar and to $15/MWh for onshore wind.

These low-end estimates are generally not achievable in high-cost regions such as Europe. Nonetheless, this summer, European solar Power Purchase Agreements (PPAs) dropped dramatically, falling below €35/MWh ($40/MWh). This drop in price reflects short term market dynamics for PPAs, as overall, renewable energy can be considered scarce, at least until full power sector decarbonisation is achieved. However, it is an indication of how cheap renewable energy may prove, if it continues on its current path of rapid expansion. While e-fuels need renewable power in abundance, their economic viability may not be as far off as thought.

Policy a critical component of success

Scaling up is a major component in reducing unit costs. E-fuels should eventually benefit from lower renewable energy costs from dedicated generation, reduced carbon sourcing costs and improvements in the economics of methanation.

However, the effect of the US Production Tax Credit shows policy is critical. On the other side of the equation, carbon pricing schemes are expected to push up the cost of unabated fuels. There are, in fact, many policy instruments which could be used to derisk the investment case for e-fuels.

Production can be subsidised. Mandates would boost demand. Hydrogen availability could be expanded in the short term more cheaply through support for blue hydrogen. And, there are multiple more concentrated sources of CO_2 than air, which could be reused before release to the environment as an interim step while DAC technology develops.

The whole system benefits of e-fuels need to be recognised and used as the motivation to create a supportive policy framework for their development. More investment in the sector will result in improved efficiency and reduced costs, potentially leading to a scalable, sustainable supply of carbon-neutral fuels, usable in any sector of the economy. ●

SHOWCASING INNOVATORS

The natural gas and broader Gas sector has long recognised that innovation is not merely an advantage – it is a necessity. As global energy demand grows and operational complexity increases, the industry has turned to advanced technologies to optimise performance across every stage of the value chain. From AI-driven predictive maintenance and real-time pipeline monitoring to digital twin modelling and automated control systems, operators are achieving new levels of efficiency while simultaneously driving down costs.

Emission reduction has become one of the most compelling frontiers for innovation in the sector. The development and deployment of technologies such as methane detection drones, electrified compression, carbon capture integration, and low-bleed valve systems reflect an industry actively engineering its way toward a lower-carbon future. These advances are not peripheral – they are central to the sector's long-term licence to operate. Innovation in infrastructure design and grid interconnection is equally strengthening the resilience of gaseous energy delivery, ensuring supply chains can withstand disruption, adapt to demand fluctuations, and continue serving as a stable backbone of global energy systems – keeping both workers and communities better protected in the process.

None of this is surprising when viewed through a historical lens – the oil and natural gas industry has always been among the world's most prolific innovators. From the earliest advances in seismic exploration and directional drilling to the shale revolution that reshaped global energy markets, the sector has a proven track record of solving some of the most technically demanding challenges on Earth. That same spirit of ingenuity is now being channelled into the energy evolution, positioning natural gas and gaseous energy not as a relic of the past, but as a dynamic, technology-driven pillar of the world's evolving energy future.

The International Gas Union (IGU) is pleased to present the following selection of emerging and small-to-medium enterprise (SME) innovators at the forefront of delivering tools, technologies, platforms, and services to the Gas and gaseous energy sectors. The contributions of these entities are directed toward facilitating operational optimisation, enhancing safety, improving environmental outcomes, and strengthening the reliability and resilience of the Gas and gaseous energy value chain.

The entities featured in the following pages were identified for inclusion on one or more of the following bases: (i) a formal introduction by an IGU Member organisation; (ii) direct investment by a corporate unit or affiliate of an IGU Member organisation; (iii) endorsement by a respected industry stakeholder(s); or (iv) their widely acknowledged standing as a leader within their respective field of specialisation.

While numerous companies met the criteria for participation, IGU acknowledges that it was not possible to accommodate all eligible applicants. The final selection was determined to achieve a representative cross-section of participants, having regard to their respective product and service offerings, the sectors they serve, and the nature of their relationships with IGU Member organisations.

The company profiles featured herein contain information supplied exclusively by the respective companies for general informational purposes only. Such information does not constitute, nor should it be construed as, an endorsement of any nature by IGU, its Member organisations, or any other parties referenced herein. IGU assumes no responsibility for the accuracy, completeness, or currency of the information provided.

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Innovator Focus

AGRIPORTANCE GMBH

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FUNDING PARTNER:
DVGW

FOCUS
Compliance software & brokerage of biomethane and LCO_2.

CHALLENGE
Biomethane producers struggle with compliance: GHG recording, mass balance documentation and sustainability certification are typically managed in spreadsheets which is slow, error-prone and costly. Cross-border certificate trading remains opaque and out of reach for most producers, leaving revenue unrealised.

SOLUTION
agriportance covers the entire value chain: greenhouse gas accounting and mass balance management, support with sustainability certification (ISCC-EU, REDcert-EU, SURE), and brokerage of biomethane and LCO_2. It combines software, regulatory expertise and an active trading desk in a single solution, enabling producers to tap into cross-border revenue streams whilst remaining audit-ready at all times.

DEPLOYMENT BY INDUSTRY
Operators of biogas plants, portfolio managers, buyers and traders of biomethane / bio-LNG / LCO_2.

AIQ

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FUNDING PARTNER:
ADNOC

FOCUS
AI Native Energy Operation System for autonomous energy activities.

CHALLENGE
Despite the rapid advancement of artificial intelligence, the reality of enterprise deployment falls short. Most AI systems today are black boxes. They are disconnected from physical operations and are fundamentally not designed for real-world, high-stakes decision-making.

Operators receive outputs, but they do not see the plan.

SOLUTION
Our AI Native Energy Operation System replicates this exact loop. It does not just generate answers. It creates a transparent, editable plan, visualizes the outcomes, and enables decisions - either by humans, or autonomously.

It is built to bridge the gap between insight and action, ensuring that intelligence is both operational and trustworthy.

DEPLOYMENT BY INDUSTRY
ADNOC, SOCAR.

ANYBOTICS AG

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FUNDING PARTNER:
Aramco Ventures, Climate Investments

FOCUS
Autonomous robotic inspection for industrial assets and energy infrastructure.

CHALLENGE
Gas operators face costly, hard-to-find fugitive emissions and safety risks in hazardous areas. Manual inspections are intermittent, expose people to risk, and miss leaks between rounds.

SOLUTION
ANYbotics provides autonomous legged robots that perform frequent inspection missions and capture repeatable, geo-referenced data (visual, thermal, acoustic, gas sensing). The system detects anomalies early, supports compliance reporting, and reduces emissions and downtime while keeping personnel out of harm's way.

DEPLOYMENT BY INDUSTRY
SLB, Yokogawa, Siemens, GE Vernova, Equinor, BP, Air Products, Petronas, CPC Taiwan, SEFE, EXXON.

ATTRIBUTES

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FUNDING PARTNER:
Equinor, Engie

FOCUS
Digital infrastructure for energy traceability, origin, and environmental value.

CHALLENGE
- Rising regulatory pressure
- Large-scale investment commitments
- Increasing demand for reliable origin and ESG energy data
- Need for energy sourcing differentiation
- Ambitius Corporate CSR commitments and emissions reduction objectives.

SOLUTION
ATTRIBUTES 'independent and standard-agnostic platform is helping energy companies to build transparent and sustainable supply chains by providing a platform that enables them to digitally trace origin, emissions, and ESG data of physical energy commodities like natural gas, LNG, crude...
The solution allows Clients to:
- Differentiate energy offering with verifiable low-carbon value and unlock premium pricing
- opportunities
- Facilitate regulatory compliance and reduce risk in long-term energy contracts

DEPLOYMENT BY INDUSTRY
Equinor, Engie, Eneco, Gaznat.

Innovator Focus

CAPSOL TECHNOLOGIES

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FUNDING PARTNER:
Siemens Energy

FOCUS
Post-combustion carbon capture for simple cycle gas turbines.

CHALLENGE
Simple-cycle gas turbines are widely used in oil & gas for compressor stations, LNG, mechanical drives, and increasingly for data centres needing reliable onsite power. Decarbonising these assets is difficult because conventional carbon capture requires electricity and steam for solvent regeneration, causing major power losses and costly retrofit complexity.

SOLUTION
CapsolGT® enables carbon capture for simplecycle gas turbines without a steam cycle. By using high-temperature turbine exhaust for solvent regeneration and generating additional electricity, it reduces power cannibalisation, increases net output, and lowers cost and footprint for space- and power-constrained oil & gas and data-centre applications.

DEPLOYMENT BY INDUSTRY
Capsol Technologies partners with leading gas turbine OEMs, including Siemens Energy and GE Vernova, and works with utilities and oil & gas companies globally with design and project.

CARBONQUEST

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FUNDING PARTNER:
Energy Capital Ventures

FOCUS
Cutting-edge distributed carbon capture techology.

CHALLENGE
Oil and gas sector is expected to reduce emissions. Our technology reduces CO_2 emissions from pipelines, including upstream compression, distributed midstream compressor stations - medium sized sources that traditional large-scale amine CCUS projects tend to neglect. There are over 3000 compressors in the U.S. alone. Some compressors generate 30,000-100,000 tons of emissions per year but cumulatively amount to millions of tons anually. Our most recent project in in the oil and gas is with Tourmaline in Alberta, Canada where we capture CO_2 from compressors using novel Metal Organic Framework (MOF) materials an solid sorbent capture.

SOLUTION
We are: distributed, containerized modular, carbon capture 2.0 using solid sorbents that require no towers and no toxic water. Our containerized and modular approach ensures ease of install and flexibility, and we have proven our technology with 5 current installations and 3 more being built. We provide end-to-end carbon management customized to each client to deliver the best value and optimal CO_2 disposal or recycling options.

DEPLOYMENT BY INDUSTRY
Tourrmaline.

CORROSIONRADAR

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FUNDING PARTNER:
Aramco Ventures

FOCUS
CUI Monitoring Powered by Data Analytics and Enabled by AI

CHALLENGE
Corrosion Under Insulation (CUI) is a costly, hidden threat across the oil, gas and petrochemical industry. It develops beneath insulation and traditional inspections provide limited visibility, leaving critical infrastructure at risk between periodic inspections. This increases failure, downtime, safety and environmental risks, while ageing assets make maintenance prioritisation difficult without continuous data insights.

SOLUTION
CorrosionRADAR helps operators turn CUI intelligence into operational advantage through continuous monitoring, AI-informed insights and expert-led guidance. Unlike traditional periodic inspections, the solution provides ongoing visibility of CUI risk, enabling smarter inspection planning, reduced downtime and improved asset reliability, while reducing inspection and maintenance costs by up to 65%.

DEPLOYMENT BY INDUSTRY
Aramco, Dow, Chevron, ADNOC, INEOS, Shell, Eni and TotalEnergies.

DAPHNE TECHNOLOGY

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FUNDING PARTNER:
Shell Ventures, Aramco Ventures

FOCUS
Reducing methane and other regulated pollutants from natural gas engines.

CHALLENGE
Methane slip, unburned methane in lean-burn natural gas engine exhaust, accounts for approximately 55% of methane emissions from compressor engines and is largely unaddressed by existing aftertreatment systems. Regulatory pressure is intensifying, with Section 136 of the U.S. Clean Air Act and EU ETS directly targeting methane slip, alongside a growing network of methane-monitoring satellites.

SOLUTION
SlipPure™ uses a patented plasma-catalytic process to remove approximately 90% of methane, 99% of carbon monoxide, 99% of formaldehyde, and 60% of NO_2 from engine exhaust. No engine modification required, no moving parts, and designed for reliable continuous operation. It replaces existing exhaust treatment systems, enabling regulatory compliance and reducing climate impact.

DEPLOYMENT BY INDUSTRY
Midstream natural gas pipeline operators (gas compression).

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Innovator Focus

FENNEX

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FOCUS
AI-powered digital tools for safety reporting, operational control, and predictive risk intelligence.

CHALLENGE
Energy operators manage safety, compliance, and operational control through fragmented, legacy systems that silo data, limit visibility, and rely on manual processes. This prevents effective use of large volumes of operational and safety data, delaying decision-making, weakening assurance, and restricting the shift from reactive reporting to proactive, predictive risk management.

SOLUTION
Fennex provides a unified, cloud-based platform that integrates safety, risk, assurance, and operational workflows into a single system. Using AI-driven analytics, it transforms existing data into predictive insights, enabling earlier intervention, improved decision-making, and full auditability. Rapid deployment, modular design, and configurable workflows differentiate Fennex from rigid, single-purpose legacy solutions.

DEPLOYMENT BY INDUSTRY
Exxon , Noble Corp, Seadrill, Transocean.

FLYABILITY

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FUNDING PARTNER:
Chevron Technology Ventures

FOCUS
Industrial confined space inspection drone.

CHALLENGE
One of the biggest headaches in oil and gas is inspecting critical assets like storage tanks, pipe racks, FCC, and stacks. These inspections happen in confined spaces or at height and are known to be risky, long, and expensive. Setting up and inspecting a tank with scaffolding may take over a week and end up costing $20'000. Inspectors then need to enter confined areas, which carry inherent risk; risks that are eliminated when using inspection drones like the Elios 3 UT.

SOLUTION
Trusted by 8/10 major oil and gas producers, the Elios 3 NDT drone removes physical risk from inspections and accelerates data capture. This solution allows inspectors to remotely collect close-up visuals and up to 250 UTMs at height per hour. No need for expensive scaffolding, rope-access, or man lifts. What sets the Elios 3 UT apart from other UAVs is its ability to reach places no other drone can and collect fully digitized API/EEMUA-compliant data.

DEPLOYMENT BY INDUSTRY
TotalEnergies, Chevron, Shell, ExxonMobile, Aramco, Equinor, ENI, BP, Philipps 66, Suncore, Petrobras.

