Consultation on legislation to measure and mitigate methane emissions in the energy sector

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Introduction

This consultation aims to collect views and suggestions from stakeholders and citizens with respect to a policy proposal for a legislative act to further reduce methane emissions in the energy sector planned for 2021, as announced in the Communication on an EU strategy to reduce methane emissions, adopted on 14 October 2020 (hereafter 'the Communication')[1].

Current policies for non-CO2 emissions are projected to reduce methane emissions in the EU by 29% by 2030 compared to 2005 levels. However, the 2030 climate target plan's impact assessment[2] concluded that stepping up the level of ambition for reductions in greenhouse-gas emissions to at least 55% by 2030 compared to 1990 would also require an accelerated effort to tackle methane emissions. The EU has reduction targets for 2030 for all greenhouse gases, with anthropogenic methane emissions covered by binding national emission reduction targets under the Effort Sharing Regulation (ESR)[3]. However, there is currently no policy dedicated to the reduction of anthropogenic methane emissions from the energy sector.

The specific objectives of the policy proposal are two-fold: i) to improve the availability and accuracy of information on the specific sources of methane emissions associated with energy consumed in the EU, and ii) to put in place EU obligations on companies to mitigate those emissions across different segments of the energy supply chain.

Point i) on improving information relates to the actions outlined in the Communication on the methane strategy on compulsory measurement, reporting, and verification (MRV) for all energy-related methane emissions at company-level, building on the methodology of the existing global voluntary initiative called the Oil and Gas Methane Partnership (OGMP[4]), which covers the upstream oil and gas sectors. As made clear in the Communication, the Commission is actively promoting the widespread implementation of the MRV framework devised by OGMP, considering it the best existing vehicle for improving MRV capability in the energy sector. In addition, the Communication announces that the Commission is working to extend the OGMP framework to more companies in the gas upstream, midstream and downstream (via OGMP 2.0), as well as to the coal sector and closed or abandoned sites.

Point ii) on mitigation relates to the action in the Communication on the methane strategy on an obligation to improve leak detection and repair of leaks (LDAR) on all fossil gas infrastructure, as well as any other production, transport or use of fossil gas, including as a feedstock; and to the action on eliminating routine venting and flaring in the energy sector covering the full supply chain, up to the point of production. The basis of all policy options to be assessed by the Commission in the area of mitigation will be measures to conduct leakage detection and repair and measures to eliminate routine venting and flaring according to prevailing and emerging best practices, including from industry, across different segments of the supply chain.

Variations in options could be in terms of sectoral scope (thus, going beyond the scope of fossil gas and also including oil, coal and biogas/biomethane) and supply chain coverage (including or not including imports), as well as the types of methodologies and/or some of the key elements of methodologies, such as the frequency of checks, standards, as appropriate.

As also highlighted in the Communication, methane emission standards, targets or other such incentives based on robust scientific analysis can play an effective role to ensure methane emission reductions in the EU and globally. The Communication announces that the Commission will examine all the options available, informed by the work of the foreseen independent international methane emissions observatory - building on the methane supply index, and that in the absence of significant commitments from international partners on methane emissions reductions, the Commission will consider proposing legislation on targets, standards or other incentives to reduce methane emissions from fossil energy consumed and imported in the EU.

[1] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on an EU strategy to reduce methane emissions (COM(2020) 663 final) https://ec.europa.eu/energy/sites/ener/files/eu_methane_strategy.pdf

[2] EU 2030 climate target plan Impact Assessment, https://eur-lex.europa.eu/resource.html?uri=cellar:749e04bb-f8c5-11ea-991b-01aa75ed71a1.0001.02/DOC_2&format=PDF

[3] Regulation, (EU) 2018/842.

[4] The Climate and Clean Air Coalition created a voluntary initiative to help companies reduce methane emissions in the oil and gas sector. The Oil & Gas Methane Partnership was launched at the UN Secretary General's Climate Summit in New York in September 2014. https://www.ccacoalition.org/en/activity/ccac-oil-gas-methane-partnership

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1. Types of instruments

Most jurisdictions with methane-specific oil and natural gas regulations have relied heavily on prescriptive requirements (such as MRV, LDAR or restrictions on flaring or venting) to achieve emissions reductions. An alternative approach to regulating methane emissions in the energy sector is via performance-based requirements, which establish a mandatory performance standard on regulated entities (such as targets set at the level of individual companies for a specific piece of equipment or facility, or a flaring efficiency standard) but do not dictate how the target must be achieved.

In a recent report delivering recommendations on methane regulations[5], the IEA states that while performance-based requirements can produce more economically efficient outcomes, such approaches often require thorough methane estimates or measurements requirements and a developed and robust measurement and reporting scheme. This is particularly the case for performance-based requirements applied at a wide-scale, such as a company-wide or facility-wide performance target. The IEA therefore recommends that prescriptive requirements (such as MRV, LDAR and restrictions on venting and flaring) can serve as a useful first step on the path to more flexible and economically efficient regulations because they are relatively simple to administer for both the regulator and the firms as it is clear what must be done to comply and it is relatively easy for regulators to determine if the standard has been met. The IEA adds that such requirements have the potential for a significant impact on overall emissions but do not require an accurate baseline understanding of the level of emissions or a robust measurement and estimation regime.

[5] Driving Down Methane Leaks from the Oil and Gas Industry: A Regulatory Roadmap and Toolkit, January 2021. https://www.iea.org/reports/driving-down-methane-leaks-from-the-oil-and-gas-industry.

1.1 Do you agree with the policy design approach described above, notably to start off with prescriptive measuring and mitigation requirements in order to establish a robust measurement and reporting scheme, then consider performance-based requirements in a second step?

at most 1 choice(s)

- ☑ Yes, this is the correct way to develop effective methane regulations in the energy sector.
- ☐ No, this is not the correct way to develop effective methane regulation in the energy sector.
- ☐ Other answer.

Please justify your answer

bp supports the development of prescriptive requirements that focus on high priority activity types that are aligned with the OGMP 2.0 framework. New regulation should have an appropriate level of detail to allow some flexibility in the implementation of the requirements, especially where technologies are evolving or where alternate approaches exist to achieve the same goal. Example areas relevant here are LDAR, MRV and flares / vents.

We support the evaluation of performance-based requirements as a logical second step, with consideration of methane and CO2 emissions / intensity needed.

1.2 Do you consider that prescriptive mitigation requirements, in and of themselves, can be sufficient to drive further decreases in methane emissions in the energy sector in the EU?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

1.3 Do you consider that performance-based requirements are necessary to achieve significant methane emissions reductions in the energy sector?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

1.4 Do you agree that company or facility wide performance-based requirements need a robust measurement and reporting regime to function properly and that they require an accurate baseline understanding of the level of emissions?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

Another type of instrument that could be used to regulate methane emissions in the energy sector in the EU is an economic type of instrument, which induces action by providing a financial incentive, such as a subsidy or a tax deduction. For instance reduced taxes or targeted financial and fiscal incentives have already been put in place in some jurisdictions to stimulate abandoned mine methane projects[6].

[6] Legal and Regulatory Status of Abandoned Mine Methane in Selected Countries: Considerations for Decision Makers. US EPA. December 2018.

1.5 For each of the following sectors, do you think that such instruments should have a part to play to incentivise utilisation of methane in certain specific situations, such as when the incentives are lacking? Please justify your answer.

	Please provide your response here.
Oil	
Fossil gas	
Coal	
Biogas/biomethane	

Further questions related to the types of instruments are also included in section 3, in the case of a wider scope including fossil energy importers to the EU.

