INTERNATIONAL GAS UNION
UNION INTERNATIONALE DU GAZ

Understanding Methane Emissions

AND WHAT THE GLOBAL GAS INDUSTRY IS DOING ABOUT THEM

The 32nd European Gas Regulatory Forum (also known as the Madrid Forum), which gathered key stakeholders across the European gas sector to discuss opportunities and challenges and to share information on European gas market regulations, took place during the first week of June. Discussions centered on the prospects for the next EU gas package (2020), including cutting methane emissions.

As requested by the Directorate General for Energy of the European Commission last year, Marcogaz and Gas Infrastructure Europe (GIE) led the development of a report presenting the current state of industry activity on methane emissions in the European Union (EU), and beyond. The report also proposes a set of recommendations and potential actions that the industry can undertake to further reduce its methane emissions.

The International Gas Union (IGU) was pleased to be among an impressive list of industry contributors to the report. The IGU's Global Group of Methane Experts, established in late 2016, was instrumental in sharing the most critical information on the issue from around the world.

We would like to take this opportunity to reiterate some of the key report findings and recommendations and to highlight the importance of continuing to reduce methane emissions from natural gas value chains.

Why Focus on Methane ?

The issue of methane emissions mitigation plays an important part in meeting global greenhouse gas (GHG) reduction efforts and contributing to meeting the Paris commitments.

Methane is the second most important GHG after carbon dioxide (CO_2). Its greenhouse gas effect is significantly stronger in the short term, which makes it a more potent short-term climate forcer than CO_2. However, it also has a much shorter mean life in the atmosphere of only 12 years, whereas CO_2 remains and accumulates over centuries.

Roughly 60% of total global methane emissions come from human activity, and the other 40% occur naturally. In order of magnitude, the biggest sources of anthropogenic (man-made) methane emissions are agriculture, fossil fuels and industry.

The oil and gas industry contributes roughly a quarter of the world's man-made methane emissions, and based on the 2017 assessment by the International Energy Agency (IEA), emissions are distributed roughly equally between the two sectors.

Natural gas combustion is highly efficient in its end-use applications of providing energy for cooking and heating, industrial use, fueling transport, and producing electricity. Almost all methane emissions occur before the gas reaches the burner tip.

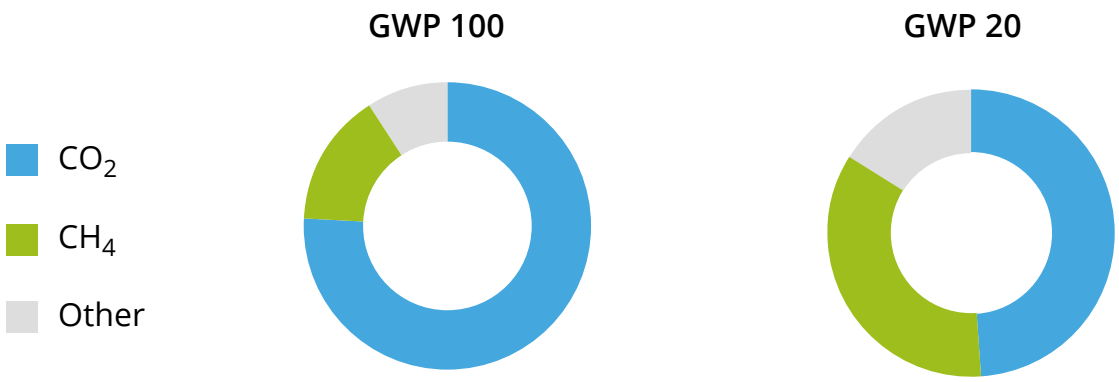
Global Warming Potential Factors

Let's also do a quick recap of an often-debated issue of how to account for the climate impact of methane. The most common choices are to calculate the Global Warming Potential (GWP) Factor over 20 years or over 100 years (GWP20 vs. GWP100).

What does that mean?

GWP is an index that allows the global warming impact of a greenhouse gas to be measured against CO_2, over a set period of time. In other words, GWP is an exchange rate for GHG's, converting them all to CO_2-equivalent units (CO_2-e) and providing a common unit for GHG inventories.

GWP100 has been the standard measure used by Intergovernmental Panel on Climate Change (IPCC) and most official GHG inventories, and it was arrived at as a compromise between the longer time frames suggested before and the shorter ones that some have promoted more recently. It also happens to align with the long-term climate change mitigation goals, allowing a more appropriate distribution of resources to meet these goals.



