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GIE Methane Emissions TF – Key messages on methane emissions

1 Introduction

Methane emissions have gained increasing attention over the last few years in the debate whether natural gas could contribute to meeting global climate change ambitions. Methane is a greenhouse gas (GHG) and an ozone (O_3) precursor. Even though methane emissions from gas mid-stream make only a marginal percentage of total emissions, GIE and its members are strongly committed to support the transition to a low-carbon society by minimising GHG emissions, and methane emissions in particular, released during their operation and maintenance activities.

The oil and gas industry represents only a small fraction of the main sources of methane emissions in Europe. According to the European Environment Agency (EEA), methane emissions from the gas chain represent 0.6% of the total Green House Gas (GHG) emissions[1]. Considering MARCOGAZ' position paper[2] "CH_4 emissions in the European Natural Gas midstream sectors" and the data provided by GIE members, the total amount of methane emitted from natural gas midstream activities (LNG terminals, underground gas storages and transmission grids) is estimated to be 0.062% of the total gas sales in Europe (EU 28). The total amount of GHG emissions caused by this emitted methane is estimated to be 0,1% of the total anthropogenic GHG emissions (CO_2 eq.) in Europe (EU 28).

Currently, many publications show a substantial uncertainty about the total methane emissions associated with the entire gas value chain. However, the publication "GHG intensity of natural gas" focused on the mobility sector found that emissions from the gas well to the downstream installation (excl. dispensing) account for 0.6% of the CNG supplied and 0.8% of the LNG supplied.[3]

GIE and its members are actively involved in technical initiatives. They provide necessary data to enable standardized, representative and transparent emissions mapping, quantification and monitoring, for the gas industry to agree on a common methodology and on a set of recommendations related to reducing methane emissions and to implement them.

The results of the efforts taken so far are clearly successful, as methane emissions are further decreasing (according to the EEA report).

[1] Annual European Union greenhouse gas inventory 1990–2015 and inventory report 2017:
https://www.eea.europa.eu//publications/european-union-greenhouse-gas-inventory-2017
[2] MARCOGAZ' position paper "CH4 emissions in the European Natural Gas midstream sectors"
http://www.marcogaz.org/index.php/component/docman/doc_download/5359
[3] According to the Sustainable Gas Institute report "Methane and CO_2 emissions from the natural gas supply chain – An evidence assessment", the majority of estimates lie between 0.5% and 3% of produced methane, while according to the EPA are around 1.5%.

2 Executive summary

Based on the evidences and experience of GIE members, a set of key messages related to the methane emissions from the mid-stream gas industry (transmission networks, underground gas storages and LNG terminals) have been developed. They are described as follows:

- The mid-stream gas industry is committed to the climate protection goals.
- GIE acknowledges that there is uncertainty regarding methane emissions. For this reason, GIE members strive to contribute to transparency via studies and initiatives on methane emissions in order to overcome the uncertainty about the total methane emissions from the entire gas value chain.
- Methane emissions from the gas chain represent a minor fraction of the overall anthropogenic methane emissions and are continuously decreasing.
- Gas infrastructure operators are strongly committed to minimizing methane emissions released during operation and maintenance activities and are implementing the best available techniques to achieve this goal.
- A common methodology (including the reporting methodology) and a set of recommendations related to the methane emissions are needed. For this reason, the gas industry is involved in several initiatives.
- Methane emissions from mid-stream constitute a marginal percentage of total emissions. Based on the MARCOGAZ' position paper "CH_4 emissions in the European Natural Gas midstream sectors" and the data provided by GIE members, methane emissions are estimated to be 0.05% from transmission networks, 0.01% from UGS and 0.002% from LNG terminals compared to the EU28 gas sales.
- Since the carbon budget accumulates over time, it is mandatory to reduce emissions as fast as possible.
- Natural gas is the fastest, cheapest and most efficient solution in meeting European climate goals and green gas emission reduction targets.
- An increased blending of biomethane, synthetic natural gas and "renewable" hydrogen with natural gas can play an important role in reducing overall GHG emissions and advancing in the energy transition. Furthermore, the gas system and its underground storages provide the flexibility needed to support a weather dependent wind and solar based energy system.

3 GIE Key Messages

GIE acknowledges that there is uncertainty regarding methane emissions. For this reason, GIE members strive to contribute to transparency via studies and initiatives on methane emissions in order to overcome the uncertainty about the total methane emissions from the entire gas value chain.

The literature shows a large range of methane emissions data across the natural gas chain. This is due to several factors, amongst others:

- Emission scopes and sources considered (fugitive emissions, flaring, venting, pneumatic, unburned methane in the stationary combustion sources, etc.);
- Methodologies and emission factors used;
- Top-down and Bottom-up methane emissions measurements;
- Different climate factors and time horizons;
- Conversion factors (density, gross calorific value, etc.);
- Pipeline distances;
- Maintenance and safety regulations;
- Basis for the calculations (production, demand, gas imported, etc.);
- Sources of data - The national inventory reports might be inconsistent with industry values and might be based on outdated figures.