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2. Identifying models for an EU regulation on methane emissions in the energy sector

There are many regulations in place across the world which impose specific requirements with regard to methane emissions in the energy sector. Proposals for EU regulations should seek inspiration from tried and tested regulations which are considered as best practice and have delivered significant methane emission reductions over time. The Commission announced in the Communication that it intends to base its legislative proposals on MRV on the methodology of the OGMP, the already existing global voluntary oil and gas industry initiative, considering it the best existing vehicle for improving MRV capabilities of companies in the energy sector. There are however no comparable international or indeed European joint industry initiatives that companies have signed up to which commit those companies (albeit on a voluntary basis) to conduct LDAR campaigns or to limits on venting or flaring.

2.1 Do you support the intention of the Commission to base its legislative proposals on MRV for oil and/or gas on the methodology of the OGMP?

at most 1 choice(s)

- [x] Yes
- [ ] No

If no, please justify your answer

The OGMP is now established as the premier global voluntary initiative with a significant European bias in both leadership and company participation. It balances ambition with credibility and is therefore a great basis for EU legislation. A legislative link to the voluntary OGMP would help level the playing field for early signatories without needing to develop standalone requirements.

2.2 Are there any elements of the OGMP framework which you think the Commission should not replicate in its proposals/any elements not contained in the OGMP framework which the Commission should consider?

No

2.3 Are there any other methodologies/standards/voluntary frameworks on MRV relevant to oil and/or gas which the Commission should pay close attention to, and why? Please state.

2.4 Which existing regulations on MRV for oil and/or gas should the Commission also take into account, and why? Please state.

2.5 Are there any standards/ voluntary frameworks/ methodologies/ regulations on MRV relevant for coal methane emissions which the Commission should pay close attention to, and why? Please state.

2.6 Are there any industry standards/ voluntary frameworks/ regulations on MRV relevant for methane emissions from biogas and biomethane production which the Commission should pay close attention to, and why? Please state.

2.7 Which existing regulations on LDAR for oil and/or gas should the Commission also take into account, and why? Please state.

2.8 Are there any methodologies/standards/voluntary frameworks on LDAR relevant to oil and/or gas which the Commission should pay close attention to, and why? Please state.

2.9 Which existing regulations on limiting venting and flaring for oil and/or gas should the Commission also take into account, and why? Please state.

2.10 Are there any methodologies/standards/voluntary frameworks on limiting venting and flaring relevant to oil and/or gas which the Commission should pay close attention to, and why? Please state.

There is a lot of technical guidance on flaring and venting available through industry bodies such as IPIECA and IOGP, and through regulatory bodies in various jurisdictions.

The World Bank-led Global Gas Flaring Reduction (GGFR) initiative publishes guidance on flare reduction and management technologies. Additionally, the World Bank “Zero Routine Flaring by 2030” voluntary initiative provides a specific focus on routine flaring with a requirement to eliminate by 2030. It should be clearly acknowledged that flares are primarily safety devices, rather than gas disposal routes. Any new standards or requirements should suitably reflect that flaring can therefore not be eliminated completely.

The EU Hydrocarbon BREF guidance note includes a section on flaring and venting which covers techniques and approaches as well as BAT:
https://ec.europa.eu/environment/integration/energy/pdf/hydrocarbons_guidance_doc.pdf

https://www.worldbank.org/en/programs/gasflaringreduction
https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030
https://www.ipieca.org/resources/good-practice/preparing-effective-flare-management-plans-guidance-document-for-the-oil-and-gas-industry/
https://www.gov.uk/guidance/onshore-oil-and-gas-sector-guidance/8-flares-at-onshore-oil-and-gas-sites

2.11 Are there any methodologies/ standards/ voluntary frameworks/ methodologies/ regulations on mitigation of coalmine methane emissions which the Commission should pay close attention to, and why? Please state.

2.12 Are there any methodologies/ standards/ voluntary frameworks/ regulations on mitigation of methane emissions from biogas & biomethane production which the Commission should pay close attention to, and why? Please state.

3. Sectoral, emissions and supply chain coverage and/or scope

Sectoral scope

Other than the methane emissions occurring at the various stages of the oil and gas chain (as included, and described below, in the OGMP scope), other significant or non-negligible direct sources of methane emissions in the EU energy sector and which can clearly be attributed to specific activities include methane emissions from coal production and from biogas production/biogas upgrading into biomethane. For this reason, the Commission intends to assess the case for including those areas of the energy sector in its policy proposals on both MRV and methane emissions mitigation.

3.1 Are you supportive of the intention of the Commission to assess the case for including coal in its policy proposals on MRV?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

3.2 Are you supportive of the intention of the Commission to assess the case for including biogas/biomethane in its policy proposals on MRV?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

3.3 Are you supportive of the intention of the Commission to assess the case for including coal in its policy proposals on methane emissions mitigation?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

3.4 Are you supportive of the intention of the Commission to assess the case for including biogas/biomethane in its policy proposals on methane emissions mitigation?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

3.5 Are there any other forms of energy which you think that the Commission should consider including in its policy proposals on MRV? Please state and justify your answer.

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

3.6 Are there any other forms of energy which you think that the Commission should consider including in its policy proposals on mitigation of methane emissions? Please state and justify your answer.

While the initial OGMP voluntary initiative framework that the Commission has committed to basing its MRV obligations on exists for oil and gas upstream, the new OGMP framework (OGMP 2.0[7]) which was launched in October 2020 has an extended scope. Specifically, the new framework includes all segments of the oil and gas sector where “material” quantities of methane can be emitted. This includes upstream exploration and production, gathering and processing, liquefaction and regasification terminals, gas transmission, underground gas storage and distribution (gas downstream). This includes all assets and facilities along the gas value chain as well as oil exploration and production facilities where associated gas is co-produced, whether used, marketed or re-injected.

[7] Mineral Methane Initiative OGMP 2.0 Framework” https://ccacoalition.org/en/files/ogmp-20-reporting-framework-finalpdf

3.7 Do you consider that the scope of the EU regulation on MRV as regards oil and gas should at least cover the same scope as OGMP 2.0?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

3.8 Do you consider that the framework of OGMP 2.0 could serve as a good basis for developing obligations for MRV in the coal sector?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

3.9 Do you consider that the framework of OGMP 2.0 could serve as a good basis for developing obligations for MRV in the biogas/biomethane sector?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

Scope of emissions

The OGMP 2.0 framework applies to direct emissions of methane that occur from sources that are owned or controlled by the reporting company (also called scope 1 emissions as defined by the GHG Protocol Corporate Standard). The OGMP 2.0 framework does not cover end users. For example, methane emissions associated with oil refining and chemical manufacture (both considered by the OGMP methodology as ends users) as well as gas end use are currently not within the OGMP framework reporting scope.

3.10 Should the scope of the policy proposals on methane extend coverage to end users?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

Methane emissions can be categorised into three scopes. Scope 1 covers direct emissions. Scope 2 emissions (which are indirect emissions from the generation of purchased energy consumed by the reporting company) and scope 3 emissions (includes the indirect emissions resulting from the consumption and use of the reporting company's products) are not within the scope of the OGMP 2.0 framework. Scope 1, 2 and 3 emissions together cover the total emissions from a company's activities.

IPIECA (the global oil and gas industry association for advancing environmental and social performance) recommends the GHG Protocol scope 3 standard[8] to companies in the oil and gas industry wishing to report scope 3 emissions, advising that category 11 'Use of sold products' is the most relevant to the oil and gas industry and noting that there is a growing stakeholder interest related to scope 3 disclosures[9] . Some oil and gas companies are already reporting scope 3 emissions voluntarily.

[8] GHG Protocol establishes global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains and mitigation actions. https://ghgprotocol.org/standards/scope-3-standard

[9] IPIECA Sustainability reporting guidance for the oil and gas industry, March 2020.

3.11 Would you consider the Greenhouse gas Protocol: Corporate Value Chain (Scope 3) Accounting and Reporting Standard as an appropriate standard to serve as basis for EU legislation for scope 3 methane emissions?

at most 1 choice(s)

- [ ] Yes
- [ ] No

If no, why not, and which alternative standard could be considered?

