Fugitive Methane Emissions

Global methane emissions are estimated to amount for approximately 570 million tonnes of methane[1] and to represent roughly 20% of total greenhouse gas ("GHG") emissions in CO_2 equivalent[2]. Fugitive methane emissions ("FME") from fossil fuels account for just 20% of these methane emissions[3], or about 5% of total GHG emissions in CO_2 equivalent and fugitive methane emissions from natural gas activities specifically are responsible for about 40 Mt of methane[4] (or about 1.5% of global GHG emissions).

Over the years, the growing awareness of the environmental importance of methane emissions has led some governments to adopt countervailing measures. Notably, (i) the USA's EPA has established reporting requirements and (ii) Russia adopted legislative measures to limit methane emission in 2009, including reporting requirements and restrictions on flaring and taxes on methane emissions[5].

The EU has, however, remained largely inactive so far on the specific issue of methane emissions and, over the past 30 years, the only European countries to have adopted strong regulatory measures specifically against (fugitive) methane emissions are Norway, Finland, Italy and the UK[6]. However, the Commission has now committed to addressing this issue; its action relates not just to energy-related emissions but also, for example, those from agriculture, which are far more significant.

Methane is a more potent greenhouse gas than CO_2 but is short-lived. On a 100-year time horizon (the standard adopted by the IPCC), it is between 28 and 36 times more powerful than CO_2[7].

The production, transport and use of natural gas can entail the production of GHG relating to the energy used as part of the extraction and transport process, as well as venting, flaring and leaking of CO_2 and methane. The diagram hereunder illustrates the relative proportion of these elements in the total indirect GHG emissions (which include fugitive emissions) of natural gas activities[8].

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1 Estimates of methane emissions are subject to a high degree of uncertainty, but the most recent comprehensive estimate suggests that annual global methane emissions are around 570 million tonnes (Mt). This includes emissions from natural sources (around 40% of emissions), and those originating from human activity (the remaining 60% – known as anthropogenic emissions). See the IEA's methane tacker, panel "*Methane and climate change*".

2 These estimates depend (i) on the CO_2 equivalent factor taken to convert tonnes of methane in tonnes of CO_2 and (ii) the estimate for worldwide methane emissions both of which vary widely from one estimate and are associated to considerable uncertainties. To give one data point, based on estimates for methane, carbon dioxide and nitrous oxide emissions from 'Our World in Data', and incorporating estimates of their relative climate change effect (CO_2 equivalent conversion rate), in 2012, this was around 17.2%. IEA

3 See the IEA's graph on sources of methane emissions.

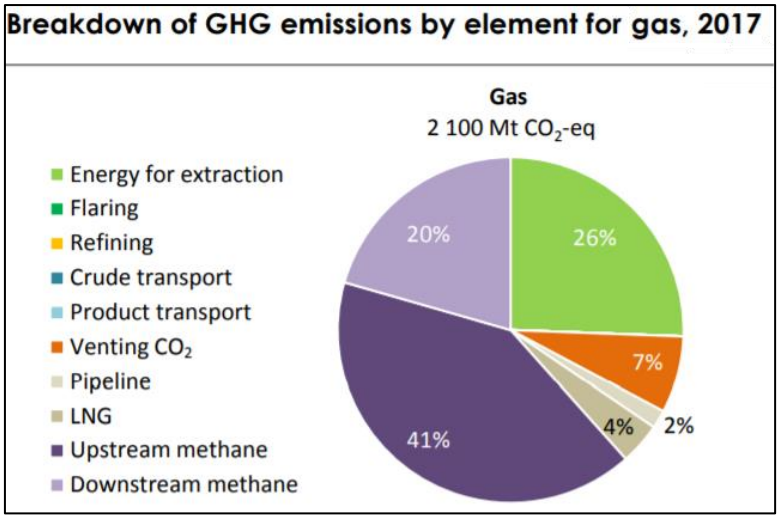
4 See the IEA's methane tracker, panel on oil and gas emissions.

5 C. Le Fevre, *Methane Emissions: from blind spot to spotlight*, Oxford Institute for Energy Studies, June 2017, available here, spec. p. 26.

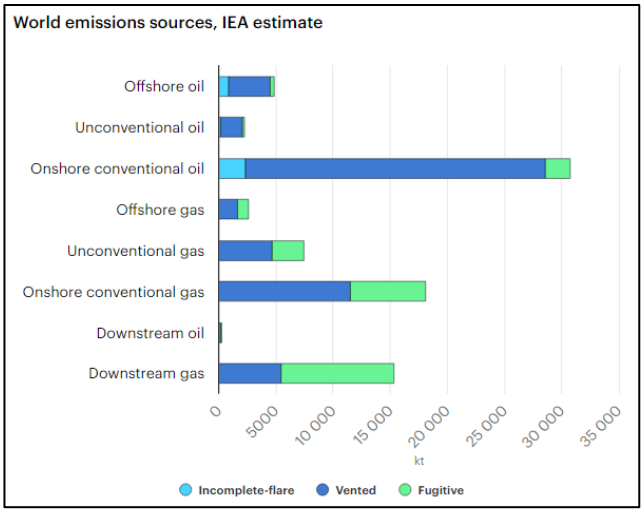
6 See the IEA's policy database.