HIGHWOOD EMISSIONS MANAGEMENT

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FUNDING PARTNER:
Energy Capital Ventures

FOCUS
A methane intelligence platform for defensible, measurement-informed emissions accounting.

CHALLENGE
Oil and Gas operators are expected to produce measurement-informed methane inventories that withstand verification. OGMP 2.0, EUMR, and MiQ demand it. But most organizations lack a repeatable system to reconcile data, quantify uncertainty, and report defensibly at scale.

SOLUTION
Highwood's Emissions Intelligence Platform (EIP) is the first end-to-end system purpose-built for measurement-informed methane inventories. It integrates field measurement data, bottom-up inventories, and reconciliation workflows to produce auditable results across OGMP 2.0, EUMR, and MiQ.

DEPLOYMENT BY INDUSTRY
Shell, Conoco Philips, Chevron, TC Energy.

IRCON SOLARONICS

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FUNDING PARTNER:
ENGIE

FOCUS
Non-contact gas & electrical industrial drying solutions.

CHALLENGE
Geopolitical shifts and the energy transition are driving fuel flexibility across energy-intensive industries. Hydrogen blends open new market opportunities for non-contact drying providers ready to tackle the associated combustion challenges

SOLUTION
As world leader in non-contact infrared drying including gas infrared drying for the paper industry, Ircon Solaronics proactively engineers hydrogen-ready infrared emitters. Our R&D-first approach ensures continuity and performance as fuel mixes evolve, a clear differentiator from competitors.

DEPLOYMENT BY INDUSTRY
Our solutions serve major paper & board and metal processing, along with a range of other industrial applications with intense process heat and drying requirements. We are currently partnering with ENGIE to test infrared emitters operating on a 30% hydrogen blend.

GAS IN TRANSITION.JUNE 2026

Innovator Focus

KINITICS AUTOMATION LIMITED

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FUNDING PARTNER:
NGIF

FOCUS
Spring-loaded electric valve actuators for the energy sector.

CHALLENGE
Methane-venting pneumatic devices at over one million well sites emit 50 million tonnes of CO_2e annually. New regulations require 75% emission reductions or a total ban on legacy venting pneumatics.

SOLUTION
Kinitics provides motorless actuators using proprietary Shape Memory Alloy (SMA) technology to eliminate 100% of vented methane while simultaneously reducing maintenance costs of surrounding infrastructure via zero deadband responsiveness. These ultra precise, low-maintenance devices feature mechanical fail-safe spring-returns, ensuring both reliability and regulatory compliance in harsh energy environments.

DEPLOYMENT BY INDUSTRY
Tourmaline, BP.

MIRICO

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FUNDING PARTNER:
Shell Ventures

FOCUS
Methane emission quantification and location through continuous monitoring laser scanner.

CHALLENGE
Regulations on emissions reporting is tightening especially for EU producers and those selling LNG into the EU. Current best practice is to do spot check surveys which can give a confusing picture of emissions. Sometimes high, sometimes low and often missing intermittent emissions. Reconcilling this data into emissions reports is confusing, time consuming and painful. Environmental NGOs are conducting their own measurements which are showing huge under reporting from the industry generating bad publicity.

SOLUTION
A novel laser based sensor that can scan the whole site from a single location. This quantifies the emissions from the whole site and identifies the times and locations of the leaks. This gives accurate data that can be trusted in reports and accepted by regulators. Follow up repairs can be done efficiently by targeting the right location at the right time. Mirico's technology replace a plethora of data sources which create uncertainty, confusion and headaches.

DEPLOYMENT BY INDUSTRY
Shell (Argentina & Canada), Vista (Argentina), Neptune (Germany).

OTD

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FOCUS
Purging pipelines into service without venting gas to the atmosphere.

CHALLENGE
Traditional purging involves venting to atmosphere to eliminate air from pipes, which contributes to methane emissions and releases gas into the atmosphere. Although safe, recent testing indicates that this process may result in higher gas emissions than previously estimated. Operational complexities such as trapped air in intricate pipe configurations and the unintended loss of usable gas highlight the importance of developing emission reducing methods that maintain safety and operational effectiveness.

SOLUTION
By removing all air from the pipeline with the vacuum, natural gas is not required to push the air out of the pipeline and the venting of this air/gas mixture to atmosphere is nearly eliminated, therefore 100% pure natural gas could be introduced into the system when gassing up the new line. This proof of concept evaluation demonstrated that venting and emissions could be nearly eliminated along from this activity.

DEPLOYMENT BY INDUSTRY
National Grid.

PERCEPTO

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FUNDING PARTNER:
Koch Disruptive Technologies

FOCUS
Remote, autonomous monitoring & inspection via integrated drone-in-a-box & software solution.

CHALLENGE
Oil & gas operators are faced with growing manual processes and increasing inspections & regulatory requirements. Without continuous, trusted asset visibility, decision quality suffers, execution timelines lag, and risk to personnel and equipment increases.

SOLUTION
We layer visual, thermal & OGI data and analytics across critical infrastructure to deliver autonomous, enterprise-wide visibility. Our software orchestrates autonomous and remote data capture across drones, sensors, and other systems to create a constantly updated, actionable reality of physical assets.

DEPLOYMENT BY INDUSTRY
Percepto is deployed across critical infrastructure for asset inspection (i.e. tanks, electric infrastructure), turnaround optimization, & more at companies such as Chevron, Delek US & Koch Industries.

Innovator Focus

RECOVER INC.

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FOCUS
Recover has developed a method to recycle drilling waste.

CHALLENGE
Horizontal drilling generates over ten million tonnes of contaminated drill cuttings annually in North America. Each tonne contains one barrel of refined distillate fuel — meaning every year, more than ten million barrels of diesel are effectively being landfilled.

SOLUTION
To validate its solvent extraction technology, Recover built a the first of its kind demonstration facility near Drayton Valley — proving both that the process was fully de-risked and economically viable. It succeeded on both fronts.

DEPLOYMENT BY INDUSTRY
Tourmaline, TAQA, Spartan Delta, Peyto, CNRL and Cenovus,. FID ready project in the Permian partnered with the largest waste management company in the basin to build future facilities directly on their landfills.

SAFETY RADAR

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FOCUS
Predictive AI safety intelligence for the gas value chain.

CHALLENGE
The gas industry's safety approach remains largely reactive. Incidents are analyzed after they occur, not prevented. Across upstream, midstream, and downstream operations, fragmented data from sensors, inspections, and workforce reports sits in silos, leaving operators without the continuous foresight needed to anticipate failures, protect workers, and safeguard critical infrastructure.

SOLUTION
Safety Radar unifies operational, environmental, and behavioral data into a continuously learning AI model that flags risk before incidents occur. Unlike reactive compliance and reporting tools, our platform delivers predictive alerts across the full value chain, from wellhead to distribution, enabling operators to intervene earlier, reduce downtime, and save lives.

DEPLOYMENT BY INDUSTRY
IGU Member.

SEEKOPS INC.

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FUNDING PARTNER:
Equinor OGCI | Climate Investments

FOCUS
FOCUS: Drone-deployed TDLAS methane and carbon dioxide MRV.

CHALLENGE
Methane, carbon dioxide$_2$, and other gas emissions are difficult to detect, localize, and quantify consistently across complex energy infrastructure. Operators need defensible, measurement-based data at scale. SeekOps addresses this using space-derived technology on two fronts: advanced laser spectroscopy hardware and astrophysics-inspired signal processing to reduce uncertainty.

SOLUTION
SeekOps pioneered drone-deployed TDLAS measurement, integrating proprietary sensors, optimized flight paths, quantification algorithms, and field-proven workflows. Beyond sensor design, it established a scalable deployment model through trained drone-service-provider networks, delivering accurate, repeatable, and compliance-ready emissions data aligned with standards like OGMP 2.0.

DEPLOYMENT BY INDUSTRY
SeekOps is primarily used by the traditional oil and gas value chain, but is actively supporting the industry transition through assisting biogas and biomethane operators.

SENSORUP INC.

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FUNDING PARTNER:
OGCI | Climate Investments

FOCUS
Carbon Intelligence Platform: Connecting detection, operations, and reporting.

CHALLENGE
Operators run multi-modal methane detection programs, but the data lives in siloed systems. Disconnected from operational context, triage takes longer, field teams address symptoms instead of root causes, and annual reporting requires weeks of labor. The result is compounding cost, wasted field time, and unreliable emissions data.

SOLUTION
SensorUp unifies detection, operational, and production data into a structured hierarchy that is hardware agnostic, and connects any sensor to any workflow. Operators see measureable improvements in methane operations, LDAR compliance, and voluntary reporting. One customer, thousands of sites, one year: 855 dispatches avoided, 44% faster leak resolution, 66% fewer repeat events.

DEPLOYMENT BY INDUSTRY
Petrobras, Oxy, MiQ, GHGsat.

Innovator Focus

UPWING ENERGY

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FUNDING PARTNER:
Equinor Ventures

FOCUS
Comprehensive natural gas production service enabled by subsurface compression technology.

CHALLENGE
In a standard gas well lifecycle, well performance begins to decline while significant resources remain unproduced. This is primarily a result of liquid loading and depletion of natural pressure, causing a falloff in production and potentially leading to premature abandonment.

SOLUTION
Upwing Energy is a gas tech innovator and service company offering a profitable and sustainable solution for operators to maximize natural gas production and recoverability from existing wells. Upwing has developed a novel downhole compressor, which is offered through the company's End2End service. The Subsurface Compressor System (SCS) improves well performance by decreasing bottomhole flowing pressure and causing higher reservoir drawdown. The company's End2End business model provides hassle-free management of production equipment, operations and data, with no capital or human resources required from well operators.

DEPLOYMENT BY INDUSTRY
Natural gas producing organizations across the Continental United States, South America, North Africa and the Middle East.

Innovation in emissions management

The oil and Gas industry is deploying an increasingly sophisticated array of technologies to detect, measure, and reduce emissions - moving well beyond manual inspection toward integrated, data-driven systems.

Aerial drones now conduct routine surveys of pipelines, compressor stations, and storage facilities, equipped with optical Gas imaging and laser-based sensors capable of identifying methane plumes in real time. Fixed-sensor networks complement this aerial capability with continuous ground-level monitoring, providing persistent emissions data across facility perimeters.

Satellite-based platforms extend this coverage to regional and basin-wide scales, offering operators the ability to identify fugitive emission sources that ground teams may not reach promptly. These remote and autonomous detection capabilities are increasingly being adopted across the industry as both technology costs fall and regulatory expectations rise.

The critical innovation lies not just in individual instruments, but in the software platforms that integrate data streams from all these sources into unified dashboards. These systems - increasingly AI-assisted - allow operators to prioritise repair workflows, demonstrate regulatory compliance, and generate auditable emissions records aligned with frameworks such as OGMP 2.0.

Together, these technologies are transforming emissions management from a periodic compliance exercise into a continuous operational discipline. The industry has made meaningful progress, and the direction of travel is clear: emissions reduction is now a recognised operational priority, backed by genuine technological commitment and measurable deployment outcomes.

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INNOVATION IN EMISSIONS MANAGEMENT

The methane transparency era: Turning measurement into action

The Oil and Gas Climate Initiative is working collaboratively with partners across the global Gas value chain to support methane emission monitoring and mitigation.

JULIEN PEREZ
Managing Director,
Oil and Gas Climate Initiative

For decades, methane emissions have represented one of the most urgent but least visible challenges facing the oil and Gas industry.

The science was clear, the operational case was strong, the climate benefits of rapid methane reduction were well understood. Yet too often, the industry was constrained by a practical problem: it was difficult to consistently detect and measure methane emissions.

In this new era of methane transparency, there is growing recognition that reducing emissions is equally essential as a climate imperative and to ensure energy security and affordability.

Satellites, aerial monitoring, ground-based sensors, AI and advanced data platforms are making methane emissions increasingly visible, and they can now be detected with greater speed and precision.

This is a profound shift for the oil and Gas industry.

As methane emissions move from estimation to evidence, and from voluntary ambition to operational accountability, these tools can help the oil and Gas industry to address the issue.

The task now is to deploy these tools at scale, build the capability to utilise them effectively, and ensure that better data leads directly to faster mitigation.

Satellite monitoring campaign

At the Oil and Gas Climate Initiative (OGCI), this has been central to our work for more than a decade. Our members have made progress in reducing methane emissions from operated assets, while sharing lessons and practical tools to help accelerate action across the sector.

Since 2017, OGCI members have reduced aggregate upstream operated methane emissions by 63%, aggregate upstream methane intensity by 62% and cut routine flaring by 72%.

In 2022, our members launched the Aiming for Zero Methane Emissions Initiative, calling for an all-in approach that treats methane with the same rigor as safety, sets a clear ambition of zero methane emissions, and drives the practical actions needed to make those reductions a reality.

OGCI companies have pioneered the work of collective emissions reporting and have pushed industry towards greater transparency and more ambitious methane reduction targets.

The 0.20% collective methane intensity ambition set by OGCI in 2018 has become widely adopted, including by the United Nations Environment Programme's OGMP 2.0 and signatories of the Oil & Gas Decarbonization Charter (OGDC), as a guide for near-zero methane emissions.

Looking ahead to 2030, OGCI's CEOs recently announced they are aiming for methane intensity of 0.1% collectively.

The next phase of progress will depend on the industry's ability to integrate detection, monitoring, measurement and mitigation into a disciplined operating model. Detection alone is not enough: a satellite alert or sensor reading must trigger investigation, diagnosis, repair and learning. The value of transparency lies not just in spotting emissions, but in acting on them.