3.12 In which end-use sectors do you consider that better information on methane emissions is necessary?

- [ ] Industry
- [ ] Power generation
- [ ] District heating
- [ ] Transport (e.g. maritime, please specify below)
- [ ] Residential
- [ ] Other

Please provide details if possible.

3.13 On which of the following appliances below do you think that better information on methane emissions would be welcome?

- [ ] Gas turbines
- [ ] Gas engines
- [ ] Gas boilers (industrial)
- [ ] Gas boilers (residential)
- [ ] Other, please specify below

Please provide details if possible.

3.14 Are you aware of national requirements (measurement and/or mitigation) regarding methane emissions from the following appliances?

- [ ] Gas turbines
- [ ] Gas engines
- [ ] Gas boilers (industrial)
- [ ] Gas boilers (residential)
- [ ] Other, please specify below

Please provide details if possible.

3.15 Should the provision of information on expected methane emissions by end-use appliances be mandated from manufacturers?

at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer

3.16 For power generation, should methane emissions be part of the emission threshold for generation under capacity market mechanisms?

at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer

Including exporters to the EU in the scope

The Communication highlights that the external carbon or methane emissions associated with EU fossil gas consumption (i.e. the emissions released outside the EU to produce and deliver fossil gas to the EU) are between three to eight times the quantity of emissions occurring within the EU. For oil, possibly even more of the emissions linked to oil consumed in the EU are occurring outside of the EU borders given that the largest share of methane emissions in the oil sector are occurring in the upstream segment whereas the largest share of methane emissions in the fossil gas sector are occurring in the downstream segment.

This means that if the EU wants to include in the scope of its regulation all of the methane emissions linked to its oil and gas consumption, it must consider either imposing obligations directly also on exporting companies of gas and oil to the EU or it could obligate importers of gas and oil into the EU. For instance, it could be examined whether obligations on MRV, LDAR and venting and flaring could somehow be extended to cover exporting companies of oil and gas, or even all fossil energy, to the EU.

3.17 Do you think that EU legislation on methane emissions in the energy sector should extend obligations to companies importing fossil energy into the EU/companies exporting fossil energy to the EU?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

3.18 Specifically, do you think it is feasible to impose the same obligations on MRV, LDAR and venting and flaring equally on all actors of the oil and gas value chain for oil and gas consumed in the EU, including actors from outside of the EU?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

In this context, and with reference again to performance-based requirements (see previous section) the Communication states that in the absence of significant commitments from international partners on methane emissions reductions, the Commission will consider proposing legislation on targets, standards or other incentives to reduce methane emissions from fossil energy not only consumed but also imported into the EU.

3.19 Would you be supportive of EU legislation imposing performance requirements on companies exporting fossil energy to the EU?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

Another means of incentivising methane emissions reductions from fossil energy imported into the EU which could either work in addition to extending MRV, LDAR and venting and flaring regulations to exporters or in isolation, could be to use market transparency tools which provide information on important emissions sources from around the globe, developed using available information from technologies that can provide accurate estimations or measurements of methane emissions such as satellite data, as well as emission data from bottom-up sources, such as inventory data.

The Communication highlights the contribution of the EU's Copernicus programme for earth observation towards improved indirect air surveillance and the monitoring of methane emissions, and suggests that Copernicus could contribute to an EU-coordinated capability for detecting and monitoring global super-emitters, which refer to a

specific site or facility with disproportionately high-emissions for a site or facility of that kind. Globally, 5% of methane leaks in the coal, oil and fossil gas sectors contribute 50% of the energy sector's emissions. Satellite technology is key to identifying these hotspots and guiding leak detection and repair on the ground as well as reconciling bottom-up data from company reporting.

The Communication also highlights that when launched in 2025, the Copernicus CO2-monitoring (CO2M) mission, which involves a constellation of three satellites, will support the identification of smaller and more prevalent sources of emissions.

The government funded International Methane Emissions Observatory, which the European Commission is currently in the process of setting up together with the United Nations Environmental Programme (UNEP), the Climate and Clean Air Coalition (CCAC) and the International Energy Agency, will be tasked with collecting, reconciling, verifying and publishing anthropogenic methane emissions data at a global level. It will also be tasked with compiling and publishing a methane-supply index (MSI) at EU and international level, composed using existing and reported data from countries' emissions inventories as well as satellite data and, in time, global data processed and published by the IMEO. The intention with this MSI would be to empower buyers to make informed choices on the methane intensity of fossil energy sources before the purchasing decision.

The MSI developed by the IMEO would be an example of such a market transparency instrument.

There seems to be an increasing need for such instruments, as interest in the environmental credentials of fossil energy companies increases, in particular as regards oil and fossil gas, in order to determine what role they could play in the transition towards carbon neutrality. There are recent examples of such an interest, specifically regarding the methane intensity of certain sources of fossil gas.

How such information could be used would then have to be explored. At the very least, coupled with data on imports of fossil fuels into individual Member States, it would allow purchasers, governments, citizens and consumers to have transparency on the methane intensity of fossil fuel imports, and would likely incentivise markets for low methane intensity fossil energy. At its most extreme, it could form the basis for conditioning imports of fossil energy into the EU according to a certain methane intensity. The widespread publication and recognition of such data could act as a strong incentive for operators to put in place effective regulations and to reduce their methane emissions.

Readings from Copernicus Sentinel 5P satellites of methane concentrations from across the globe are currently being processed to identify large sources of emissions such as from oil, gas and coal operations, and the results are being published in the media. This recently revealed for instance that the number of large methane leaks from the oil and gas industry globally rose by nearly a third in the first eight months of 2020[10]. Providing a platform for public access to such sources information, such as via the future web-site of the IMEO, in cooperation with satellites and data processing firms, and an instrument such as the MSI enabling purchasers of fossil energy to make more informed choices, could be considered very useful[11].

[10] https://www.reuters.com/article/us-climate-change-energy-methane/despite-green-plans-energy-sectors-methane-leaks-are-up-kayrros-idUSKBN26Z1DA

[11] Other transparency tools exist. For instance, the Canadian State of Alberta publishes an annual report that includes a list of oil and gas operators ranked by their flaring and venting emissions.

3.20 Are you generally supportive of the development of such methane transparency tools and the announced intentions of the Commission in this area, regarding the setting up of the IMEO and the development of a methane supply index?
at most 1 choice(s)

- [x] Yes
- [ ] No

If no, please justify your answer

3.21 How prominently do you think that such transparency tools should play a role in the future?
at most 1 choice(s)

- [ ] They should play a central role, and be the key instrument to provide the energy sector the incentives to reduce their methane emissions;
- [ ] They should play a role alongside and together with obligations on MRV, LDAR and limits on venting and flaring on exporters of fossil energy into the EU;
- [ ] They should play a role together with methane intensity standards on exporters of fossil energy into the EU;
- [ ] They should play a key role, alongside both prescriptive and performance based requirements on exporters of fossil energy into the EU;
- [ ] They should play no role.

Please justify your answer

4. Legislating on leakage detection and repair

Fugitive (unintentional) leaks represent one of the main sources of methane emissions from the gas and oil sectors.

It is widely considered that the main mitigation strategy for reducing emissions from fugitive methane leaks from pressurized equipment used in the oil and gas industry is a leakage detection and repair (LDAR) program.

Key elements of LDAR programs of importance for devising LDAR regulations are widely considered to be:

1. Instruments used for leak detection;
2. Frequency of LDAR campaigns;
3. Quantification of emissions;
4. Leak repair considerations, such as time taken between leak detection and repair.