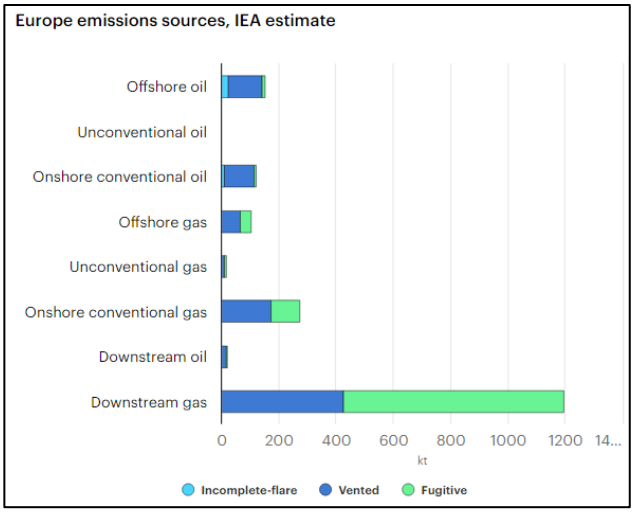
7 According to the IEA's methane tracker: "*the Intergovernmental Panel on Climate Change (IPCC) has indicated a GWP for methane between 84 and 87 when considering its impact over a 20-year timeframe (GWP_{20}) and between 28 and 36 when considering its impact over a 100-year timeframe (GWP_{100}). This means that one tonne of methane can be considered to be equivalent to 28 to 36 tonnes of CO_2 if looking at its impact over 100 years.*"

8 Modified version of the graph from the IEA 2018 World Energy Outlook states, p. 477-487.



Indirect and fugitive methane emissions vary widely according to the type of natural gas considered. The figures below show methane emissions sources for both the World and Europe. Worldwide, onshore conventional gas is responsible for the largest amount of estimated indirect and fugitive methane emissions whereas. In Europe, downstream gas accounts for the largest proportion of emissions.





In addition to the type of natural gas considered, it is also widely recognized that the amount of fugitive (or vented) methane emissions emitted during the gas extraction process differs significantly between countries, depending in particular on the regulatory environment, notably in countries where regulations are lax[9] and where, for example, significant amounts of flaring still takes place. Furthermore, it is widely acknowledged that fugitive emissions are largely caused to a number of 'super-emitters', i.e. sites and infrastructures that, due to abnormal processes or conditions, emit high amount of unintended fugitives GHG emissions[10].

One of the key issues regarding FME is the lack of objective data. An ongoing study has been commissioned by the Commission aimed at providing a greater degree of reliable objective data, whose delivery is expectedto be soon published . In addition, the Commission contributes to the UN Climate & Clean Air Coalition Mineral Methane Initiative[11], which *inter alia* is focussed on collating data. Through the use of satellites, considerable data can be collected in addition to that provided by individual countries, particularly to identify 'super emitters' sites.

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9 See, for example, this New York Time special reporting, this bio geoscience study.

10 Zavala-Araiza, D., Alvarez, R., Lyon, D. *et al.* Super-emitters in natural gas infrastructure are caused by abnormal process conditions. *Nat Commun* **8,** 14012 (2017). https://doi.org/10.1038/ncomms14012

11 https://www.ccacoalition.org/en/news/global-alliance-significantly-reduce-methane-emissions-oil-and-gas-sector-2030

The following summarises the options are available to address this issue:

- Option 1. Improved transparency and reporting

At present, the reporting obligation in place stems from the Paris Agreement. The IPCC identifies three 'tiers' of information provision. Roughly speaking, Tier 1 means that a signatory country simply declares the level of FMR emitted in its territory without substantive justification. Tier 3 requires reporting on a verified plant-by-plant approach.

An approach to improving measurement, reporting and transparency would be the establishment of a body or 'institution' that would be permanently responsible for collecting and verifying data and ensuring transparency. Whilst ideally any such institution would be international in nature (given that most gas comes from outside the EU), it remains to be determined whether, and how, this might be achieved.

- Option 2. 'Diplomatic' action

According to the IEA, at least 50% of global (fugitive) methane emission from natural gas activities could be saved by using technologies and approaches that would pay for themselves through the captured methane that can be sold[12]. By a mixture of:

(i) applying strict regulatory measures on reporting, and

(ii) providing the right information to industry actors about the win-win technological options available, significant FME emissions could therefore be abated rather easily and at little cost.

This would be a 'quick win' if the countries with a large number of super-emitters or with outdated and carbon-inefficient extraction techniques could be persuaded to take the robust action necessary.

- Option 3: Applying taxes or quotas reflecting the level of FME

Under such an approach a border tax could, for example, be imposed on gas in proportion of its GHG potential from FME, based on the current ETS price.

Such an approach has clear merits, as it is important that GHG emissions are fully incorporated into energy pricing as part of energy sector integration.

However, it also has potential drawbacks, at least in the short-term, and these will need to be taken into account in determining the correct approach.

Firstly, gas is to some extent a 'fungible' commodity. If the EU were to introduce taxes/quotas, the 'good gas' may be diverted to the EU whereas the 'bad' gas would go to markets with less strict regulatory requirements. This would deprive the EU of any influence to persuade 'bad' gas producers to improve regulatory standards, and may therefore actually be counter-productive[13]

Secondly, political and strategic implications of taxing gas from certain countries or regions would need to be fully taken into account. Applying a tax/quota approach may have unintended consequences in terms of energy security and the stability of countries bordering the EU.

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[12] The IEA 2018 World Energy Outlook states, p. 426: "*With 2015 gas prices, some 50% of methane emissions (38 Mt) could be avoided just by using technologies and approaches that would pay for themselves through the captured methane that can be sold. Further reductions would start to rely on technologies or approaches that would cost money rather than saving it, either because the gas cannot be monetised (if it is flared for example) or because capital and operating costs are larger than the revenue that would be received from selling the gas recovered*".

[13] Reaching a conclusion on this issue requires, however, a better understanding of the extent to which gas flows would in reality be physically able to divert to alternative markets.