That is the principle behind OGCI's Satellite Monitoring Campaign. Launched in 2021 with a pilot project in Iraq, the campaign has demonstrated how high-resolution satellite data can help identify large methane emissions events at oil and natural gas assets, and how confidential peer-to-peer engagement with local operators can support practical action on the ground.

OGCI has since scaled the campaign to more countries and assets, including in Central Asia, North Africa and South America.

The Iraq pilot demonstrated the potential of this model: the campaign helped enable local operators to address methane plumes equivalent to an estimated 1 Mt (megatonne) of CO_2e over the course of one year.

OGCI's satellite monitoring is also offered to OGDC signatories. Representing around 40% of global oil production, OGDC's 56 signatories, two-thirds of which are national oil companies, aim to achieve near-zero upstream methane and zero routine flaring by 2030.

Through strong OGCI member company leadership, the campaign's learnings are being scaled to a diverse set of operators across different geographies, catalysing broader sector adoption and accelerating industry decarbonisation efforts.

The campaign has further demonstrated that satellite data is a powerful tool when it is combined with operational expertise, trusted engagement and a practical pathway to abatement.

This is why OGCI developed its Satellite Methane Detection Response Playbook. Published to help operators respond effectively to methane emissions detected from space, the playbook sets out a structured six-step framework from initial satellite notification to on-the-ground investigation, repair and ongoing improvement.

It draws on the practical experience of OGCI →

Indeed, transparency only delivers impact when institutions are properly equipped to respond. **The transparency era will be defined by the availability of data and the impact it enables.**

member companies and is designed to be used across a wide range of operating environments.

Transparency ecosystem

Innovation is also expanding what is possible.

OGCI's collaboration with Carbon Mapper, a science-based nonprofit, highlights how public satellite methane data, science-driven insight and industry engagement can be brought together to accelerate emissions reductions.

The collaboration combines Carbon Mapper's publicly available satellite-based methane data with OGCI's peer-to-peer industry model, helping operators identify, prioritise and mitigate emissions more effectively.

We work collaboratively with other leading organisations, including the World Bank, the United Nations Environment Programme (UNEP), the International Energy Forum (IEF), the Environmental Defense Fund (EDF), the Clean Air Task Force, and Rocky Mountain Institute (RMI). Through these efforts, we amplify our impact and accelerate progress.

Artificial intelligence (AI) strengthens this transparency ecosystem. By combining operational data, emissions measurements and predictive analytics, AI can help companies identify patterns, prioritise interventions and move from reactive leak detection toward more predictive methane management.

In short, AI can help operators make better decisions, faster – particularly when it is integrated with reliable measurement data and field-level response processes.

The same principle applies to government action. The International Methane Emissions Observatory's Methane Alert and Response System (MARS) has created the first global system providing free, satellite-based alerts for major methane emission events to governments.

New technical guidance prepared by the International Energy Agency (IEA) in collaboration with IMEO proposes a five-step process for governments responding to these notifications – from receiving and classifying alerts to notifying operators, verifying responses and documenting outcomes.

Indeed, transparency only delivers impact when institutions are properly equipped to respond. The transparency era will be defined by the availability of data and the impact it enables.

Annual reporting is also an essential part of this journey. OGCI's reporting provides a mechanism to track performance, maintain accountability and demonstrate progress over time. It reflects a broader direction of travel across the industry as measurement-based methane reporting becomes more established. This scaled impact has been seen in OGDC over the last two years. In 2025, OGDC signatories adopted the OGCI reporting framework to increase measurement, transparency and standardisation of Scope 1 and 2 emissions. Improving data measurement will help companies scale decarbonisation in support of the aims of the Charter.

The oil and Gas industry has a responsibility to act on methane with urgency and credibility. It also has an opportunity to show that innovation, collaboration and transparency can deliver measurable results. The challenge now is execution.

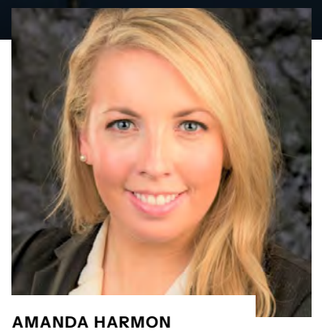
At OGCI, we believe the industry can meet this moment. The new methane transparency era is about enabling action, not exposing failure.

By making emissions visible, verifiable and manageable we can accelerate reductions, strengthen trust and support a lower-emissions future for oil and gas. ●

INNOVATION IN EMISSIONS MANAGEMENT

Looking ahead: The next frontier of methane emissions innovation

Emissions management technologies have developed immensely in the last decade. The challenge now is to tie those technologies together into cohesive, highly performing systems.



AMANDA HARMON
Senior Director, Emissions Management, GTI Energy

It is important to recognise how far the natural gas industry has progressed in methane emissions measurement. A decade ago, emissions were largely estimated using engineering assumptions and static emission factors, often with limited empirical validation. Today, the landscape is different. Operators now have access to a diverse suite of measurement technologies spanning satellite, aerial, and continuous monitoring systems, alongside increasingly sophisticated ground-based detection and quantification tools. These capabilities have expanded coverage from discrete assets to entire basins, improved detection sensitivity, and enabled a more dynamic understanding of emissions variability.

At the same time, the emergence of measurement-informed inventories and standardised protocols has begun to address long-standing challenges related to data consistency, reconciliation, and transparency. What was once a fragmented, assumption-driven process is evolving into a data-rich, science-based discipline, one that is increasingly capable of supporting not only reporting, but operational decision-making and performance management at scale.

Over the past decade, natural gas stakeholders have invested heavily in methane emissions management. The industry is no longer debating whether to prioritise measurement or mitigation. The next challenge of emissions management is how to integrate measurement and mitigation into systems that deliver consistent, scalable, and verifiable emissions reductions.

What distinguishes the next phase of innovation is not the introduction of entirely new classes of measurement technologies, but the ability to connect existing capabilities into cohesive, high-performing systems. Across the natural gas value chain, this transition is already underway at various scales and redefining how data is integrated, interpreted, and applied.

Interoperability across technologies and datasets

The rapid expansion of measurement technologies has created a diverse data ecosystem. Satellite observations, aerial surveys, continuous monitoring sensors and equipment-level measurements each provide valuable insight but can operate in isolation. The next decade of emissions management will be defined by the ability to integrate these datasets into unified frameworks that reconcile differences in scale, frequency, and uncertainty with portfolio level operations.

This level of interoperability is essential to moving beyond individual measurements toward comprehensive emissions visibility and a more effective leak detection and repair program. It enables operators to analyse top-down and bottom-up data, improving confidence in emissions estimates, and strengthening the credibility of reported reductions. More importantly, it transforms emissions measurement from a diagnostic tool into an operational system that supports continuous operations focused on proactive decision-making.

Data-driven decision systems and advanced analytics

As the volume and complexity of emissions data increase, the role of analytics becomes central. Traditional approaches to emissions monitoring can be replaced by more advanced modeling and analytical tools that can analyse large, multi-source datasets and identify patterns that would otherwise remain hidden.

These capabilities allow operators to move from reactive to proactive emissions management. Predictive analytics can identify high-risk assets, optimise inspection schedules, and inform prioritisation of mitigation investments. Systems modeling can support strategic decisions, including capital allocation, technology deployment, and compliance strategies. In this context, analytics is not simply an enhancement to measurement, it is the mechanism that translates data into action.

Scaling from pilots to portfolios

Many methane technologies and programs have demonstrated effectiveness at the pilot or asset level. The next challenge is scaling these solutions across full asset portfolios, where variability in infrastructure, geography, and operations introduces additional complexity.

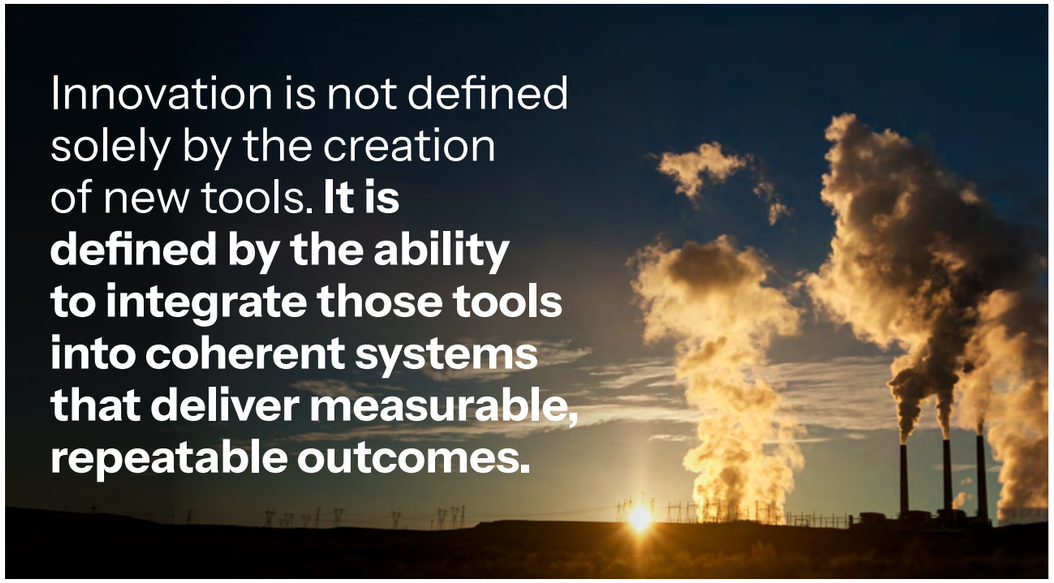
As methane emissions gain greater visibility in policy, **markets, and financial systems, alignment across voluntary initiatives, certification frameworks, and regulatory requirements become increasingly important.**

Achieving scale requires a shift in how solutions are designed and deployed. Standardisation of methodologies, integration with operational workflows, and alignment with business processes become critical. Solutions must be adaptable across diverse systems while maintaining consistency in outputs. The ability to scale effectively determines whether innovations deliver incremental improvements or transformative impact.

This transition also introduces a new level of operational discipline. Portfolio-wide deployment demands coordination across teams, clarity in governance, and sustained investment. In this environment, methane management begins to resemble other core operational functions, with defined processes, performance metrics, and continuous improvement cycles.

Alignment across frameworks, markets, and regulation

As methane emissions gain greater visibility in policy, markets, and financial systems, alignment across voluntary initiatives, certification frameworks, and regulatory requirements become increasingly important. Discrepancies and lack of clarity can create friction, limit comparability, and reduce confidence in reported outcomes. Regulations should provide clarity that maintains technical rigor while enabling practical implementation. Measurement-informed approaches offer a pathway to this alignment, providing a consistent foundation for reporting, certification, and regulatory compliance. →



At the same time, market drivers; such as differentiated Gas, emissions-linked financing, and procurement requirements, are reinforcing the need for credible, comparable data. This creates a feedback loop in which improved measurement supports market signals, and market signals drive further investment in measurement and mitigation.

Collaboration as a scaling mechanism

Underlying each of these advancements is the continued importance of collaboration. The pace of progress achieved to date has been driven by shared efforts across operators, technology providers, academic institutions, and policymakers. No single entity has the capability to address the full scope of the challenge.

Sustaining momentum will require expanding these collaborative models, with an emphasis on transparency, data sharing, and joint problem-solving. Collaboration is not only a catalyst for innovation, but also a mechanism for scaling it. Lessons learned in one region, technology, or segment must be transferable across the broader system to maximise impact.

Conclusion: Integration of methane emissions into operations as innovation

Methane emissions reduction is often framed as a technical challenge, one of developing better sensors, more precise measurements, or more efficient mitigation technologies. In practice, it is a systems challenge, requiring the alignment of technologies, data, operations, and incentives across the entire value chain.

Innovation is not defined solely by the creation of new tools. It is defined by the ability to integrate those tools into coherent systems that deliver measurable, repeatable outcomes. Measurement must inform mitigation. Mitigation must validate measurement. Data must flow across scales and stakeholders. And operational decisions must be grounded in consistent, credible insight.

The shift to integration is redefining how the industry approaches methane management. It is enabling a transition from fragmented activities to co-ordinated systems, from periodic assessments to continuous performance management, and from compliance-driven approaches to operational excellence.

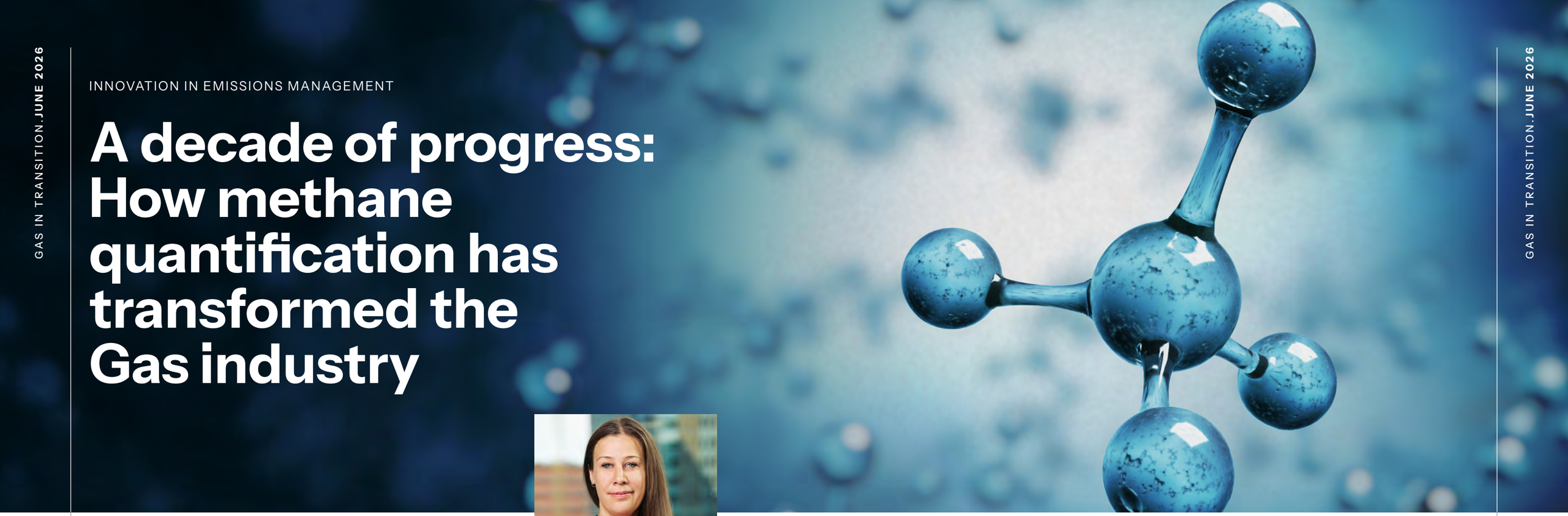
For organisations such as GTI Energy and its partners, the focus is on accelerating this transition. Through measurement-informed frameworks, collaborative programmes, and education and training, the objective is to move beyond understanding emissions toward systematically reducing them.