4.1 Are there any other elements which should be considered key elements of LDAR programmes of importance for devising LDAR regulations?

at most 1 choice(s)

- [ ] Yes
- [x] No

If yes, please justify your answer

Instruments used for leak detection

While there are many instruments used for leak detection in the oil and gas industry, the use of optical gas imaging (OGI) cameras has become common. These are infrared imaging devices with optics, filters and cooled sensors made specifically for detecting methane which are used at close range during inspections carried out on foot. These devices produce an image that allows an otherwise invisible plume of leaked gas to be seen. Several types of these cameras are available with different minimum detection capabilities. OGI devices have become the standard leak detection device used by the regulatory LDAR programs required in North America in the upstream and midstream (i.e: gas processing plants) segments and are also recognised by many other jurisdictions [12][13]. In some jurisdictions, OGI cameras are equally recommended both in offshore and onshore facilities.

Other portable leak detectors such as Flame Ionisation Detectors are also sometimes used and allowed in regulations but tend to be used much less for a number of reasons[14].

Methane detectors more sensitive than OGI cameras are usually used in downstream industry segments because distribution system leaks are often smaller, and generally below the OGI detection threshold[15]. For small leaks, ultrasound detectors are recommended in some jurisdictions.

While close-range instruments using handheld Instruments are indispensable for identifying and documenting component-level fugitive sources, they are relatively labour intensive. Rather than relying exclusively on handheld instruments, regulations in Canada and the US are moving towards the integration of screening technologies. For

instance, fixed sensors, mobile ground labs, unmanned aerial vehicles, manned aircraft and satellites, which until now have been used for research-based applications and for monitoring other air pollutants are gaining interest as tools for LDAR[16].

[12] Potential ways the gas industry can contribute to the reduction of methane emissions, Report for the Madrid Forum (5 - 6 June 2019)

[13] Methane Guiding principles: Reducing Methane Emissions: Best Practice Guide on equipment leaks, November 2019

[14] Methane Guiding principles: Reducing Methane Emissions: Best Practice Guide on equipment leaks, November 2019

[15] Methane Guiding principles: Reducing Methane Emissions: Best Practice Guide on equipment leaks, November 2019

[16] A review of close-range and screening technologies for mitigating fugitive methane emissions in upstream oil and gas. Thomas A Fox et al 2019 Environ. Res. Lett. 14

4.2 Should EU legislation on LDAR include the type of device to be used for detecting leaks?
at most 1 choice(s)

- [ ] Yes
- [x] No

Please justify your answer

We recommend an outcome-based strategy in which performance standards are defined (e.g. limits of detection). However, regulations should be technology agnostic (subject to minimum standards / quality) to support innovation.

It is incumbent upon new technology to demonstrate equivalency to existing system performance based on outcomes. For example, moving rapidly between sites may reduce sensitivity, thus potentially missing smaller releases, but the faster response to larger emissions will still reduce overall methane losses.

4.3 Among the following devices, which should be recommended as the devices of choice in the following sectors and to what extent? – specify:

1. For highly recommended,
2. For recommended depending on the type of leak or other factor,
3. Not appropriate

	Production	Processing	LNG terminals	Transmission pipelines	Transmission compressor stations	Underground storage	Distribution pipelines	Distribution pressure regulating and metering stations
Optical gas imaging								
Flame ionisation detectors								
Ultrasonic detectors								
Fixed detectors								
Soap spray/soap bubble screening								
Bagging								
High flow sampler								
Mass flow meters								
Laser detectors								
Catalytic bead sensors;								

Semiconductor detectors								
Electrochemical detectors								
Cavity ring down spectroscopy								
Radial plume mapping								
Mobile gas chromatography								
Tracer gas release								
Mobile ground labs								
Unmanned aerial vehicles								
Manned aircraft								
Satellites								

Other (please specify)

Frequency of LDAR campaigns

The frequency of LDAR campaigns is an important determining factor for reducing fugitive emission. The more often they are carried out, the lower the release of fugitive emissions[17]. According to the Methane Guiding Principles[18], the US Environment Protection Agency considers that detection and repair in upstream and midstream operations can produce a 40% reduction in emissions from fugitive leaks if carried out once a year, a 60% reduction if carried out once every three months, and an 80% reduction if carried out once a month[19].

[17] Potential ways the gas industry can contribute to the reduction of methane emissions, Report for the Madrid Forum (5 - 6 June 2019), GIE-Marcogaz, page 108

[18] A voluntary, international multi-stakeholder partnership between industry and non-industry organisations with a focus on priority areas for action across the natural gas supply chain, from production to the final consumer. https://methaneguidingprinciples.org/who-we-are/

[19] Methane Guiding principles: Reducing Methane Emissions: Best Practice Guide on equipment leaks, November 2019

4.4 Should EU legislation on LDAR determine the frequency of LDAR campaigns?
at most 1 choice(s)

- [ ] Yes
- [x] No

Please justify your answer

LDAR scope and frequency should not be prescriptive but risk-based, site and activity specific, and informed by prior assessments.

Directed Inspection and Maintenance (as per OGMP TGD #1) moves the focus of LDAR to one that is both flexible and targeted. This, for example, recognises that the leakage sources tend to be weighted to certain processes, equipment, and components, and that therefore those areas of the plant / process should be the focus of LDAR. Likewise, areas without such leakage sources should be a lower priority. In practice, the LDAR programme should be informed by the results of previous surveys, equipment present, and experience, and should not be averaged across the facility. Equally, similar assets across a company portfolio may not require the same LDAR frequency / scope.

A minimum frequency of annual campaigns will be appropriate in most cases, but consideration of activity type and the sources present may warrant less frequent campaigns, e.g. pipelines and remote well pads with no wellsite equipment.

4.5 If you consider that EU legislation on LDAR should determine the frequency of LDAR campaigns, which of the following parameters are important to take into account and set into legislation? For each, please state the level of importance.

	Highly important	Moderately important	Neutral	Relatively unimportant	Completely unimportant	No opinion
The leak detection device/approach used	○	○	○	○	○	○
The type of potentially leaking component concerned	○	○	○	○	○	○
The results of previous LDAR campaigns	○	○	○	○	○	○
The cost-effectiveness of LDAR campaigns	○	○	○	○	○	○
The safety risk evaluation	○	○	○	○	○	○
The environmental risk evaluation	○	○	○	○	○	○
The operating pressure	○	○	○	○	○	○

Other? Please specify and rate the importance in the same terms as provided in the table.

4.6 Please specify the recommended frequency of LDAR campaigns according to the following type of potentially leaking component (in terms of frequency per year):

	Frequency per year
Valves	
Connectors	
Open-ended lines	
Flanges	
Control valves	
Pressure relief valves	
Pumps	
Compressor stations	
Regulating / reduction / metering stations	
Valve stations	
Measurement stations	
Gas delivery station	
Pressure regulating stations	
Metering stations	
City gate stations	
Other (please specify)	

Quantification of emissions

Emissions from fugitive leaks can be quantified either via models (using emission factors), via engineering estimations, or by direct measurement. To effectively estimate and reduce fugitive methane emissions, direct measurements via field surveys are considered of paramount importance[20].

[20] Potential ways the gas industry can contribute to the reduction of methane emissions, Report for the Madrid Forum (5 - 6 June 2019), GIE-Marcogaz, page 105

4.7 Should EU legislation on LDAR determine the methods to be used to quantify fugitive leaks?
at most 1 choice(s)

- [ ] Yes
- [x] No

Please justify your answer

Quantitative LDAR is an emergent science and the quality of data and ease of operation remain unclear. There is little data on performance from which to build approved methods. Any regulatory frame should recognise the current limitations whilst building flexibility for use of novel, emerging techniques.

Accuracy and quantification are less important in LDAR than finding and fixing, though the amount helps prioritising.

It should also be noted that the technology for quantifying is not via direct measurement of the methane source (such as bagging procedures, US EPA Method 21) and that environmental factors such as temperature and wind can directly impact the data quality. For example, for OGI cameras there needs to be a clear temperature differential between the background and source. Similarly, a "swirling" wind may create false volumes. This is especially relevant in the exposed offshore environment.