Depending on the timescale selected, there is a wide range of assessments of the climate change impact of methane relative to CO_2.

Recalibrating GHG impact estimates from 100-year to 20-year GWP values would hit the main methane emitting sectors like agriculture and energy harder, while reducing the burden on large CO_2 emitters, like coal generators.

It is important, because the selection of timescale dramatically redefines the climate problem. Using 20-year GWP values puts a much greater emphasis on short-lived gases like methane, while in relative comparison sharply reducing the weight of long-lived gases, particularly CO_2.

The choice of time horizon for GWP metric is an expression of policy preference, and it reflects a particular view of climate change mitigation. Focusing on a short time-period (e.g., 20 years) prioritizes the rate of climate change over its long-term magnitude. It places greater emphasis on avoiding abrupt, non-linear climate responses (so-called “tipping points”), rather than irreversible climate change over the long run.

Policies that aim to avoid long-term irreversible climate change through the Paris commitments need to be based on GWP100. Using GWP20 would alter that aim, by shifting the focus from the long-term magnitude to the short-term rate of change. That would smooth the short-term fluctuations, while missing the long-term temperature target, as CO_2 will continue to accumulate.

In sum, for an effective approach to emissions reductions and climate change mitigation, both short and long-lived forcers need to be addressed; and GWP100 ensures that the balance is maintained.

Safety Regulations, Reductions to Date, Uncertainties & Data Challenges

As the industry developed and matured, over the decades, regulations and codes have been enacted that require it to monitor and repair methane leaks and to modernize pipe and equipment with more efficient, lower emitting materials. These practices were largely driven by concern over safety. Despite the initial motivating factor, the net result was significant reductions of emissions, in both the EU and throughout the global industry.

Between 1990 and 2016, European oil and gas GHG emissions dropped by 38%, driven in large part by abated methane emissions in the natural gas sector. Notably, this happened while gas demand rose by a quarter. In the same period, the US distribution sector achieved a 70% reduction in emissions, while adding over 11mn km of pipeline connecting 20mn new customers. System-wide, the US emissions dropped by 18%, while production went up by 55%.

In other areas, like the Russian Federation, methane emissions have been taxable under ecological regulations since the 1980's and measurable reductions have been achieved – for example gas transit emissions dropped by 30%, while the gas grid expanded by 28%, in the 1990-2016 period.

But even though a lot has been accomplished, it is not enough, with the immense pressure of meeting the Paris agreement targets. The IEA's recent report on *Tracking Clean Energy Progress* noted that methane emissions reductions are not on track with their sustainable development scenario, and that:

> *Further innovation is needed both to increase understanding of emissions levels and to help reduce the cost of emissions mitigation strategies such as leak detection and repair.*

Detection and quantification challenges and data uncertainties remain at the core of the challenge for industry and regulators to enhance quantifiable reductions, the IEA says:

> *There is considerable uncertainty about oil and gas methane emissions levels, however, as estimates are based on sparse and sometimes conflicting data, and there is wide divergence in estimates at the global, regional and country levels.*

However, there is continuous progress in both science and technology, thanks to the surge of assessment and R&D activities over the last ten years.

North America was the origin of the rigorous analytical activity in this space, as initially spurred by rapid shale gas developments and the related fears – now addressed – of higher emission rates. This investigative activity then spread to the entire delivery network, and other regions such as Europe, where many studies are now underway, with

industry mobilizing efforts to achieve further reductions. Beyond Europe and the OECD, there remain gaps in knowledge however, and the next priority needs to be the expansion of these efforts to the other regions.

So, why is all this studying and analysis activity needed, and why not just get straight to reductions?

The simple answer is – you cannot reduce what you cannot accurately identify and quantify. Natural gas networks are vast and geographically diverse, spreading across thousands of square kilometers. They are a great and reliable asset, but one whose monitoring and maintenance needs sophisticated approaches.

Key Takeaways

FROM THE EUROPEAN REPORT BY GIE / MARCOGAZ

1 — The Industry is Committed to Seize the Opportunity

Today, more than ever, the prevention and mitigation of methane emissions is top priority for the natural gas industry. It makes good commercial sense, but beyond that, the industry considers this as an opportunity to actively contribute to solving the tough global environmental challenges and achieve a sustainable energy future, in which natural gas will play a vital role.

There are numerous collaborative industry initiatives working to improve the understanding of methane emissions and to identify reduction opportunities. These include, but are not limited to: the Methane Guiding Principles Coalition; Oil and Gas Climate Initiative; Global Methane Initiative; Natural Gas Star Program; Methane Challenge; ONE Future; Natural Gas Sustainability Initiative; IPIECA's methane work; and Climate and Clean Air Coalition.