In a landscape where expectations for emissions performance are increasing, success will depend on the ability to integrate speed, scale, and credibility. The systems that deliver will be those that connect data to action, technology to operations, and innovation to impact.

Progress of emissions reduction will not be measured by the sophistication of individual technologies, but by the magnitude and durability of emissions reductions achieved. And in that respect, integration will define the next chapter of methane emissions innovation. ●

INNOVATION IN EMISSIONS MANAGEMENT

A decade of progress: How methane quantification has transformed the Gas industry



Over the last 10 years, methane quantification has emerged as a key step to reducing emissions, with collaboration a critical component.

JESSICA SHUMLICH
COO & Co-founder, Highwood Emissions Management

Ten years ago, methane emissions occupied a very different place in the global Gas conversation. They were widely acknowledged and frequently discussed, but poorly understood in practice. Measurement was sporadic, data was dominated by estimates, and most decisions rested on generalised assumptions rather than direct observation.

Today, the picture looks fundamentally different. Across the global Gas industry, methane quantification has undergone a quiet but consequential transformation. What was once largely an exercise in estimation has evolved into a rapidly advancing discipline, supported by improved measurement technologies, expanding datasets, and a growing expectation of transparency and accountability. This shift has not been driven by a single mandate or breakthrough but by sustained effort from operators, service providers, researchers, and innovators working across the value chain.

While challenges remain, it is worth pausing to recognise how far the industry has come, and why this progress matters. Methane quantification has moved from a peripheral exercise to a foundational capability, shaping how Gas is produced, evaluated, and defended in an increasingly scrutinised energy system.

From estimates to evidence

A decade ago, most methane inventories relied heavily on emission factors and engineering calculations. These approaches provided a broad sense of scale, but they were never designed to capture the complexity and variability of real-world operations. Emissions were assumed to be relatively uniform across similar equipment and facilities, and infrequent surveys meant that temporal variability often went unseen.

The past 10 years have fundamentally challenged those assumptions.

Improved measurement has shown that methane emissions are rarely uniform. Instead, they are episodic, concentrated, and highly dependent on operating conditions. A small number of sources can account for a disproportionate share of total emissions. This insight has reshaped how operators think about methane, shifting the focus from abstract averages to specific, actionable sources.

Crucially, this shift has moved methane from the realm of storytelling to evidence. As measurement improved, operators began to see clear connections between emissions, equipment performance, and operational practices. Methane ceased to be an invisible externality and became something that could be observed, interrogated, and managed.

Technology as an enabler, not a silver bullet

One of the defining features of the last decade has been the rapid expansion of methane measurement technologies. Aerial surveys, mobile monitoring, fixed sensors, and satellites have all contributed to a richer and more nuanced understanding of emissions.

Yet this progress cannot be explained by technology alone. Tools, by themselves, do not create rigor or accountability. What matters is how data is interpreted, contextualised, and applied.

The most meaningful advances have occurred where measurement has been embedded into operational decision-making. In these cases, data is used to prioritise maintenance, guide inspections, validate repairs, and track performance over time. Measurement becomes part of how assets are managed, not simply how reports are produced.

Equally important, methane measurement has become more accessible. While adoption has been fastest in North America, capabilities are improving globally. What was once limited to pilot programs and research studies is now deployed routinely across assets and regions. This broader access has allowed companies of varying sizes and maturity to engage with methane management in ways that were simply not possible 10 years ago.

Learning what actually drives emissions

As measurement expanded, so did learning. Understanding what actually drives emissions, and how to cost-effectively reduce them, represents one of the industry's greatest opportunities.

Across basins and asset types, operators are beginning to identify common emission drivers. These extend beyond individual equipment failures →

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to include maintenance practices, operating regimes, facility design, and organisational processes. This learning has been cumulative. Each new dataset adds clarity, enabling companies to refine their approaches and avoid repeating costly mistakes.

Perhaps most importantly, improved quantification is helping distinguish theoretical risk from real impact. Not all equipment contributes equally to emissions, and not all mitigation efforts deliver the same results. Measurement-informed approaches allow operators to focus effort where it matters most.

The practical implications are significant. Methane mitigation guided by real data is typically faster, more cost-effective, and more durable than generic programs. It also builds confidence that actions taken are delivering measurable outcomes.

Transparency as a catalyst for improvement

Alongside technological advances, the past decade has seen a steady move toward greater methane transparency. Voluntary initiatives, industry collaborations, and evolving reporting frameworks have raised expectations around how emissions are quantified and communicated.

Transparency is often framed as a risk, but in practice it has acted as a catalyst for improvement. When emissions are measured and shared, they become visible and visibility drives action. Operators can benchmark performance, identify outliers, and demonstrate progress over time.

This matters not only for regulators, but for markets. Gas increasingly competes on more than price alone. Buyers, investors, and financiers are seeking confidence that emissions claims are credible, consistent, and grounded in evidence. Quantification provides the foundation for that confidence, but only when it is applied rigorously and consistently.

A global effort, with uneven starting points

Progress in methane quantification has not been uniform across regions. Differences in infrastructure age, market maturity, regulatory frameworks, and access to technology mean that starting points vary widely.

Nevertheless, the past decade has demonstrated that improvement is possible in all contexts. Capacity building, knowledge sharing, and technology transfer have allowed lessons learned in one region to inform practices elsewhere. For emerging Gas markets, early investment in measurement can help avoid costly retrofits and misaligned systems later.

> Tools, by themselves, do not create rigor or accountability. **What matters is how data is interpreted, contextualised, and applied.**

Industry collaboration has been central to this progress. Methane quantification has advanced most rapidly where operators, service providers, and industry organisations have worked together to share insights and align approaches.

Quantification as the foundation for the next phase

Looking ahead, it is clear that quantification is not the end goal. Reductions are. But experience shows that reductions achieved without robust data are harder to sustain, harder to compare, and harder to defend.

Quantification provides the confidence needed to act decisively. It enables smarter mitigation, better allocation of resources, and clearer communication with stakeholders. It also supports innovation, allowing new technologies and practices to be tested and refined against real-world evidence.

The key question is no longer whether methane should be measured, but how to ensure that measurement remains fit for purpose, practical, scalable, and underpinned by methods that preserve consistency and comparability as expectations rise.

Recognising progress, maintaining momentum

The Gas industry has made meaningful progress in methane quantification over the past decade. What was once invisible is now measurable. What was once assumed is now observed. That progress deserves recognition.

At the same time, momentum matters. Expectations will continue to rise, and methane will remain central to discussions about the role of Gas in a changing energy system. Continued investment in measurement, learning, and transparency will be essential, not as an end in itself but as the foundation for lasting credibility.

The past 10 years have shown what is possible when industry and innovators work together. The next 10 will determine whether that progress is consolidated into systems that are rigorous, comparable, and trusted, or allowed to fragment under the weight of complexity. ●

How continuous methane monitoring translates into confident operational decisions

Sensirion Connected Solutions IoT Cloud. Illustration only.

Methane emissions management is evolving beyond periodic inspections toward continuous monitoring, giving operators a more time-resolved and actionable understanding of emissions across their assets.

Traditional leak detection and repair programs remain valuable for identifying emission sources, but they provide only a snapshot in time. Operators often lack visibility into when emissions occur, how long they persist, and which events require the most urgent attention.

Continuous monitoring changes that equation. By providing around-the-clock visibility, operators can detect emissions sooner, respond faster, and allocate resources more effectively. The resulting data supports mitigation efforts while improving overall understanding of emissions performance.

The transition from periodic screening to IoT-based continuous monitoring solutions by Sensirion has already delivered measurable results. In one example, an initial deployment across 100 sites was expanded to 400 sites, with learnings from the first phase immediately applied across the broader program. Within 12 months, the operator reduced the average duration of emission events by a factor of ten, contributing to an overall reduction of approximately one-third of total methane emissions.

A key advantage was real-time visibility. Continuous 24/7 monitoring, combined with actionable notifications, enabled operational teams to receive emission alerts within hours and assess events in under 30 minutes. This allowed teams to quickly distinguish expected releases from fugitive emissions requiring intervention. For operators managing geographically dispersed assets, the system-wide view also improves prioritization by helping field crews focus on the most significant events and deploy limited resources more effectively.

Data quality is another important benefit. Event timestamps enable emissions to be reconciled with SCADA and operational data, helping teams identify root causes faster and determine the right response.

In addition to operational benefits, continuous monitoring strengthens external transparency and accountability. As satellite and third-party methane monitoring initiatives expand, high-resolution on-site monitoring provides critical ground-level context, improves source attribution, and supports more accurate emissions accounting. This helps operators respond more effectively to emissions events, regulatory requirements, and reporting objectives.

Looking ahead, continuous monitoring is poised to become a core layer of compliance-grade methane management. As quantification algorithms, sensing technologies, and gap-filling methodologies continue to improve, it offers operators a practical pathway toward more transparent, measurement-informed reporting aligned with OGMP 2.0 Level 5 principles and similar MRV frameworks.

Over time, the combination of persistent site-level data, stronger source attribution, and integration into operational workflows is expected not only to accelerate emissions reduction but also to support more scalable, auditable reporting across larger asset portfolios. ●

SENSIRION
connected solutions

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INNOVATION IN EMISSIONS MANAGEMENT

Certified Methane Performance: The market's fastest climate action lever

Overview

There is no faster, cheaper lever in the climate action toolkit than reducing methane emissions from oil and Gas operations. The International Energy Agency estimates that the sector could cut roughly three-quarters of its methane emissions using technology that already exists – and that nearly 40% of those reductions would pay for themselves through the value of the captured Gas. The lever exists. What has been missing is a credible way for producers to prove they are pulling it and for buyers to reward those who do.

That is what MiQ's methane performance certification was built to do. A UK-based not-for-profit, non-governmental organisation, anchored in independent third-party methane measurement and verification, and operating a digital registry that tracks every certificate from issuance to retirement, MiQ has become the most established standard for differentiating methane performance in natural gas markets – and now in crude oil as well.

MiQ is currently certifying close to 30% of natural gas production in the United States and is also certifying natural gas and crude oil assets in Canada, offshore from the United States, and in the North Sea. MiQ's standard is designed to be adopted globally and can be used in oil and natural gas producing regions worldwide.

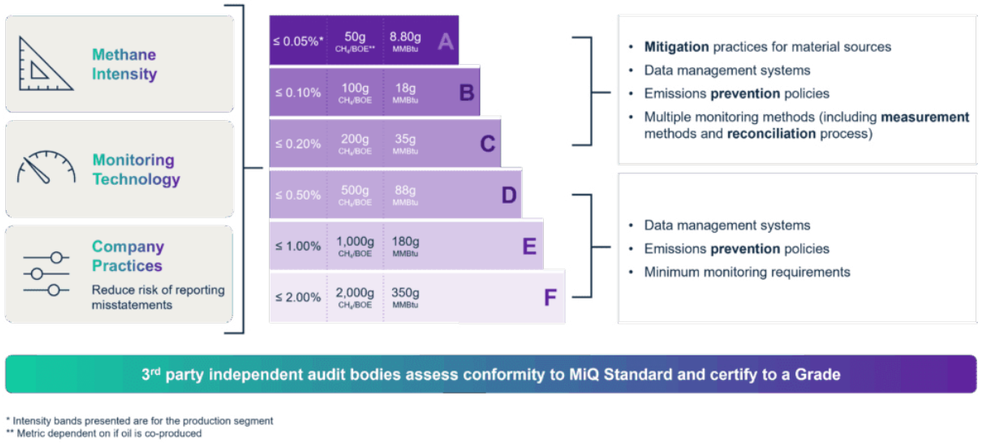
The methane problem

Methane is the climate problem with the shortest fuse. Over a 20-year horizon, methane traps over 80 times the heat of an equivalent mass of carbon dioxide, which means cuts made today register on the temperature record within a decade rather than a century. The oil and natural gas sector accounts for roughly a third of methane emissions from human activity, and intensity varies widely across assets, basins, and operators. That variability is precisely the point – two molecules of Gas burning in the same power plant can carry very different upstream emissions profiles depending on how they were produced and moved. Without a way to see that difference, the most effective emissions reductions cannot be realised – and, significantly, the market cannot reward the emission with the lowest overall GHG footprint.