4.8 If you consider that EU legislation on LDAR should determine the methods to be used to quantify fugitive leaks used in LDAR campaigns, would you recommend that direct measurements via field surveys are used in all instances when it is technically feasible to do so?
at most 1 choice(s)

- [ ] Yes
- [ ] No

If no, please justify your answer

4.9 Can you list instances in which it is acceptable to estimate fugitive leaks via modelling or engineering estimations instead of direct measurements? Please specify.

The estimation of fugitives is acceptable where they are only a small source and represent only a small percentage of total emissions from a site.

4.10 Are there any cases in which direct measurements can never be used?
at most 1 choice(s)

- [x] Yes
- [ ] No

Please specify.

Direct measurement solutions are not available for subsea environments where it is physically impossible to take samples or image a leak.

4.11 If there are cases in which it is acceptable to estimate fugitive leaks via modelling or engineering estimations instead of direct measurements, do you agree that some harmonization in approaches used should be included in legislation?
at most 1 choice(s)

- [x] Yes
- [ ] No

Please justify your answer

Improvements are needed in the detail of emission factors. At present, the same component in two different jurisdictions could be assigned different methane emissions. Legislation should correct this discrepancy and harmonise emission factors across Europe. Diplomacy could support more global harmonisation.

4.12 If you answered yes above (to 4.11), please specify what elements of such approaches should be harmonized.

New empirically derived emission factors that reflect modern standards for valves etc.

Leak repair considerations

The time taken between leak detection and repair in LDAR campaigns has some bearing on the amount of methane emissions from fugitive leaks. It depends on many factors, including safety, environmental concerns, leak size, accessibility and cost-effectiveness considerations. In all segments of the gas and oil chains where LDAR campaigns are carried out, such considerations lead to a categorisation of urgency of actual repair following inspection and detection which spans from immediate repair to repair only after several years. For leaks that are not or cannot be repaired immediately, typically as part of LDAR campaigns, a number of details on the leak needs to be recorded which together will be used to determine when the leak should be repaired. After the repair, leaks can also be measured to verify the effectiveness of the repair, after which periodic controls can also be carried out, depending on the circumstances.

Safety considerations are often the key consideration, and both the frequency of leak monitoring and speed of action of leak repair are typically determined by elements which have a bearing on risk to safety. To take the example of gas distribution networks, this would include maximum operating pressure, location of leaking/potentially leaking component (characterised in terms of whether the leaking component is in a rural, urban/industrial location, or close to a building), numbers of leak (per km of pipeline), the risk of the leak leading to intoxication, burning or explosion. It is not clear whether there are requirements to repair all detected leaks across all EU jurisdictions. It is certainly at least theoretically feasible to imagine, given the traditional focus in the case of distribution networks on safety considerations, that very low risk leaks are left unrepaired for many years or indefinitely, leading to high levels of actual methane fugitive emissions over time.

4.13 Should EU legislation on LDAR impose a requirement to repair all detected leaks?

at most 1 choice(s)

- [ ] Yes
- [x] No

If no, please justify your answer

LDAR is primarily for safety and any emission control requirements should never compromise that. We would not wish to see minor leaks prioritised over safety-critical work and therefore support a risk-based approach to methane leak repair that takes materiality into consideration. A minor leak should form part of a repair schedule that has to take into consideration other safety and operational risk priorities. For material leaks, we do support a regulatory repair requirement subject to the time-to-repair reflecting operational constraints and shutdown requirements. It should be acknowledged that the ability to repair a leak quickly may be dependant on a number of factors so legislation should again set broad expectations when determining success of a programme without being too prescriptive.

4.14 Should EU legislation on LDAR determine the time taken for leaks to be repaired, according to a classification of leaks, after detection?

at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer

4.15 What elements should be taken into consideration in a classification of leaks? Please provide a ranking for your answers, from highly important, important to unimportant.

	Highly important	Moderately important	Neutral	Relatively unimportant	Completely unimportant	No opinion
Safety	◉	○	○	○	○	○
Environmental concerns	○	◉	○	○	○	○
Leak size	◉	○	○	○	○	○
Accessibility/ease of repair	○	○	◉	○	○	○
Cost effectiveness	○	○	◉	○	○	○

Other? Please specify at which level of importance.

4.16 Should EU legislation on LDAR campaigns include provisions for fines if repair delays are not respected?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

5. Legislating on venting and flaring

Excess gasses in oil, gas and coal production and processing can be a safety hazard and must therefore be processed, either by trapping and utilisation or by flaring or venting. Flaring is the process of burning associated, unwanted or excess gases and liquids released during normal or unplanned processes in, inter alia, oil-gas extraction, refineries, chemical plants, and coal mining. Venting is the process of directly releasing gasses into the atmosphere, often for the same reasons as listed previously for flaring, as well as to balance pressure within gas infrastructure throughout the supply chain. While flaring is sometimes seen as a suitable substitute for venting, it can only ever be regarded as poor second best to full emission abatement.

As announced in the Communication, venting and routine flaring should be restricted to unavoidable circumstances, for example for safety reasons, and recorded for verification purposes. Venting and flaring need to be approached both from a within-EU perspective on domestic production, transmission, and distribution as well as from the perspective of the EU being a large-scale importer of fossil gas for which venting and flaring represent major upstream greenhouse gas emission sources.

Venting is the single largest source of methane emissions in the oil and gas sector, responsible for as much as 4.7Bt CO2eq globally. In addition to releasing waste gas, venting is also used to balance pressure within gas infrastructure, particularly in distribution and transmission.

While venting is an important contributor to emissions of both the oil and gas sectors, most flaring that takes place today is known as routine flaring and occurs during normal oil production operations. An estimated 145 bcm of gas is flared globally every year, which represents around 30% of the European Union’s annual gas consumption.

The proportion of gas burnt during flaring is referred to as ‘flare efficiency’, i.e. the ratio between the mass flow rate of methane in the exhaust gas of the flare and the mass flow rate of methane in residual gas stream that is flared. In theory, more than 99% of the gas is combusted when flaring is done in optimal conditions. In real-world conditions, however, flaring can be significantly less efficient due to sub-optimal combustion dynamics (e.g. variable heat content, flame instability). As a result, substantial volumes of methane can be released (so called methane slip),

along with other potent GHGs. The Communication on an EU to reduce methane emissions, further announces that flaring efficiency will be tackled as a priority.

Flaring in the EU accounts for only 0.17% of total global flaring, as such this is overwhelmingly an issue as regards supply chains linked to the EU rather than within the EU.

Nevertheless, addressing emissions from both venting and flaring in the EU can help towards domestic greenhouse gas reduction objectives and improve local air quality.

5.1 How far do you agree/ disagree with this statement: 'It is feasible to eliminate routine venting and flaring associated with energy produced and consumed in the EU'?

at most 1 choice(s)

- ☐ Fully agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Totally disagree
- ☐ No opinion

Comment (optional)

5.2 Should there be a phase-out period for routine venting and flaring? If yes, how long should it be?

- ☐ None
- ☐ 1 year
- ☐ 2 years
- ☐ 3 years
- ☐ 4 years
- ☐ 5 years
- ☑ More than 5 years

Please justify your answer

The phase-out period should be aligned with existing initiatives such as the "Zero Routine Flaring by 2030" initiative.

There could be certain operations where more rapid phase-out may be feasible. Operators should be encouraged, but not mandated, to follow a more ambitious timeline where possible.

Definitions

Venting and flaring can occur as a response to unexpected incidents to preserve health and safety, or as part of operations in what is often referred to as 'routine'. Terms such as 'non-routine', 'safety circumstances', and 'testing circumstances' are commonplace in regulatory frameworks globally to indicate circumstances where venting and flaring can be carried out without a permit. Although there are common understandings of how each form of venting and flaring can be defined, there are no widely held standards defining the parameters within which venting and flaring can take place in these circumstances. If not clearly defined and monitored, these circumstances provide loopholes for companies to avoid acquiring permits or utilising associated gas.