For this reason, GIE members and the gas industry in general are contributing to increased transparency via studies, analysis and initiatives[4] on methane emissions in order to overcome the uncertainty about methane emissions from the entire gas value chain. Moreover, they are cooperating to improve the quality of the data by releasing relevant data and they can prioritise the methane reduction areas.

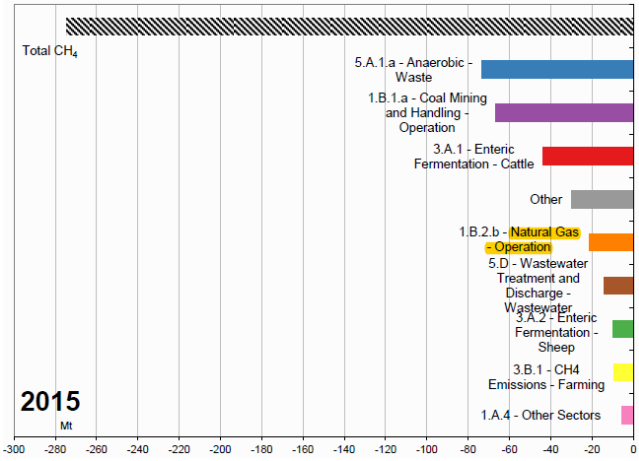
Methane emissions from the gas chain represent a very small fraction of the overall anthropogenic methane emissions and are significantly and continuously decreasing.

In the past, the scientific research dealing with climate policy used to focus mainly on carbon dioxide (CO_2), but these emissions represent only one of the ways in which human activities affect global climate. Methane (CH_4) and other GHGs (summarized within the "basket of six" greenhouse gases) also play a significant role. In this context, Member States already report their emissions to the United Nations Framework Convention on Climate Change (UNFCCC) and to the European Commission (EC), under the greenhouse gas monitoring mechanism.[5]

[4] NGVA report "GHG intensity of natural gas"; MARCOGAZ' reports on methane emissions from gas infrastructures; UNECE questionnaire on methane emissions; IEA questionnaire on methane emissions, etc.

[5] Decision 2000/479/EC Decision on the implementation of a European pollutant emission register (EPER) according to Article 15 of Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC).

Figure 1 - Absolute change of CH_4 emissions by large key source categories 1990 to 2015 in CO_2 equivalents (Mt) for EU-28 and Iceland and shares of largest source categories in 2015

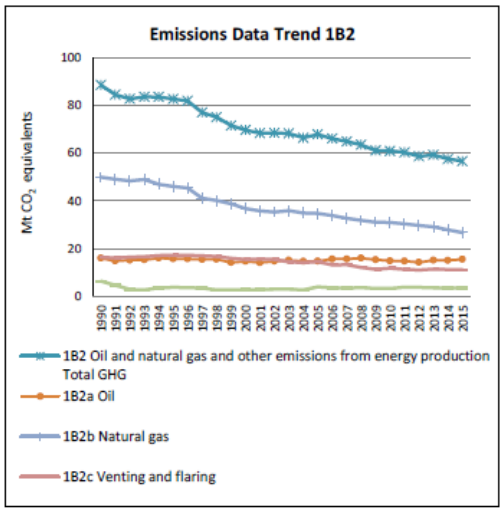


Source: EEA - Annual European Union GHG inventory 1990–2015 and inventory report 2017

According to the EEA greenhouse gas inventory for the EU published in 2015, total methane emissions were reduced by 37% since 1990 and represented 11% of the total GHG emissions in the EU in 2015.

From 1990 to 2015 methane emissions of the natural gas sector[6] have decreased more than 21 million tonnes CO_2 equivalent (see Figure 1 and Figure 2), representing a 48% reduction. They only accounted for 0.6% of the total GHG emissions (EU-28 and Iceland). The magnitude of such a reduction can be illustrated comparing it to equivalent emissions of passenger vehicles. A reduction of 20 million tons of CO_2 would be equivalent to the removal of more than 8 million passenger vehicles from the road in Europe.[7]

Figure 2 - 1B2-Fugitive Emissions Oil and Natural Gas: Trend



Source: EEA - Annual European Union GHG inventory 1990–2015 and inventory report 2017

[6] Methane from source category 1.B.2.b. Fugitive emissions from natural gas correspond to emissions from all sources associated with the exploration, production, processing, transmission, storage and distribution of natural gas.