MiQ and methane performance certification

MiQ was founded with a single, narrow mission: to accelerate methane reductions across the oil and natural gas value chain by giving the market the information it needs to act. Methane performance certification – the assessment, verification, and labeling of an asset's methane emissions intensity and management practices – is the central instrument. Each certified molecule of natural gas, and now crude oil, carries a verifiable claim, graded from A to F, that describes how that production performs against the standard. MiQ does not sell technologies or natural gas, nor does it audit oil and natural gas assets itself.

Methane Performance Standard: Grading System



* Intensity bands presented are for the production segment
** Metric dependent on if oil is co-produced

It writes and maintains the standard, accredits the auditors who apply it, and operates the registry where the results are recorded. That separation of roles is deliberate and provides credibility for certifications and emissions data produced under the standard.

Why certify? The value proposition of voluntary markets

Regulation alone will not move methane emissions at the speed the climate requires, particularly in the United States, where federal rulemaking is in flux and likely to remain so. Voluntary, market-based mechanisms are not a substitute for sound regulation, but they are increasingly the most viable and efficient way to realise emission reductions and put a price on performance. Certified natural gas allows producers who invest in monitoring, leak repair, and equipment upgrades to differentiate their product, attract premium buyers, and demonstrate environmental performance to investors, lenders, and counterparties. Buyers – utilities, LNG off-takers, industrial users – gain a credible way to substantiate GHG scope 3 emissions reductions and to meet disclosure expectations from regulators, shareholders, and customers. The acid rain trading program under the US Clean Air Act showed decades ago that well-designed markets can drive down emissions faster and at lower cost than command-and-control alone. Certified natural gas applies the same logic to methane.

Inside MiQ's approach

The MiQ Standard rests on three pillars. The first – company practices – requires operators to have policies and procedures aligned with industry best practice, from leak detection and repair to venting and flaring controls. The second – methane monitoring and measurement technology deployment – requires both source-level and facility-level surveys, with credit awarded for higher frequency and broader spatial coverage. The third – methane intensity – measures actual emissions per unit of production. Every certified asset is then graded from A, the highest performance level, down through F. Assessment is carried out not by MiQ but by accredited independent auditors who follow MiQ's protocols and whose work is itself subject to ongoing oversight. The results are recorded in the MiQ Registry – an independent digital ledger that issues, tracks, and retires every certificate across its lifecycle, ensuring no claim is double-counted and that buyers and sellers can trace each certificate back to a specific asset.

Credibility is paramount

A certification scheme only works when people trust it. Independent certification – alongside a credible and robust verification program – is the only way that industry emissions reporting will be considered legitimate in a voluntary market and reporting system.

In addition, if the standard-setter also benefits from the grading or volume of certifications issued, or if the auditor is paid in ways that reward leniency, the system collapses into self-marketing. MiQ's governance is designed to prevent that outcome. The standard is set independently of certified producers; the auditors who apply it are formally recognised by – but are financially independent of – MiQ; and →

the registry sits outside the commercial transaction between buyer and seller. That structural separation – what governance specialists call functional independence – is not a stylistic preference. It is the precondition for buyers, regulators, and investors to accept certified claims at face value. Certification programs – as well as associated verifiers – must not have a financial interest in the outcome of the certification.

MiQ also publishes its standards openly and updates them through public consultation, which means producers know what is expected and outside observers can scrutinise the criteria for themselves. Standards are revised on a regular cadence to incorporate advances in monitoring technology, alignment with reporting frameworks such as the Oil and Gas Methane Partnership 2.0 or the EU Methane Regulation and, most importantly, lessons learned from the audits themselves. Trust is earned through structure, not asserted through a logo.

Built for natural gas, crude oil, and global markets

Methane performance certification is designed for adoption in oil and natural gas gas producing regions across the globe. The MiQ Standard covers onshore and offshore production, gathering and boosting, processing, transmission and storage, and the full LNG chain – and, as of 2026, has been used for both onshore and offshore crude oil assets, as well. That matters because methane emissions do not respect a barrel-versus-MMBtu boundary; associated gas vented or flared at oil wells in the Permian or Central Asia has the same atmospheric effect as fugitive emissions from a natural gas-focused field in Appalachia or the North Sea. MiQ today certifies more than 7% of global natural gas supply, with operators participating across North America and Europe. Its new registry includes the Certificate Inter-Regional Import System (CIRIS), designed to align with the European Union's Methane Regulation requirements for imported natural gas, LNG, and crude. The architecture is built to work in parallel with existing oil and Gas markets, not in opposition to them – a pragmatic reflection of the reality that molecules will continue to move. The question is how cleanly.

The next decade of the energy evolution will be defined less by what producers and buyers pledge than by what they can prove. Verified, measured, market-based methane performance is how that proof is achieved. ●

MiQ

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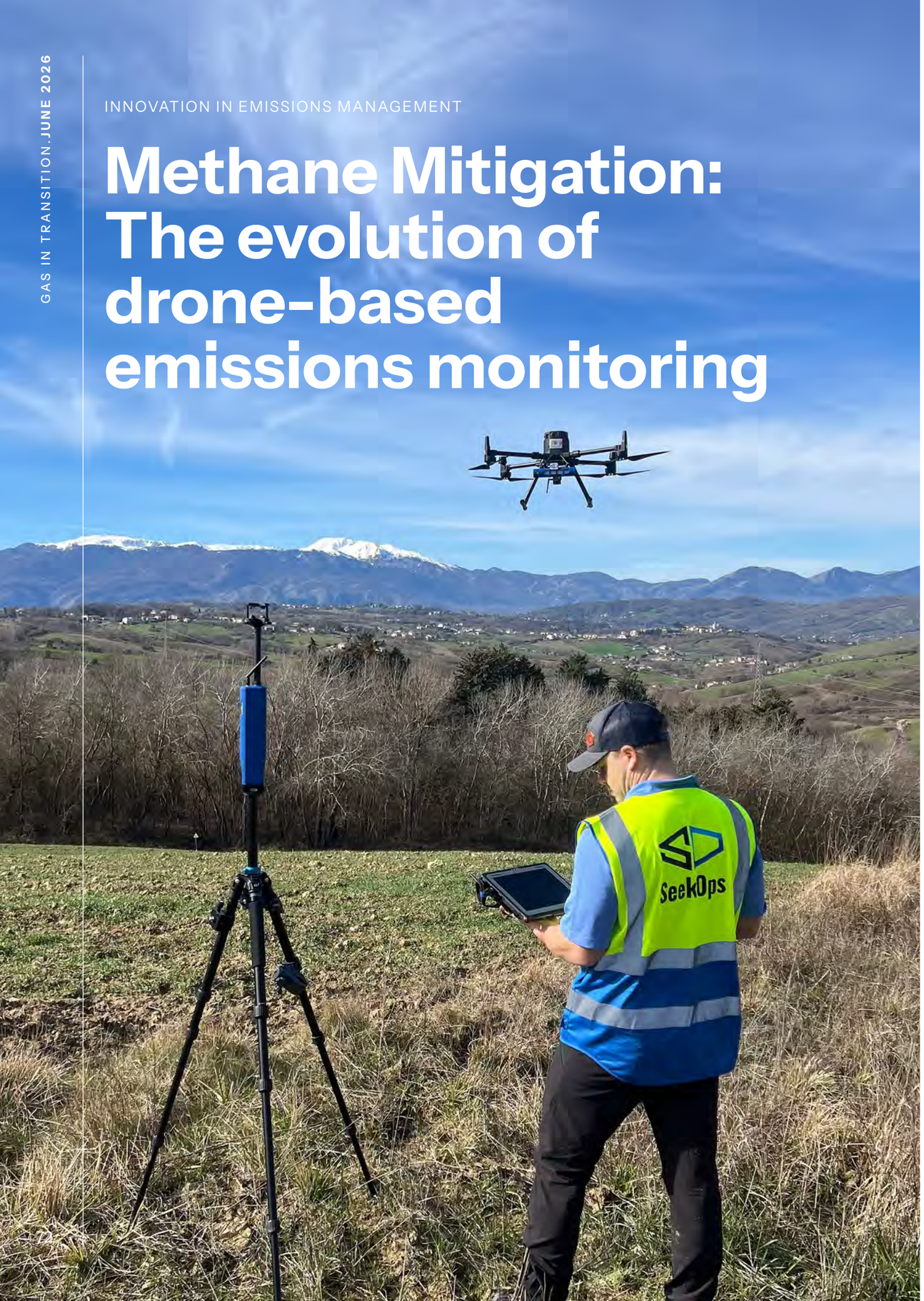
INNOVATION IN EMISSIONS MANAGEMENT

Methane Mitigation: The evolution of drone-based emissions monitoring



Methane management has become one of the defining challenges facing the global energy sector. As regulators, investors, operators, and the public push for greater emissions transparency, the ability to accurately detect and quantify methane is now essential across the natural gas value chain.

Over the past decade, drone-based methane sensing has matured from specialised scientific instrumentation into a practical operational tool capable of surveying energy facilities safely, rapidly, and at scale.

From NASA science to industrial application

SeekOps' origins trace back to NASA's Jet Propulsion Laboratory, where high-precision laser sensing was originally developed for planetary exploration and then adapted for atmospheric science. The same principles used to measure trace gases in difficult environments proved well-suited to a pressing need in oil and natural gas: identifying and quantifying methane emissions.

Early methane work relied on handheld detectors, optical Gas imaging cameras, and soap and bubble testing. These tools were useful, but they generally required close access and offered limited-to-no flowrate quantification. Satellite and aircraft systems then showed the value of large-scale observation, yet operators still needed a way to translate regional screening into site-level action. Drone-based monitoring filled that gap. By pairing unmanned aircraft with sensitive methane sensors, operators gained an efficient way to inspect facilities and generate quantitative data to support maintenance decisions, regulatory reporting, and emissions reduction strategies.

Today, drone-based methane monitoring is increasingly integrated into operations across upstream production, midstream transportation and storage, LNG infrastructure, distribution networks, renewable natural gas facilities, and landfill applications.

Why drone-based monitoring matters

The growing adoption of drone-based monitoring reflects several practical advantages. Drones improve safety and accessibility by inspecting hard-to-reach infrastructure with minimal personnel exposure and operational disruption. They also deploy quickly in challenging environments. As an example, in West Papua, SeekOps and local drone partners completed full-facility methane measurements within days, a timeline difficult to achieve with conventional ground or aircraft-based methods.

Just as important, modern drone systems move beyond simple leak detection to quantification. Operators need to know not only whether methane is present, but how much is being emitted, where it originates, and which sources require urgent attention. That ability to generate repeatable, quantitative data is helping shift methane management from reactive maintenance into a more strategic, data-driven process.

Regulation is now the commercial driver

Nothing illustrates that shift more clearly than Regulation (EU) 2024/1787, the EU Methane Regulation, which is now in force. From January 1, 2027, new and renewed contracts to import oil, Gas, and coal into the EU must demonstrate that producers along the supply chain are subject to monitoring, reporting, and verification standards equivalent to the EU's own. In practice, that means reporting under OGMP 2.0 Level 5 with independent third-party verification, the pathway currently recognised as compatible with the regulation's MRV requirements.

The 2027 deadline is closer than it looks. EU buyers are already running procurement cycles 12 to 24 months ahead of contract start, which puts 2026 squarely in the window where US LNG, oil, and coal exporters need credible, measurement-based methane data rather than emission estimates. Drone-based quantification, delivered with third-party verification, gives producers a defensible way to meet that bar at the asset level.

From pilot projects to global operations

One of the clearest signs of the application's maturity is the scale at which methane monitoring programs are now deployed. The industry has moved past isolated pilots toward systematic campaigns built into routine operations.

A good example is SeekOps' long-running work with BP. According to a publicly available Climate Investment case study, the relationship began in 2018 when BP evaluated technologies to help manage fugitive methane across its operations. SeekOps' ability to directly quantify emissions provided both source identification and emission-rate measurement, allowing teams to prioritise mitigation more effectively.

The collaboration expanded from onshore operations in the United States and Oman to offshore work in the North Sea, where drone-based systems reliably quantified methane in complex offshore conditions. SeekOps has since surveyed more than

290 offshore assets globally across multiple operators and regions.

The case study also highlights how methane monitoring has evolved alongside broader sustainability commitments, including OGMP 2.0 and the Oil and Gas Decarbonization Charter. At a major natural gas processing facility in Azerbaijan, SeekOps helped divide a complex site into smaller measurable subgroups, improving site-level understanding and planning. To date, SeekOps has surveyed more than 2,000 facilities across 35 countries and 6 continents, supporting operators in oil and natural gas, biogas, and waste management.

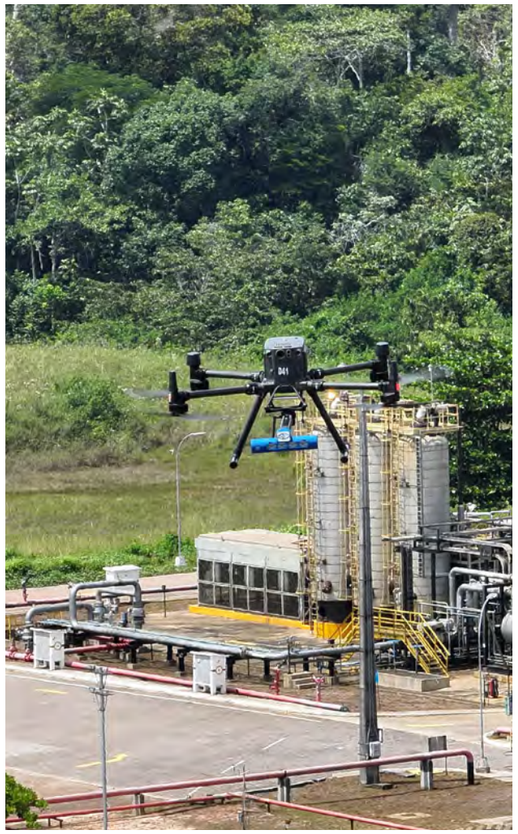
The role of drones alongside other technologies

As methane monitoring technologies evolve, no single approach can address every challenge. Satellites are effective at flagging large regional plumes and major release events. Fixed-wing aircraft efficiently screen extensive infrastructure. Continuous monitors provide persistent observation at critical facilities. Drone-based systems sit in an important middle ground, combining mobility and operational flexibility with high-resolution measurements that support site-level decisions.