5.3 Do you think a common set of definitions and parameters for venting and flaring is necessary?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

5.4 Should the EU devise a common set of definitions and parameters for venting and flaring?
at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer

5.5 Should the EU establish an inventory of clearly defined circumstances under which venting and flaring is necessary to provide a better monitoring frame?
at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer

5.6 In your opinion, what can be considered routine/non-routine venting and flaring? Would you subscribe to any existing definitions? If so, please name them. Please specify.

The definition of routine/non-routine flaring should be aligned with the GGFR definition: http://documents1.worldbank.org/curated/en/755071467695306362/pdf/106662-NEWS-PUBLIC-GFR-Gas-Flaring-Definitions-29-June-2016.pdf

Work is underway by MGP to define routine venting and the EU legislation should aim to be aligned with this upcoming guidance.

Voluntary Initiatives

Increasing visibility on the issues of venting, flaring and methane slip (the emission of unburned methane from a flare or the use of gas) can help to change industry norms and bring global attention. This visibility can incentivise accountability at the national and company level. Voluntary initiatives can play an important role in developing new approaches to abatement and in demonstrating what is possible and practicable. There are a number of voluntary, including industry-led, efforts to reduce methane emissions from oil and gas operations, including the Methane Guiding Principles (MGP - a multi-stakeholder collaborative platform aiming to advance understanding and best practices for methane emissions reduction) and the World Bank's Global Gas Flaring Reduction Partnership (GGFR - a Multi-Donor Trust Fund composed of governments, oil companies, and multilateral organizations) works to end routine gas flaring at oil production sites across the world with its Zero Routine Flaring by 2030 initiative.

5.7 Which of the above voluntary initiatives would you consider as an important basis on which to base EU legislation on venting and/or flaring to be imposed as obligations on companies? Please list and indicate the importance you attach to them.

5.8 Specifically, should the EU adopt and further develop the current World Bank Global Gas Flaring Reduction Partnership (GGFR) definitions of routine, non-routine and safety flaring and further extend the terminology?
at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer

5.9 Can you recommend any other voluntary initiatives or existing regulations on venting and/or flaring that you think should be considered best practice and a basis for EU legislation?
at most 1 choice(s)

- [ ] Yes
- [ ] No

If yes, which initiative or regulation?

Verification of reporting

Reporting accuracy is an important aspect to the tracking and elimination of venting and flaring. Where regulatory frameworks exist at a national or subnational level, they often lack independent auditing and verification of data. Significant discrepancies between reported data and satellite data on methane emissions have been identified, which undermines the scope for regulators to hold companies accountable for underreported or unreported emissions. For example, the National Oceanic and Atmospheric Administration (NOAA) satellite data systematically indicates a greater volume of flaring than the data collected by states and the US Energy Information Administration (EIA). Also according to the IEA, venting, flaring and methane slip are all potentially underestimated in company reporting, partially as a result of an absence of independent verification but also frequent use of estimations in place of specific measurement.

5.10 Do you think industry can be relied on to accurately report venting and flaring activities without third party verification?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

5.11 Should voluntary industry initiatives be encouraged to create own auditing and verification systems?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

5.12 Should voluntary industry initiatives be encouraged to create harmonised methods for measuring, data handling, estimation, and use of specific models?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

5.13 Would you consider the establishment of independent third-party auditing and verification necessary?

5.14 At which level (national, regional, global, other) should auditing and verification be organised?

5.15 Should the EU commission consider setting up an independent global auditing authority to verify company data?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

5.16 Should the EU Commission consider adoption of harmonised methods for measuring, data handling, estimation, and use of specific models?

at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer

5.17 If independent monitoring and verification identifies misreporting of emissions from venting and flaring by companies within EU jurisdiction, should EU legislation include provisions on fines?

- [ ] Yes
- [ ] No

Please justify your answer

5.18 If independent monitoring and verification identifies misreporting of emissions from venting and flaring by companies outside EU jurisdiction, should EU legislation include provisions on restricted access to EU markets?

- [ ] Yes
- [ ] No

Please justify your answer

5.19 Which of the following measures should be taken to achieve reductions in venting and flaring associated with energy produced in the EU? Please mark your rating with an 'X'.

	Very appropriate	Appropriate	Neutral	Not very appropriate	Inappropriate	No opinion	**Please explain your choice. If you consider it very appropriate or appropriate, please describe possible implementation.**
Encourage sharing of best practices on avoiding venting and flaring							
Encourage company participation in global voluntary initiatives to share best practices and work towards the elimination of routine venting and flaring							
Mandate company participation in global voluntary initiatives to share best practices and work towards the elimination of routine venting and flaring							
Developing a database of all routine vents and flares							
Developing a database of all routine vents and flares, cross-referencing this information with databases of permits and exemptions							
Set a total cap on venting and flaring activities for the entire EU							
Mandate detailed environmental impact assessments of new oil and gas operations that account for the potential emissions from venting and flaring							

Introduction of financial incentives for reductions in emissions from venting and flaring (taxes/penalties or allowances).							
Outright ban on venting and flaring (except where no other ramification is available for health and safety reasons).							

Others (please elaborate)

Venting

This section focuses specifically on venting, which is the process of directly releasing associated, unwanted or excess gases into the atmosphere, during normal or unplanned processes, such as in oil-gas extraction, refineries, chemical plants and coal mining, as well as to balance pressure within gas infrastructure throughout the supply chain.

5.20 In which parts of the value chain do you consider Venting most relevant? (multiple answers possible)

	Gas	Oil	Coal (active and abandoned mines)
Exploration	☐	☐	☐
Production	☐	☐	☐
LNG	☐	☐	☐
Transmisison	☐	☐	☐
Storage	☐	☐	☐
Distribution	☐	☐	☐
Use (industrial)	☐	☐	☐

Please elaborate.

Quantification methods for methane emissions deliver a rate, such as mass per time (e.g. kilograms per hour) or volume per time (e.g. standard cubic meters per hour), and can be produced by engineering estimations, by direct measurement of the methane sources, or by use of models. Recording of venting requires appropriate measurement and verification. This is in part an issue of the quality of data from companies, as many companies do not measure their emissions from venting but rather estimate them based on emission factors.

5.21 In your opinion, is the use of emission factors a sufficient approach to the quantification of venting?
at most 1 choice(s)

- ☐ Yes
- ☑ No

Please justify your answer

Quantification of venting should be achieved using a suite of approaches that include both measurement (e.g. metering) and calculations. The choice of approach will be determined by the size of the vent with a bias towards measurement for large continuous vents. Small discontinuous vents can be adequately reported using calculations with emission factors.

5.22 In your opinion, are there situations in which the use of emission factors is the only feasible approach to the quantification of emissions from Venting?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

5.23 Can you list instances in which it is acceptable to estimate venting emissions via modelling or engineering estimations instead of direct measurements? Please specify.

Small discontinuous vents can be adequately reported using calculations with emission factors. The cost of installing direct measurement (e.g. metering) is disproportionate to the impact they have on total emissions.

5.24 Are there any cases in which direct measurements can never be used? Please specify.

5.25 Are there appropriate technological solutions available for the direct measurement and quantification of venting along the different parts of the oil and gas (and coal) value chains? Please name them. Do you consider them cost-effective?

	Available technologies	Level of quantification	Cost-efficiency
Exploration			
Production			
Transmission			
LNG			
Storage			
Distribution			
Use (industrial)			

The ‘Best Practice Guidance for Methane Management in the Oil and Gas Sector’ (United Nations Economic Commission for Europe) specifies several accepted and recommended methods of direct measurement for venting. Those methods include using a calibrated vent bag, a high-volume sampler, flow meters, or anemometers.