[7] If a car emits 123.4 g CO_2/km, with an average daily driving distance of 55 km: http://ec.europa.eu/clima/policies/transport/vehicles/cars_en

Gas infrastructure operators are strongly committed to minimizing methane emissions released during operation and maintenance activities and are implementing the best available techniques to achieve this goal.

Figure 2 reflects the result of the efforts that the gas industry has made to design and develop accurate methane detection and measurement technologies and to implement methane emissions reduction technologies and practices. The implementation and utilisation of the "best available techniques" and an effective maintenance of the infrastructure contribute significantly to methane emissions reduction. Some examples[8] of the measures that have already been implemented by GIE members are:

- Pumping and recompression of the gas in the pipeline before a maintenance work requesting to empty them, instead of venting;
- Replacement of the valves driven by gas actuators by either electric or compressed air valves;
- Direct inspections and maintenance of the underground pipelines and above ground installations (such as Leak Detection and Repair programs);
- Replacing wet seals by dry seals;
- Hot taps for in-service pipeline connections;
- Composite wrap repair for non-leaking pipeline defects (supressing the need for venting);
- Electric motor starters in compressors;
- Electrical driven chemical plants;
- Converting gas pneumatic controls to instrument air;
- Eliminating unnecessary equipment and/or systems;
- Optimising the operation and managing to align it with the maintenance works in order to reduce venting.

GIE members are committed to have an active policy on methane emissions reductions.

A common methodology and a set of recommendations related to methane emissions need to be developed.

Although gas companies are implementing various methods and carrying out economical efforts to reduce their emissions, it is urgent to establish a common methodology for assessing methane emissions and a set of recommendations for reducing them. That would help reduce the uncertainty of the data and make it comparable.

Recent and actual measurements and updated correlation factors will provide significant improvements for data quality and will most likely show lower emission levels than currently reported.

In addition, current mapping, quantification and monitoring of methane emissions can be improved. GIE members are recommended to be involved in reporting initiatives, providing necessary data to enable standardized, representative and transparent emission mapping when required.

GIE would like to highlight the uncertainty provided via the National Inventory Reports (NIR) submitted by national Governments to the EC and to the UNFCCC mainly due to the calculation of emissions based on coefficient calculations in the NIR instead of using actual measurements. There is a lack of standards in collecting the data and of a harmonised methodology that lead to discrepancy.

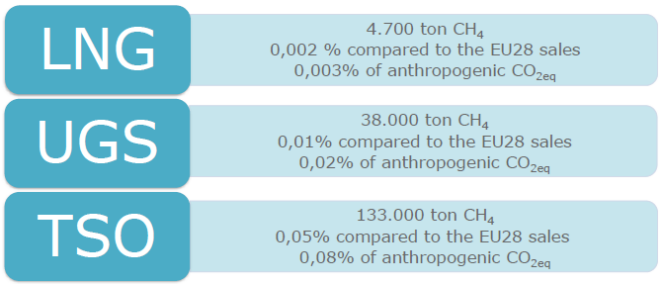
[8] GIE members choose within the different available techniques the most cost-effective solution in each case. This does not mean that all the GIE members have implemented all these measures.
MARCOGAZ is working on a report on Best Technologies and Practices to reduce CH_4 emissions.

GIE members are proactively cooperating closely with the National Authorities: firstly, they check the national inventory reports for correctness in order to improve their accuracy and secondly, they provide new and actual measurements methods for facilities.

Methane emissions from mid-stream constitute a marginal percentage of total emissions

Based on the MARCOGAZ' position paper "CH_4 emissions in the European Natural Gas midstream sectors" and the data provided by GIE members, the total amount of methane emitted from natural gas midstream activities (LNG terminals, underground gas storages and transmission grids) is estimated to be 0.062% of the total gas sales in Europe (EU 28). The total amount of GHG emissions caused by the methane emitted is estimated to be 0,1% of the total of anthropogenic GHG emission (CO_2 eq.) in Europe (EU 28).

Table 1 – Methane emissions in 2015 in the gas midstream sector



Source: MARCOGAZ' position paper "CH4 emissions in the European Natural Gas midstream sectors"

According to NGVA report "GHG intensity of natural gas" and the data provided by GIE members, methane emissions from transmission networks and underground gas storages represent 0.058% of the gas annually transported. In the case of LNG terminals, methane emissions represent 0.003% of the technical capacity per year (2015 data).