That flexibility is particularly valuable for facilities that are difficult to access or operationally complex, including offshore platforms, compressor stations, processing plants, LNG infrastructure, and large production sites. Operating close to sources also allows drone systems reach sensitivities that broader screening tools struggle to match. Rather than replacing other approaches, drone-based monitoring is becoming part of an integrated strategy that combines multiple technologies across different scales.

The future of methane monitoring

The next phase will likely be defined by deeper integration, more automation, and stronger transparency. AI and advanced analytics are expected to improve how data is processed and interpreted, while tighter links between satellite, aerial, drone, and ground systems will produce more comprehensive emissions intelligence. More autonomous drone operations may also enable near-continuous monitoring of critical infrastructure.



Reporting expectations will keep rising. With the EU Methane Regulation setting a measurement-based bar, and similar frameworks taking shape elsewhere, operators face growing pressure from regulators, investors, customers, and the public to provide credible, verifiable data. Technologies that deliver transparent, repeatable, and independently verifiable measurements will play an increasingly central role.

Methane mitigation is now an operational and commercial opportunity, not only an environmental responsibility. Reducing emissions improves efficiency, preserves product, strengthens public trust, and supports the long-term role of natural gas in a low-emission energy system.

The continued evolution of drone-based methane monitoring demonstrates how scientific innovation, industry collaboration, and operational deployment can work together to accelerate meaningful emissions reduction across the global energy sector. ●

SeekOps

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INNOVATION IN EMISSIONS MANAGEMENT

Maintaining momentum: Permian methane emissions intensity contracts 23% in 2025

S&P Global Energy's latest examination of methane emissions intensity in the Permian Basin of Texas reveals a marked decline, attributed to increased monitoring frequency and broader deployment of monitoring and mitigation technologies

SOLICIA XU
Principal Analyst, North America Upstream Product, S&P Global Energy

In 2025, methane emissions intensity in the Permian Basin dropped to 0.34%/barrel of oil equivalent (boe) produced, down from 0.44% in 2024, according to S&P Global Energy CERA analysis.

This represents a 23% year over year reduction in upstream methane intensity and continues a sustained downward trend observed since the inception of this dataset in 2022. From 2022 to 2025, basin-wide methane intensity declined by nearly two-thirds, reflecting continued improvement in upstream emissions performance.

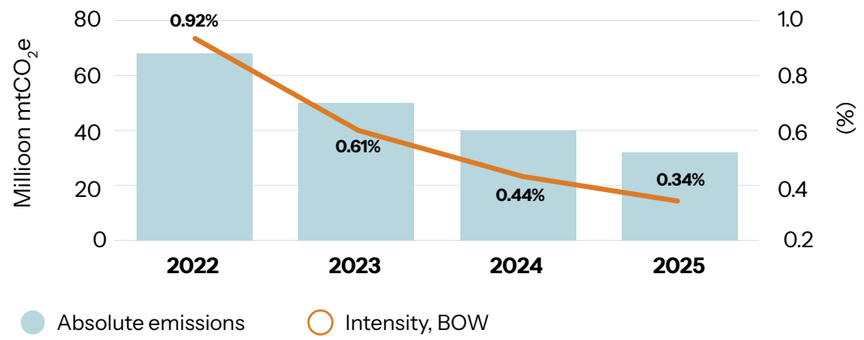
Four key trends emerged from the 2025 assessment:

- Sustained intensity decline: Methane intensity continues a multiyear downward trajectory, with 2025 marking another step-change lower in basin-wide performance, consistent with findings from our 2024 analysis.
- Stable activity context: The reduction occurred within a largely stable production environment and alongside expanded monitoring frequency, suggesting that the observed decline is not driven by reduced activity levels.
- Methodological evolution: Increased flight frequency and refined event-duration assumptions have improved the temporal resolution and overall reliability of the 2025 dataset.
- Regional divergence: A persistent performance gap remains between states, with methane intensity in Texas (0.39%) materially higher than in New Mexico (0.25%).

Between 2024 and 2025, upstream methane emissions in the Permian fell from 38.9mn metric tons of CH equivalent ($mtCO_2e$) to 32.1mn $mtCO_2e$ – a decline of about 6.8mn $mtCO_2e$, according to S&P Global Energy CERA estimates. This corresponds to roughly 0.27mn $mtCO_2e$ of CH_4, assuming a global warming potential (GWP) of 25.

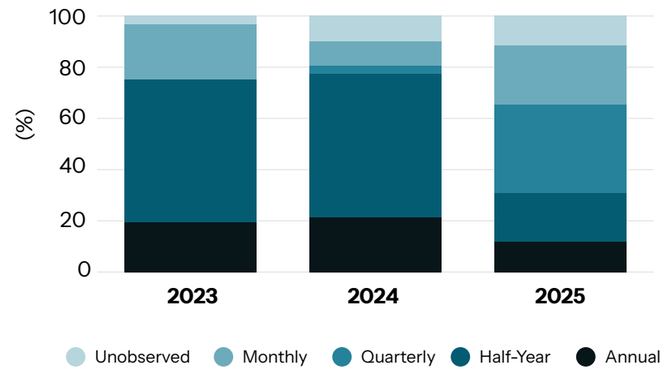
For context, a 6.8mn $mtCO_2e$ reduction is comparable to about half the annual emissions of all

Trend in estimated Permian upstream methane intensity



Date Compiled: Feb 20, 2026. Source: S&P Global Energy

Trend in estimated Permian upstream methane intensity



Date Compiled: Feb 20, 2026. Source: S&P Global Energy

data centres in Virginia, the country's largest data-center hub, or to the annual emissions of roughly 1.5mn passenger vehicles.

These estimates are focused exclusively on upstream operations. Methane emissions also occur across midstream, gathering and processing systems – but those emissions fall outside this assessment's scope.

While this benchmark is primarily based on aerial survey data from our partnership with Insight M (now part of Zeitview), satellite-based observations from Sentinel 5P – ingested by S&P Global Energy CERA – provide an additional, independent view of methane emissions across the basin. Differences in detection thresholds, spatial coverage and temporal frequency across measurement technologies can result in variation between datasets. Those variations highlight both the progress being made and the measurement uncertainties that persist when quantifying methane emissions at scale.

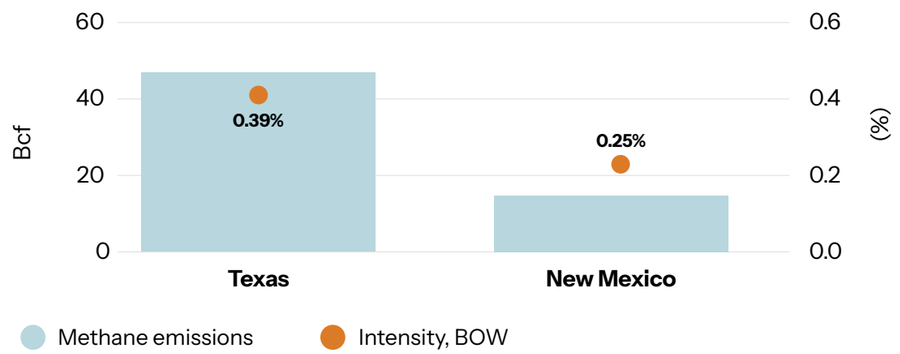
Improving accuracy with frequency

While the 2025 headline numbers highlight continued reductions in methane emissions, substantial improvements in the dataset and notable methodological evolution are raising the reliability of the S&P Global Energy CERA Permian Upstream methane intensity estimate.

As discussed here, every methane detection technology has its advantages and drawbacks. The technology S&P Global Energy CERA used for the Permian benchmark – aerial surveys – benefits from low threshold of detection, and sufficiently high resolution to attribute the emissions to upstream, midstream or other sources. Coverage may be lacking in some regions, but the Permian benchmark has →

GAS IN TRANSITION.JUNE 2026

Permian methane emissions by state



Date Compiled: Feb 20, 2026. Source: S&P Global Energy

consistently covered 88% or more of assets and production. The primary weakness is the frequency of observations; low frequency introduces the possibility that the observation may not be representative and makes the calculation of duration, the estimate of the period between observations, more uncertain.

In 2025, there was a significant increase in the frequency of the overflights by Insight M, which underpins the S&P Global Energy CERA Permian benchmark. In 2023, only 0.62% of Permian production received monthly flyover observations. By 2025, this figure had risen to 22% of basin production.

Furthermore, over two-thirds of assets were observed at least once per quarter, meaning that the assets producing more than 55% of total basin oil and natural gas production were observed at least quarterly. This represents a marked improvement.

Improving frequency has a knock-on effect on the duration calculation as well, since it allows for greater resolution in timing both leak repairs and long-duration emitters.

Insight M refined the event-duration methodology to improve temporal accuracy. In 2025, the default duration for detected leaks was halved from 14 to seven days, reflecting faster data processing and reporting cycles.

After detection during a flight, operators are now notified within 24 hours, rather than the previous seven days, enabling more rapid repair responses. Furthermore, maintenance-related events are now assigned a fixed one-day duration, rather than being modeled as fugitive leaks, ensuring these short-lived, episodic activities are not overstated in annualised emissions estimates.

Together, these updates improve temporal reliability and reduce the potential for duration-based error. As a result, the 2025 dataset represents a significant improvement and our best available estimate of methane performance in the Permian to date.

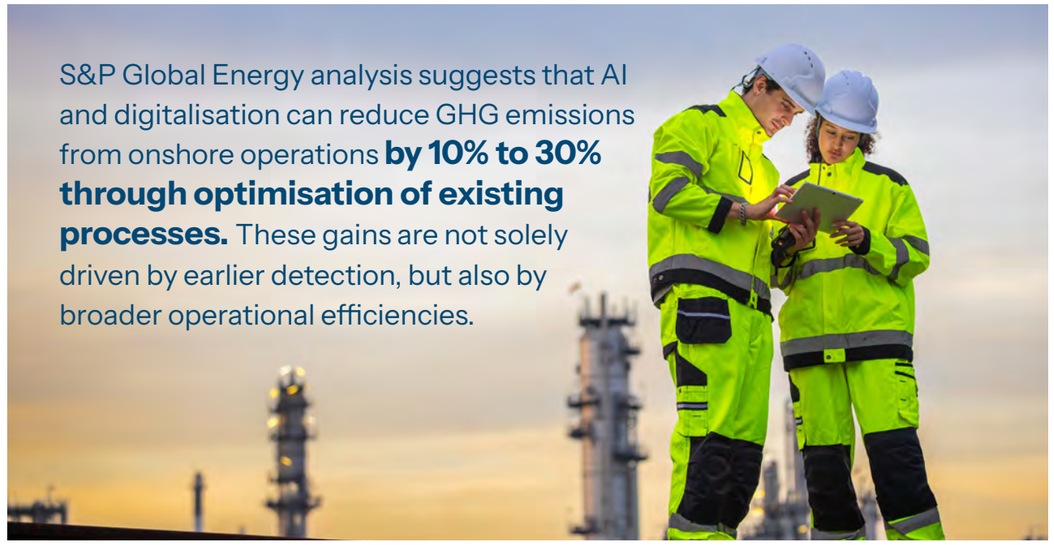
Granular Benchmarking: Dissecting the Texas – New Mexico performance gap

A state-level comparison within the Permian Basin highlights a clear divergence in methane performance. Texas accounts for roughly 70% of total basin production and, therefore, most absolute methane emissions. However, the difference is not purely a matter of scale. In 2025, methane intensity in Texas was 0.39%, compared with 0.25% in New Mexico, indicating materially higher emissions per unit of output in Texas.

Based on a review of regulatory frameworks, one potential driver of this divergence may be differences in regulatory structure. New Mexico has implemented more stringent methane controls in recent years, including tight restrictions on routine venting and flaring. In contrast, Texas maintains a comparatively flexible regulatory framework. Differences in enforcement, infrastructure alignment, and asset maturity may also contribute to the variation in intensity outcomes.

For operators and investors, these results highlight the importance of state-level comparisons. Basin-wide averages can obscure jurisdictional differences that materially affect emissions performance. As regulatory and disclosure pressures evolve, understanding these structural differences will remain critical for asset evaluation and methane management strategies.

GAS IN TRANSITION.JUNE 2026



Beyond Monitoring: The technology and operational shift underneath the numbers

Monitoring improvements tell part of the story; the other part is what's happening on the ground.

The broader industry trend points in the same direction. Upstream tech partnerships increased 26% between 2023 and 2024, reversing several years of decline. The Permian, with its scale and operator density, tends to be where these tools land first. The shift is practical and field-level: autonomous drone inspections, AI-assisted well monitoring, and remote operations, alongside structural changes in how assets are configured and run – particularly the replacement of legacy pneumatic controllers, pad consolidation, and more standardised equipment and workflows designed to reduce routine emissions.

A decade ago, these were pilot programmes. Now they're becoming standard parts of how assets are run day to day. Major operators are already scaling deployment: Chevron is using drones equipped with optical gas imaging (OGI) for methane detection across its assets, while companies such as Shell are integrating drone- and sensor-based monitoring into routine leak detection programmes. Collectively, these examples reflect a broader transition from experimentation to embedded operational practice.