5.26 Do you consider these and other available best practices as comprehensive enough to enable companies to accurately measure and quantify methane emissions from venting?

at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer

5.27 Should the EU mandate direct emission measurement for venting within the EU supply chain?

at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer

5.28 Should the EU mandate the use of specific approaches for the measurement and quantification of venting?

at most 1 choice(s)

- [ ] Yes
- [x] No

Please justify your answer

The EU should focus on setting performance standards (e.g. accuracy and uncertainty) for an outcome-based approach to the measurement and quantification of venting. Mandating specific technology choices risks stifling innovation in a rapidly evolving technology landscape.

5.29 Would you consider the available best practices referred to above as sufficient basis for such mandates?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

5.30 Would you consider the Clean Development Mechanism methodologies as a feasible basis for mandates on measurement of venting emissions?

at most 1 choice(s)

- ☐ Yes
- ☐ No

If yes, which?

5.31 If you consider that EU legislation on Venting should determine the means of quantifying emissions, would you recommend that on site measurement is used in all instances?

at most 1 choice(s)

- ☐ Yes
- ☐ No

If no, please justify your answer

5.32 If you consider that there are instances in which such determination is not feasible or proportionate, please name them.

5.33 Should the EU mandate the use of specific intervals or continuous measurement of venting?

at most 1 choice(s)

- ☐ Yes
- ☑ No

Please justify your answer

The EU should focus on setting performance standards (e.g. accuracy and uncertainty) for an outcome-based approach to the measurement and quantification of venting with measurement intervals set accordingly.

5.34 How appropriate do you think the following measures would be in reducing venting associated with energy produced in the EU?

	Very appropriate	Appropriate	Neutral	Not very appropriate	Inappropriate	No opinion	**Please explain your choice. If you consider it very appropriate or appropriate, please describe possible implementation.**
Mandating the replacement of pieces of equipment known to cause emission from venting with non-emitting substitutes.							

An industry report from GIE and Marcogaz presented at the 2019 Madrid Forum highlighted, among other, solutions to avoid venting in the EU gas system.[21]

[21] GIE Marcogaz, (2019). Potential ways the gas industry can contribute to the reduction of methane emissions, Retrieved on 16.12.2020 from https://ec.europa.eu/info/sites/info/files/gie-marcogaz_-_report_-_reduction_of_methane_emissions.pdf

5.35 How appropriate do you think the following measures would be in reducing venting in the EU?

	Very appropriate	Appropriate	Neutral	Not very appropriate	Inappropriate	No opinion	**Please explain your choice. If you consider it very appropriate or appropriate, please describe possible implementation.**
UPSTREAM							
Implement Gas to Power units to use the vented or flared gas at remote production sites (avoid venting the associated gas).							
Minimise venting of hydrocarbons from purges and pilots, without compromising safety, through measures including installation of purge gas reduction devices, flare gas recovery units and inert purge gas.							
TRANSMISSION, STORAGE, DISTRIBUTION							
Implement minimising vents programmes.							
Recompression instead of venting							
Use of vacuum pressure pumps during commissioning of distribution networks.							
Replacing natural gas starters with electric engine starters at compressors, hence reducing operational venting							

Please provide any other measures you would deem appropriate for the reduction of venting and flaring in the EU gas system

Flaring

This section focuses specifically on Flaring, which is the process of burning associated, unwanted or excess gases and liquids released during normal or unplanned industrial processes, such as oil-gas extraction, at refineries or chemical plants.

5.36 In which parts of the value chain do you consider Flaring most relevant?

	Gas	Oil
Exploration	☐	☐
Production	☐	☐
LNG	☐	☐
Transmisison	☐	☐

	Gas	Oil
Storage	☐	☐
Distribution	☐	☐
Use (industrial)	☐	☐

Quantification methods for methane emissions deliver a rate, such as mass per time (e.g. kilograms per hour) or volume per time (e.g. standard cubic meters per hour), and can be produced by engineering estimations, by direct measurement of the methane sources, or by use of models. Recording of Flaring requires appropriate measurement and verification. Independent studies have consistently found company data to underreport flaring activities. [22] [23] [24] This is in part an issue of the quality of data from companies, as many companies do not measure their emissions from flaring but rather estimate them based on emission factors. In the below questions, measurement of flaring refers to the amount of burnt gases and liquids, flare efficiency will be addressed separately in the next section.

[22] IEA estimate 80Mtoe of flaring compared to 15Mtoe on the basis of flaring efficiency claims by companies (i.e. they estimate there is far more flaring than what is reported by companies). (IEA, (2020), Flaring Efficiency).

[23] EDF, (2020). Permian Methane Analysis Project, Retrieved on 17.12.2020 from https://data.permianmap.org/pages/flaring

[24] Leyden, (2020). Satellite data confirms Permian gas flaring is double what companies report, EDF, http://blogs.edf.org/energyexchange/2019/01/24/satellite-data-confirms-permian-gas-flaring-is-double-what-companies-report/

5.37 In your opinion, is the use of emission factors a sufficient approach to the quantification of flaring?
at most 1 choice(s)

- ☐ Yes
- ☑ No

Please justify your answer

Flares should be metered wherever practicable using meters with a clear statement of accuracy and uncertainty to collect high quality data of burnt fuel volume and composition. This should be supplemented with modelling and measurement to validate destruction efficiency used in the calculation of methane emissions from the input data.

5.38 In your opinion, are there situations in which the use of emission factors is the only feasible approach to the quantification of emissions from Flaring?
at most 1 choice(s)

- ☐ Yes
- ☐ No

If yes, please specify

5.39 Can you list instances in which it is acceptable to estimate flaring emissions via modelling or engineering estimations instead of direct measurements? Please specify

While metering should be the preferred route to quantification, allowance for alternative approaches should be made in cases where volumes are low; for example very short lived flares installed during exploration drilling and/or as part of a maintenance programme, large numbers of dispersed smaller flares, and flow meter maintenance / repairs. In these instances, modelling (e.g. CFD), engineering estimates or less robust metering may be suitable.

5.40 Are there any cases in which direct measurements can never be used? Please specify

5.41 Do you consider appropriate technological solutions for the direct measurement and quantification of flaring along the different parts of the oil and gas value chains are available? Please name them. Do you consider them cost-effective?

	Available technologies	Level of quantification	Cost-efficiency

Exploration			
Production			
Transmission			
LNG			
Storage			
Distribution			
Use (industrial)			

5.42 Should the EU mandate direct emission measurement for flaring within the EU supply chain?

at most 1 choice(s)

- [x] Yes
- [ ] No

Please justify your answer

On the basis that measurement of flaring refers to the amount of burnt gases and liquids (as per the questionnaire guidance) bp supports mandating measurement (e.g. metering). We recommend that legislation is aligned with existing standards, e.g. API 14.10 and requirements on flare meter measurement uncertainty in the EU emissions trading system.

5.43 Should the EU mandate the use of specific approaches for the measurement and quantification of flaring?

at most 1 choice(s)

- [ ] Yes
- [x] No

Please justify your answer

The EU should focus on setting performance standards (e.g. accuracy and uncertainty) for an outcome-based approach to the measurement and quantification of flaring. Mandating specific technology choices risks stifling innovation in a rapidly evolving technology landscape.

It should be clearly acknowledged that flares are primarily safety devices, rather than gas disposal routes. Any new standards or requirements should suitably reflect that flaring cannot be eliminated completely.

There are a number of proven and readily available technologies and approaches for determining the flaring volume and efficiency from which methane emissions can be calculated using generic or specific emissions factors.

Conversely, direct measurement of methane from flares is not readily available nor the most appropriate solution. Hence the focus should be on accurate measurement of the support data flows that will in turn allow for accurate methane (and flare) reporting. This should cover the metering of the gas going to the flare, the composition of that gas and the tools, processes, and solutions to confirm the destruction efficiency.

With flow measurement of flares, the choice of meter or alternative approach needs to be mindful of the significant variations in flow in normal versus upset conditions which can affect measurement uncertainty.