This report shows that emissions from the well to tank (to compare the values emissions from dispensing are excluded) for the natural gas and LNG pathways in Europe are 0.6% of the CNG supplied and 0.8% of the LNG supplied:

Table 2 – Methane Emissions - CNG supply – weight percentage (wt.%) related to CNG dispensed in the tank

[g CH_4 / g $CNG_{in\ tank}$]	CNG Supply [wt.%]
Gas transmission, storage and distribution	0.209 wt.%
Feedstock transportation (Pipeline, LNG carrier)	0.100 wt.%
Gas production, processing and liquefaction	0.291 wt.%

Source: NGVA report "GHG intensity of natural gas"

Table 3 – Methane Emissions - LNG supply – weight percentage (wt.%) related to LNG dispensed in the tank

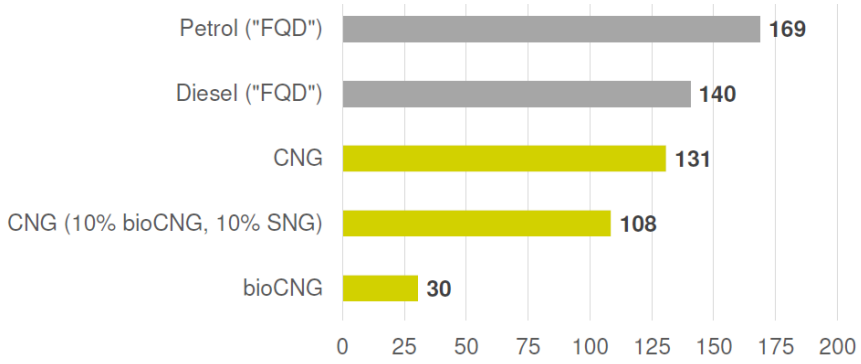
[g CH_4 / g $LNG_{in\ tank}$]	LNG Supply [wt.%]
Gas transmission, storage and distribution	0.002 wt.%
Feedstock transportation (Pipeline, LNG carrier)	0.021 wt.%
Gas production, processing and liquefaction	0.840 wt.%

Source: NGVA report "GHG intensity of natural gas"

Emissions reduction can be achieved thanks to the possibility of transport and use of biomethane, synthetic natural gas and renewable hydrogen in combinations with natural gas.

Natural gas is not only the cleanest, most efficient and versatile of fossil fuels and can reduce carbon emissions immediately by replacing other fossil fuels, but the uptake and utilisation of green gases injected into the gas system further reduces the carbon footprint of the natural gas sector. Besides being renewable fuels, green gases bear many advantages when integrated in the gas system. They can be produced with a nearly constant output and quality. They can be stored, traded, transported efficiently over long distances at low costs through existing networks and storages, and they can provide flexibility to intermittent energy resources. The gas infrastructure operators are prepared and committed to accommodate the injections of these gases in their systems. Furthermore, the production of biomethane and synthetic natural gas also provides societal benefits such as production of energy from waste streams and local employment.

Figure 3 – WTW emissions in g CO_{2eq}/km



Source: NGVA report "GHG intensity of natural gas"

Additionally, the gas industry works together with the agricultural sector – the largest methane emitter – to solve a societal problem by blending the upgraded biogas with natural gas and therefore reducing the emissions from that sector.

Combining these inherent properties with the increasing production of renewable gases, its wide range of application possibilities and its competitive cost of supply, natural gas must be considered a critical part of the European energy mix, which will strongly contribute to reaching greenhouse gas emissions reduction targets whilst ensuring Europe's competitiveness on a global level.

Annex: Reference to the World Energy Outlook 2017

World Energy Outlook Report 2017 (WEO 2017) includes a detailed focus on natural gas and its chapter 10 specifically focuses on the environment and emissions for natural gas.

According to WEO 2017, the case for natural gas encompasses a strong environmental dimension. The combustion of natural gas releases around 40% less CO_2 than the combustion of coal and about 20% less than burning of oil. However, methane emissions along the natural gas value chain may threaten to reduce the climate benefits of using natural gas, unless they are reduced significantly.

The WEO 2017 estimated the global gas related emissions in 2015 to about 42 Mt corresponding to an emission intensity for gas of 1.7% – that is the average percentage of gas that is lost to the atmosphere before it reaches the consumer. These emissions come from a wide variety of sources along the gas value chains: from production, processing of gas, as well as from its transmission and distribution to end-use consumers. Some emissions are accidental, i.e. because of a faulty seal or leaking valve, while others are deliberate, often carried out for safety reasons or due to the design of the facility or equipment. IEA estimates that it is technically possible to reduce these emissions by roughly 75% and that reduction in the range of 40-50% can be implemented at no net costs i.e. paying for them self from the methane recovery.

The issue of methane emissions grew in prominence as the unconventional oil and gas production began to take place in USA. Several studies have improved the knowledge of emission levels in recent years not only in USA, but also in Russia and Europe. IEA stresses that additional focus is needed in this area worldwide to reduce the emissions both on voluntary and regulatory basis. Furthermore, IEA highlights the need for improved studies and more standardized methods to increase the reliability and reduce the uncertainty of the studies. There is already work being done to both improve the top-down and bottom-up methods, but also to combine the two methods.