What's changed isn't just the technology itself, but how tightly it's woven into operations. Operators are no longer waiting for a scheduled overflight to find out something is leaking. Continuous monitoring systems and fixed optical Gas imaging cameras flag anomalies in real time. Autonomous drones run inspection routes without needing a crew on site. At the same time, operators are changing the physical baseline of assets: high-bleed pneumatic controllers – widely used across the basin – are being replaced with low- or zero-bleed systems or instrument air, eliminating emissions from entire equipment classes rather than simply detecting them after the fact.

This matters because the largest driver of methane emissions is not chronic leakage but operational variability – venting events, equipment upsets, and maintenance releases that occur between inspections. A significant share of these emissions has historically come from normal equipment operation, particularly pneumatic controllers, which account for more than half of basin-level methane emissions in the Permian.

S&P Global Energy analysis suggests that AI and digitalisation can reduce GHG emissions from onshore operations by 10% to 30% through optimisation of existing processes. These gains are not solely driven by earlier detection, but also by broader operational efficiencies. In parallel, equipment-focused interventions – such as replacing high-bleed pneumatics – can reduce methane emissions by up to 99% in some cases, making them one of the most direct levers for emissions reduction.

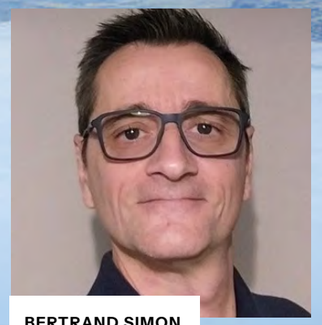
The Texas–New Mexico gap fits this picture. Better technology helps, but only if operators are incentivised to deploy it. New Mexico's stricter rules have driven faster detection and repair cycles, along with more aggressive equipment upgrades and standardised practices. Texas, with a more flexible framework, shows what happens when that pressure is absent. Regulation sets the floor. Technology and operations together determine how far above it operators go. ●

INNOVATION IN EMISSIONS MANAGEMENT

From measurement to meaning: rethinking methane data in the energy transition

With a greater short-term impact on global climate change, methane has been elevated to a higher profile by operators and regulators alike.

AMINE KOLIAI
National Metrology Specialist, Bureau Veritas



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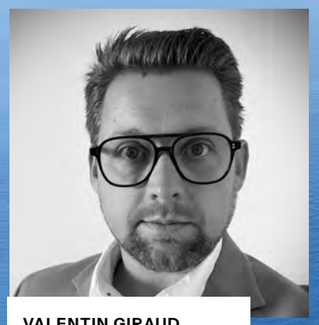

VALENTIN GIRAUD
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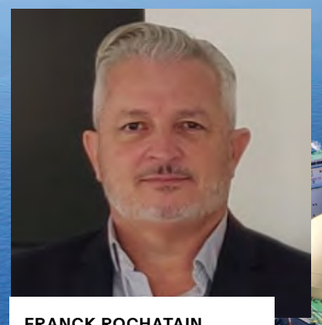


FRANCK ROCHATAIN
Solution Manager LDAR CH4, Bureau Veritas

This evolution is driving the adoption of integrated approaches that bring together multiple data sources – **LDAR campaigns, aerial surveys, continuous sensors – into a single analytical environment.**

Methane's moment – and a shifting challenge

Methane has rapidly moved to the centre of the climate conversation. While CO_2 remains the dominant long-term driver of warming, methane's short-term impact has pushed regulators and operators alike to prioritise faster, more immediate reductions. Regulatory developments such as the European Union's Methane Regulation and initiatives like OGMP 2.0 reflect this urgency, placing new emphasis on transparency, measurement accuracy, and accountability.

However, as requirements evolve, a deeper challenge is becoming apparent across the energy sector. It is no longer enough to detect emissions; operators must now explain them. What was once primarily a technical activity – identifying and repairing leaks – has turned into a broader expectation: producing emissions data that is coherent, auditable, and defensible for regulators, investors, and the public. In this context, the question is shifting from "Where are emissions occurring?" to "How well are they understood?"

More measurement, less alignment

Over the past decade, methane measurement capabilities have expanded significantly. Leak detection and repair (LDAR) programmess have matured, while aerial, satellite, and continuous monitoring technologies have improved both coverage and sensitivity. Together, these tools provide unprecedented visibility into emissions. Yet they also introduce a new layer of complexity: each method captures a different reality, operates at a different scale, and relies on different assumptions.

This has created a growing disconnect within organisations. Bottom-up approaches offer granular insights into emissions from individual components – such as valves, compressors, and fittings – supporting targeted maintenance and repair strategies. At the same time, top-down measurements provide a broader perspective, capturing total site emissions and often highlighting discrepancies that cannot be fully explained at component level. These differences are not necessarily contradictions; rather, they reflect the inherent difficulty of measuring a diffuse and variable phenomenon under real-world operating conditions.

As a result, operators are increasingly confronted with multiple "versions" of their emissions. Regulators, in parallel, are raising expectations. They are no longer satisfied with isolated datasets but are seeking consistency and clarity – a defensible explanation of how emissions are measured, why methodologies differ, and how uncertainties are managed. The core challenge is therefore no longer measurement alone, but alignment between different measurement perspectives.

From measurement to integration

In response, methane management is undergoing a structural transformation. The focus is shifting from collecting data to integrating and interpreting it within a coherent framework. Measurement is no longer viewed as an isolated activity, but as part of a broader data ecosystem requiring consistency, traceability, and governance.

This evolution is driving the adoption of integrated approaches that bring together multiple data sources – LDAR campaigns, aerial surveys, continuous sensors – into a single analytical environment. By centralising these inputs and applying consistent calculation methodologies, operators are better equipped to compare results, understand discrepancies, and identify potential gaps in coverage or interpretation. Just as importantly, maintaining traceability of assumptions and methodologies strengthens confidence in reported emissions, both internally and in interactions with regulators.

Experience in the field suggests that this integrated approach delivers tangible benefits. It enhances the robustness of emissions inventories and →

Platforms such as **Bureau Veritas's Veri M** illustrate this direction, combining source-level and site-level data within a unified framework and enabling traceable reconciliation between the two.

improves readiness for audits and regulatory reviews. It also creates operational value: discrepancies between bottom-up and top-down data can reveal undetected emission sources or inefficiencies in maintenance practices, enabling more effective prioritisation of mitigation actions. Over time, this supports a shift from periodic, compliance-driven measurement campaigns to continuous emissions management, where performance is monitored, analysed, and improved on an ongoing basis.

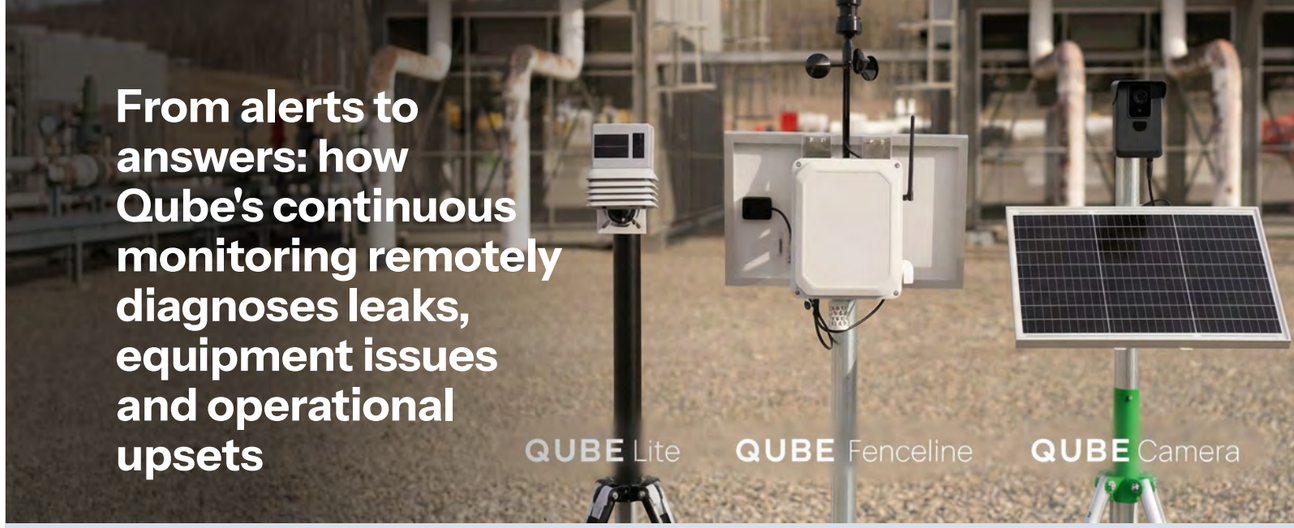
Crucially, this transformation is not driven by technology alone. Human expertise remains essential to interpret complex datasets, validate anomalies, and ensure that conclusions are technically sound. The combination of advanced measurement techniques with expert oversight is increasingly seen as the foundation of credible and actionable emissions reporting.

Towards methane intelligence

This change in perspective is also reflected in the emergence of integrated digital environments designed to manage methane data more holistically. Rather than focusing on a single detection technology, these solutions aim to structure and reconcile diverse datasets, providing transparency into how emissions figures are constructed and how different measurement approaches relate to one another. Platforms such as Bureau Veritas's Veri M illustrate this direction, combining source-level and site-level data within a unified framework and enabling traceable reconciliation between the two.

More broadly, this signals a shift within the industry – from measurement to understanding, and from understanding to action. As methane continues to rise on the regulatory and societal agenda, the ability to produce clear, consistent, and intelligible emissions data will become a key differentiator. Operators who can demonstrate not only what their emissions are, but how well they understand them, will be better positioned to meet compliance requirements, strengthen stakeholder confidence, and identify effective pathways for reduction.

Ultimately, the transition underway is not only technological, but conceptual. Methane management is evolving into what can be described as methane intelligence: the capacity to transform diverse and sometimes conflicting data into a coherent, actionable picture. In that context, the value lies not only in detecting emissions, but in making sense of them – and in using that understanding to drive sustained and measurable progress. ●



From alerts to answers: how Qube's continuous monitoring remotely diagnoses leaks, equipment issues and operational upsets

Some of the the most significant emissions events are not always conventional leaks. They can be process upsets, equipment failures, and operational or maintenance actions that produce emissions which are brief, intermittent, and resolved long before an inspection crew can be scheduled.

Qube's Continuous Monitoring Solution

Qube Technologies built its continuous monitoring solutions to solve this problem. The Qube Fenceline provides sitewide coverage, detecting and quantifying methane and co-emitted gases using physics-based atmospheric dispersion modelling, with over 8,000 devices deployed globally. It supports OGMP 2.0 Level 5 reporting, MiQ certification, and is approved as an alternate test method under US EPA NSPS OOOOb/c. Qube Lite focuses emission detection to individual equipment, and Qube Camera adds event-triggered visual confirmation: timestamped imagery linked directly to emission alerts.

Performance is third-party validated through 13 weeks of blind controlled-release testing at Colorado State University's METEC ADED program. Results show 96.7% localisation accuracy, greater than 90% probability of detection within 15 minutes for releases above 5 kg/h, quantification within 1% for source rates above 1 kg/h, and essentially 100% detection of all sources including elevated tank-top releases.

Case Study: Continuous Monitoring in Action

At an upstream gas processing facility equipped with Qube Fenceline, Lite and Camera, an inlet slugging event beginning at 1 AM drove excess liquid and vapor toward the tank farm. As the VRU destabilised, vapors were routed to flare. Qube Lites registered spikes to 25,000 ppm, the Fenceline localised the release to the tank farm at 10–12 kg/h, and Qube Camera timestamped the flaring. By correlating all three data streams against SCADA, the operations team reconstructed the complete event sequence without leaving their desks.

Operators using Qube's continuous monitoring have reported measurable benefits across their programs:

- $9,000 saved in a single event by catching a broken regulator early and preventing dry pumping at a dehydration unit skid
- 82% drop in total monthly emission volumes, with site-normalised emission rates falling 93%
- 75% reduction in OGI spend by integrating continuous monitoring into an optimised inspection approach

This is what the shift from detection to diagnosis looks like in practice. To learn how Qube's monitoring solutions can deliver operational insights at your assets, visit qubeiot.com or contact info@qubeiot.com.

Qube Technologies is the global leader in continuous emissions monitoring. With deployments across oil and gas, biogas, utilities, landfills, and mining operations worldwide, Qube delivers cost-effective sensors, best-in-class data modeling and an intuitive visual platform for emissions analysis and reporting.

QUBE

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Regional Update

Africa

Aka Nwokedi
General Counsel, NLNG
Nigeria

The ongoing events in the Middle East have sent the region into rethink mode. What is clear is that there is deliberate focus across the region to expand Gas export capacity not only because of its criticality as a foreign exchange earner but also for sustained global positioning.

We also see at the same time a strong push to grow domestic Gas supply as a foundation for industrial growth underpinned by governments seeking to create the right legal and fiscal environment to attract investment and tackle energy security risks.

To reposition the region, African governments are seeking to deepen regional collaboration and integration through robust infrastructure, business partnerships and alliances that combine operational efficiency, technology transfer, and access to markets by addressing execution risk matters such as financing, regulatory and policy uncertainties which limit progress and constrain investment interests within the region.

There is no doubt that the world needs reliable Gas supply and Africa wants to ensure it is ready and well placed to provide it. Here are some high impact developments that are helping to not only have a positive impact in the domestic scene but also transforming Africa's supply position into the global market.