Some of the industry participants in these groups have committed to voluntary reduction targets, while others focus on capacity-building and education and others again delve into reporting and mitigating. But they are all committed to supporting the development of science and technologies to accelerate progress. The GIE and Marcogaz report provides a valuable summary of virtually all these initiatives and includes a listing of available reduction targets.

And notably, it also identifies gaps that have yet to be addressed by the industry. This is very important: with so much activity all around the world, in different segments of the industry and across various groupings, this is an extremely valuable component of the report.

2 — Quantification: challenges, opportunities, and prospects

Invisible in a gaseous state (without special equipment), quantifying methane emissions is a difficult task. Nevertheless, over the years, the gas industry has developed several complementary approaches to assessing and quantifying methane emissions and continues to work on improving their precision.

In debates over quantification methodologies, it is common to see four major groupings: Measured or Estimated (or Modelled); and Top-Down or Bottom-Up. While each on its own is flawed, taken together they are complementary; and are continuously improving. There are substantial efforts by the industry, public bodies, and the scientific community to find the best ways to reconcile the four techniques, taking the best from each to improve the overall accuracy.

Measuring and Calculating vs Estimating, or Modelling

This is where methane emissions experts will get more technically picky about using the right term than a non-expert could think possible. Yet it is necessary, because getting these nuances right is a big part of solving the data puzzle.

When an expert refers to "measured emissions," they mean that someone, or something, has physically collected measurements in the field, by using some form of leakage detector, followed by some tool of measurement, such as "sampler bagging."

"Calculated" emissions are different: in this case, an event allows for a reliable calculation by simply using the known parameters, such as volume, time, and pressure.

"Bottom up:" With today's commercial technology options, the industry can model the overall emissions from the entire infrastructure with a high degree of accuracy.

As technology development continues and costs come down, it is likely that assessments, quantification and abatement methods will continue to evolve, and new combinations of techniques would emerge, to allow further zooming in on and driving down the emissions.

Reconciling Bottom-Up and Top-Down Methodologies

So in sum, the Bottom-Up approach, described above, is a source-specific emissions quantification from each individually identified source, which subsequently helps to get rid of these emissions at that identified source.

"Top-Down," is a complementary methodology. It takes an aggregate (often regional scale) assessment of an area, such as through flying an aircraft upwind and downwind of a study area, driving a car with a sensor nearby, or using a satellite to do so. Top-down is very useful for assessing the overall magnitude of emissions and identifying emission hotspots in a given area, but less so for quantifying these emissions. It is very difficult to

identify specific sources of the emissions captured by an aerial sample and to control for variations caused by weather (wind, precipitation, etc.) and sporadic temporal events, like maintenance activity.

One important goal for the industry is to identify effective ways of combining the two approaches. This is possible, and likely to become practicable in the not so distant future, as the recent work by the National Academies of Sciences showed.

Its study found that the time of day when the previous top-down measurements were taken coincided with significant maintenance activity, which caused an episodic release of methane and skewed the measurements. It therefore stressed the importance of finding ways to reconcile Top-Down and Bottom-Up measurements, and of taking into account important temporal factors.

3 — What the Industry is Doing About It

The European report provides an overview of the voluntary emissions reduction targets set by gas companies. These show the commitment of the companies and provide a reference for other companies wishing to set their own. We should note that targets can be tricky, because they must be based on a clear understanding of the baseline and of what is achievable. Thus, the reduction potential can vary greatly by geography, part of the value gas chain, and company.

The biggest takeaway from the GIE/Marcogaz report should be that the European gas industry is demonstrating the willingness to put its words into action.

The IGU gives its full support to defining these commitments and measuring our success in delivering them, and this can take many forms.

We would like to highlight one critical recommendation outlined in the report, and that is the “harmonisation of definitions and standards for common reporting.” The intent to propose a set of harmonised definitions and standards for reporting methane emissions, as well as ensuring that the data is comparable for the different parts of the gas value chain is not a trivial undertaking. However, it is a critical element for identifying and estimating what we want to reduce.

The industry also made clear its willingness to work with the regulators and other sector stakeholders to ensure the development of effective policies toward methane emissions in the EU.

By no means should that be the final point, but it is a very good start, and we look forward to working with our European colleagues and supporting them in their efforts toward reduction of methane emissions from the gas value chain and ensuring that gas continues to play a vital role in a sustainable and prosperous future.