West Africa Ajaokuta–Kaduna–Kano (AKK) Gas Pipeline (Nigeria)

We continue to see progress on the Ajaokuta–Kaduna–Kano (AKK) Gas Pipeline, which is a strategic infrastructure project designed to transport natural gas from the southern to northen parts of Nigeria – Ajaokuta in Kogi to Kano State, traversing multiple states and key urban centres as part of the broader Trans-Nigeria Gas Pipeline network.

Spanning approximately 614 km, the pipeline is intended to establish a cohesive national Gas transmission backbone, conveying over 2.2bn ft^3/day of natural gas per day from southern production hubs to major demand centres in the north, including Abuja, Kaduna, and Kano.

The project is currently estimated to be over 90% complete and is progressing toward its final commissioning phase, with initial natural gas delivery to Abuja targeted for Q3 2026.

NLNG Train 7 (Nigeria)

The Nigeria LNG Limited (NLNG) Train 7 project located on Bonny Island, Rivers State, Nigeria has reached approximately 91% completion and progressing toward commissioning. The project is expected to deliver an incremental 8mn metric tons (mt)/year of LNG, increasing NLNG's total production capacity by approximately 35%, from 22mn mt/year to 30mn mt/year and reinforcing Nigeria's position as a leading global LNG supplier.

The Final Investment Decision (FID) for Train 7 was taken on December 27, 2019, and upon completion, Train 7 is expected to further enable the monetisation of Nigeria's extensive proven natural gas reserves, estimated at approximately 215 trillion ft^3, among the largest globally, to meet increasing global energy demand.

North Africa

In North Africa, recent natural gas sector developments reflect a combination of energy rebalancing, foreign exchange pressures, and renewed upstream activity. Egypt has undergone a marked shift from natural gas exporter to net importer, driven by declining domestic production and rising demand. Although natural gas output has fallen in recent years, creating a widening supply gap and prompting an increase in LNG imports, we have seen policy measures to prioritise natural gas allocation to power generation and key industries, alongside efforts to secure foreign exchange for energy imports and maintain system stability.
In parallel, Egypt continues to pursue upstream recovery, including new offshore discoveries and expanded drilling programmes with international oil companies.

Likewise, Libya is focused on incremental upstream ramp-up to restore and expand hydrocarbon output following years of disruption. Recent project start-ups and operational improvements by its National Oil Corporation have supported production stabilisation, with oil output just over 1.4mn barrels/day by late 2024 and associated natural gas volumes increasing alongside. While Libya's natural gas sector remains less developed, its resource base and geographic proximity to European markets underpin longer-term export potential, contingent on sustained stability and investment.

Central Africa: Congo LNG (Republic of Congo)

In Central Africa, the Republic of Congo is emerging as a new LNG exporter through the Congo LNG project, led by Eni. The development is a floating LNG project located within the Marine XII concession. Phase 1 commenced in 2024 using the Tango FLNG unit, with capacity of approximately 0.6mn mt/year. A second phase involves the addition of Nguya FLNG offshore, supporting the activity of Tango FLNG and increasing the project's overall liquefaction capacity to 3mn mt/year.

The project positions the Republic of the Congo as an emerging LNG exporter, while its phased, modular design supports both export growth and domestic Gas utilisation, contributing to broader economic development and improved energy access.

Eastern Africa: Tanzania LNG (Tanzania)

East Africa's Gas outlook is increasingly defined by large-scale LNG commercialisation, with the Tanzania LNG project emerging as a key development approaching pre-FID. The project, located in Lindi, Tanzania, is planned as a 10mn mt/year LNG facility, with an estimated development cost of US$42bn. It is being advanced by a consortium led by Shell and Equinor, with participation from ExxonMobil, in partnership with the Government of Tanzania. The project is expected to monetise Tanzania's significant offshore natural gas reserves (estimated at 57 trillion ft^3), with first LNG production projected around 2034, subject to FID and execution timelines.

Tanzania LNG represents a next-wave African LNG project, with potential to unlock a new export corridor from East Africa. Its scale, sponsor strength, and resource base position it as a critical future supply →

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source for global LNG markets, while also offering domestic economic benefits through infrastructure development, government revenues, and natural gas utilisation.

Southern Africa

Mozambique LNG (Mozambique)

The Mozambique LNG project (led by TotalEnergies) is a 12.9mn mt/year development that was suspended in 2021 due to security issues. In November 2025, TotalEnergies confirmed preparations to lift force majeure and restart the project, with ongoing engagement with the Government of Mozambique and export credit agencies to re-mobilise contractors and financing. The lifting of force majeure and restart of Mozambique LNG represents a significant near-term upside for Southern Africa's natural gas outlook. More broadly, it serves as a critical test case for African mega-projects, with its successful resumption and delivery likely to shape investor confidence in large-scale LNG developments across the continent.

Quiluma Field (Angola)

Angola's natural gas production is expanding, notably with the start-up of the Quiluma gas field in 2026, developed under the New Gas Consortium (NGC) and operated by Azule Energy (a 50:50 joint venture between BP and Eni). The project represents the country's first non-associated natural gas project and a key milestone in diversifying its hydrocarbon base. Initial production from Quiluma is 150mn ft^3/day, with output expected to ramp up to 330mn ft^3/day by the end of 2026. Natural gas is processed at the NGC treatment plant in Soyo (commissioned in 2025) and supplied to the Angola LNG facility for both export and domestic consumption, supporting power generation and broader industrial use. The project underpins Angola's efforts to diversify away from crude oil dependence, expand LNG export capacity, and increase domestic natural gas utilisation for economic development.

Some of the key actions from African Government to address supply security and market repositioning:

Government Actions	
Supply security	LNG imports (Egypt)
Market positioning	Export diplomacy (Nigeria, Algeria)
Energy resilience	Demand management (East Africa)
Fiscal reset	Arrears payments (Egypt), FX reforms (Central Africa)

Other Regional Actions	
Accelerating project execution	Mozambique, Angola
Leveraging existing infrastructure	Central Africa
Expanding LNG optionality	South Africa, Egypt
Repositioning Africa in global supply chains	Nigeria, Angola, Mozambique, Tanzania

Conclusion

Africa's relevance in the global Gas market has increased especially with the Strait of Hormuz crisis, which has accelerated Africa's positioning as a strategic Gas supply alternative. While the region is well positioned to take advantage of the opportunities, focus needs to be given to addressing delivery risks and project execution.

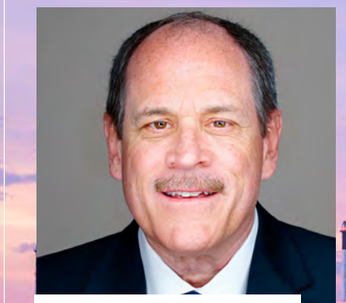
There is need to keep strengthening supply frameworks, advancing bankable cross-border infrastructure, mobilising financing, harmonising regulatory frameworks, and enhancing policy coordination to enhance certainty and transparency.

While future energy growth is anchored in countries like Mozambique, Angola and Tanzania as the gravity shifts towards the east and south of Africa, domestic Gas markets, particularly for power and the industrial sectors, are also becoming as important as exports and Nigeria exemplifies that positional shift. ●

INNOVATION IN EMISSIONS MANAGEMENT

From Detection to Accountability: Rethinking methane management in a changing energy landscape

How advances in methane detection, digitalisation, and integrated survey strategies are transforming leak management from a compliance function into a core pillar of decarbonisation.



PAUL WEHNERT
Executive Vice President
and Chief Customer Officer

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The global Gas industry is at a defining moment. As energy systems evolve to balance security, affordability, and decarbonisation, one issue has moved decisively to the forefront of both regulatory frameworks and public discourse: methane emissions. Methane is not only the primary component of natural gas-it is also a potent greenhouse gas. Its management has therefore become central to how the industry demonstrates environmental stewardship while maintaining its critical role in the global energy mix.

Increasingly, success is no longer measured by production efficiency alone, but by the ability to detect, quantify, and reduce emissions with precision and transparency. This shift is redefining expectations across the value chain. Operators must now demonstrate not only that they are managing emissions, but that they can prove it-consistently, accurately, and at scale.

This transformation is driving rapid innovation in Gas leak detection. What was once a compliance-driven field activity is now evolving into a data-driven, technology-enabled discipline that underpins the industry's broader decarbonisation strategy. Leak detection is no longer simply about identifying the presence of Gas-it is about enabling accountability, building confidence, and supporting measurable progress toward emissions reduction goals.

Historically, leak detection has relied on handheld instrumentation and walking surveys-methods that, while effective, are inherently limited in speed and coverage. As pipeline networks expanded and regulatory scrutiny increased, the limitations of these approaches became more apparent. Detecting leaks across vast, complex infrastructures using manual methods alone is resource-intensive and often reactive.

Recent progress has fundamentally changed what is possible. Advances in sensing technologies-particularly optical-based detection methods-have significantly improved sensitivity and selectivity. These technologies allow operators to identify methane and at lower concentrations and from greater distances, opening the door to new survey methodologies.

At the same time, mobile detection platforms have redefined how quickly large geographic areas can be assessed. Vehicle-based systems enable operators to cover extensive pipeline networks in a fraction of the time required by traditional surveys. This increase in speed is critical, not only for operational efficiency but also for improving the frequency and consistency of monitoring. →

Ultimately, the evolution of methane detection is about more than technology. **It is about building confidence**

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Equally important is the integration of detection with data. Modern systems now capture geospatial information, time-stamped records, and analytical outputs that transform raw measurements into actionable intelligence, such as Gas quantification and source localisation.

This creates a continuous feedback loop between field operations and decision-making processes.

This evolution marks a shift from reactive detection to proactive management. Instead of responding to isolated leaks, utilities can begin to identify patterns, recurring issues, and areas of elevated risk. Leak detection becomes not just an operational task, but a strategic function that informs maintenance planning, asset management, and regulatory reporting.

As methane emissions take center stage in global climate discussions, leak detection is increasingly tied to broader environmental performance. Industry frameworks and regulatory bodies are emphasising measurement, reporting, and verification-requiring operators to demonstrate not only detection but traceability. This introduces a new layer of complexity, where documentation and auditability are as important as detection accuracy.

Within this evolving landscape, companies with deep operational expertise are playing a critical role in translating innovation into practical application. Heath Consultants is one such example. With decades of experience supporting gas utilities, Heath has focused on integrating new technologies into real-world workflows-ensuring that innovation delivers measurable improvements in safety, efficiency, and compliance.

Rather than treating technology as a standalone solution, Heath's approach has emphasised integration. The company has contributed to advancing leak detection by aligning sensing technologies, field operations, and digital platforms into cohesive systems that address both operational and regulatory needs.

One of the most significant developments in this area has been the adoption of mobile methane detection. Heath's Discover AMLD® platform exemplifies how this shift is unfolding. By combining sensitive methane analysers with vehicle-based deployment and geospatial mapping, Discover AMLD enables rapid, large-scale surveys that were previously impractical.

The value of this approach lies in its ability to scale detection without sacrificing insight. Utilities can identify methane plumes across entire networks, gaining visibility into potential leak locations with greater speed and coverage. This allows for more efficient identification of issues and more targeted deployment of field crews for the leak investigation process.

Importantly, mobile detection enhances-not replaces-traditional methods. It acts as a screening layer, identifying areas that warrant further investigation. Field technicians can then use handheld instruments to verify and pinpoint leaks with precision. This layered approach improves overall system effectiveness while optimising resource allocation.

In parallel, the integration of digital tools is transforming how leak detection data is managed and applied. Platforms that aggregate, visualise, and analyse survey data provide operators with a clearer understanding of system performance. They also support audit readiness by creating a defensible record of detection activities.

Building on this foundation, integrated approaches are emerging that combine multiple detection methods into a unified strategy. Heath's HYBRID model represents this evolution. By bringing together industry first self-calibration, advanced leak detection and digital data integration, the HYBRID approach enables utilities to balance speed with accuracy while strengthening compliance and operational outcomes.

From a strategic perspective, this integration supports a shift toward risk-based leak management. Rather than applying resources uniformly, utilities can prioritise areas based on data-driven insights-focusing efforts where they will have the greatest impact. This aligns closely with broader industry trends toward predictive analytics and performance optimisation.

Digitalisation is a critical enabler of this transition. Cloud-based platforms allow for real-time data access, centralised reporting, and improved collaboration across teams. Advanced analytics can uncover trends that would otherwise remain hidden, informing both operational decisions and long-term planning.

At the same time, regulatory expectations are likely to continue evolving. As methane reduction becomes a key component of decarbonisation strategies, requirements for measurement and reporting will become more stringent. Operators will need systems that not only detect emissions, but provide clear, auditable evidence of performance.

This convergence of technology, data, and regulation is redefining leak detection as a system-level capability. It is no longer confined to the field-it is integrated into enterprise-wide strategies that connect operations, compliance, and sustainability objectives.

Ultimately, the evolution of methane detection is about more than technology. It is about building confidence-in the industry's ability to manage emissions responsibly and contribute meaningfully to the energy evolution. Transparency, accountability, and measurable progress are becoming the hallmarks of effective methane management.

For the global Gas industry, this transformation presents both a challenge and an opportunity. By embracing innovation and integrating detection technologies into broader operational frameworks, operators can demonstrate leadership in emission reduction while enhancing efficiency and reliability.

As the industry moves forward, the ability to detect, quantify, and act on methane emissions will remain a critical differentiator. Those who can translate data into insight, and insight into action, will be best positioned to meet evolving expectations and sustain their role in the global energy system.

In this context, leak detection is no longer just a compliance requirement-it is a cornerstone of progress. From detection to accountability, the industry is redefining how it measures success, ensuring that methane management is not only effective, but demonstrably so. ●

GAS IN TRANSITION

BY THE INTERNATIONAL GAS UNION IGU

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