5.44 Would you consider the Clean Development Mechanism methodologies as a feasible basis for mandates on measurement of flaring emissions?

at most 1 choice(s)

- [ ] Yes
- [ ] No

If yes, which?

5.45 If you consider that EU legislation on flaring should determine the means of quantifying emissions, would you recommend that on-site measurement is used in all instances?

at most 1 choice(s)

- ☐ Yes
- ☐ No

If no, please justify your answer

5.46 If you consider that there are instances in which such determination is not feasible or proportionate, please name them.

5.47 Should the EU mandate the use of specific intervals or continuous measurement of flaring?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer

5.48 How appropriate do you think the following measures would be in reducing flaring associated with energy produced in the EU?

	Very appropriate	Appropriate	Neutral	Not very appropriate	Inappropriate	No opinion	**Please explain your choice. If you consider it very appropriate or appropriate, please describe possible implementation.**
Mandate equipment standards and conditions for flaring in the EU							

Others (please elaborate)

Flare efficiency

Flaring is often seen as a favourable substitute to venting and therefore there is the possibility that in an effort to minimise venting there can be an increase in flaring. With a high-level of combustion efficiency, this can make significant reductions in methane emissions, but will still generate other environmentally and socially damaging by-products. In the case of low combustion efficiency, it can mean relatively little greenhouse gas emission reductions versus venting. It is also suboptimal to other options for the abatement of emissions. Where flaring is strictly necessary, it should be under optimal burning conditions and to high standards to minimise the release of methane and other harmful pollutants.

Flaring efficiency has been shown to be largely determined by wind velocity, gas exit velocity at the tip of the flare, flare tip diameter (tip size), and the energy content of flare gas. The best flares can achieve high efficiencies, 99% or better, but in the worst cases efficiencies could be as low as 50%, even 0% if the flame extinguishes. It is often assumed that flares on average operate at 98% efficiency, meaning that 2% of the waste gas is not burned, and approximately 2 million metric tons per year of methane is released into the atmosphere as unburned gas. However, some stakeholders estimate average flare efficiency to be substantially lower. In its methodology for estimating flare efficiency (defined as methane destruction efficiency) for open flares and enclosed flares, and subject to conditions, the UNFCCC recommends using a default 50% efficiency for open flares and a 90% default efficiency for enclosed flares[25].

In most countries with large-scale flaring activity, flaring is associated with conventional oil and gas production. However, flaring may also be associated with unconventional oil and gas production. Flow rates of flared gas can vary widely between locations. A small fraction of sites can account for the majority of the flared gas. This distribution may affect the economic viability of mitigation strategies. Flow rates of flared gas can also vary over time, particularly for unconventional oil production (where production declines rapidly), or in regions where the infrastructure for using gas is being constructed. The duration of flaring may also influence how economically viable certain mitigation strategies are.

Accurate monitoring of methane slip in flaring operations and its mitigation can provide at least a second-best advance towards emission reductions.

[25] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf/history_view

Note that the methodology is designed for flare gases that contain only methane, hydrogen and carbon monoxide. It is designed to be used for gas from organic decomposition such as anaerobic digesters or for gas vented in coalmines. Nonetheless, it may be used to derive estimates of flaring efficiency in the oil and gas sector. In any case, the 90% flare efficiency default can be considered as conservative estimate.

5.49 Should EU regulation address flare efficiency?

at most 1 choice(s)

- [x] Yes
- [ ] No

Please specify.

Current emission estimates and reporting requirements from flares assume a destruction efficiency of 98% based upon research conducted in the 1980s, yet the technology in flare design has significantly progressed since. Better guidance on the use of efficiency values in the reporting process is required.

It is recommended that any proposals are technology agnostic as the technology is still developing. As an example, camera-based solutions for flare efficiency are being actively tested by industry.

The EU should also recognise that there is natural variability in flare destruction efficiency driven by various factors such as wind conditions, so any limits stipulated should provide reasonable tolerance e.g. long term averages, percentiles and ranges.

5.50 How appropriate do you think the following measures would be in reducing emissions from inefficient flaring?

	Very appropriate	Appropriate	Neutral	Not very appropriate	Inappropriate	No opinion	**Please explain your choice. If you consider it very appropriate or appropriate, please describe possible implementation.**
Transparency requirements on reporting of flaring efficiency by EU companies							
Prescriptive provisions on the monitoring of flare efficiency							
Prescriptive provisions/methodology for the quantification of flare efficiency							
Prescriptive provisions on technical configuration of flares							
Establish flaring efficiency targets for oil and gas companies in the EU							

Other, please specify.

To directly measure and monitor flaring efficiency, a number of instrumentation techniques can be used. These techniques are classified into two groups – extractive and non-extractive. In extractive technique, samples are removed from the flare plumes and analysed using combined Gas Chromatography and Mass Spectroscopy. Extractive techniques are shown to provide reliable estimates of flaring efficiency. In non-extractive technique, instead of removing samples from the flare plumes, chemicals present in the flare are identified and quantified using infrared spectroscopy. Remote sensing techniques have been shown to provide slightly less accurate but still acceptable estimates of flaring efficiency. In these techniques, instruments are mounted on the ground or aerial platforms and are located close to the flare sites.

5.51 Do you consider the available technological solutions for the direct measurement of flaring efficiency to be technically sufficient for accurate monitoring and quantification of methane emissions?

at most 1 choice(s)

- [ ] Yes
- [x] No

If no, please justify your answer.

EU policy should be outcome-focused and allow for flexible approaches for as long as the methodologies can be detailed, documented, and meet certain quality criteria. For instance, direct measurement can be supplemented by models.

Technology for flare destruction efficiency is developing and yet to be fully proven so any regulations in this space should be forward looking e.g. a preferred route as opposed to mandated approaches and requirements today. This will encourage innovation.

5.52 Do you consider the available technological solutions for the direct measurement of flaring efficiency to be cost effective? Are you aware of relevant methods which should be considered best practice for the direct monitoring and quantification of flaring efficiency?

Currently available radiometry techniques, while providing very valuable insights, are costly, difficult to operate, and only provided by a very small number of companies. A number of approaches are being actively tested by industry, but it is still too early to draw conclusions on suitability and cost.

5.53 Are there any cases in which direct measurements can never be used? Please specify.

5.54 Should direct measurement and quantification of flaring efficiency be mandated for flaring activities within the EU?

The EU should focus on setting performance standards for an outcome-based approach to the measurement and quantification of flare efficiency and allow for flexibility in the adopted approach. Mandating specific technology choices risks stifling innovation.

There can be cases where modelling will provide similar results to direct measurement in a cost effective manner, such as where volumes are low; for example very short lived flares installed during exploration drilling and/or as part of a maintenance programme, large numbers of dispersed smaller flares, and flow meter maintenance / repairs. In these instances, modelling (e.g. CFD), engineering estimates or less robust metering may be suitable.

5.55 Should such a mandate include intervals for measurement? Please specify.

Besides optimisation of flare conditions, flaring efficiency can be improved by steam injection and air injection, also known as steam-assist and air-assist. Steam-assisted and air-assisted flares produce smokeless flares by adding steam or air into the combustion zone, which creates turbulence for mixing and provides more air for combustion. However, too much steam or air has been to shown to have detrimental effects on flaring efficiency.

5.56 Are you aware of industry best practices for the improvement of flare efficiency? Please specify.

5.57 Should EU regulation stipulate technical requirements for the operation of flares with regard to optimisation of efficiency?
at most 1 choice(s)

- [ ] Yes
- [x] No

Please justify your answer.

Flares vary in design and continue to improve. Therefore, any technical requirements would struggle to address and keep up with the broad range of circumstances in which they are operated. It is recommended that the EU focuses on outcomes by setting performance standards, not operational decisions.

5.58 Should EU regulation stipulate technical inspection requirements for the setup of flares?
at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer.

Satellite technology allows the monitoring of global oil and gas sector flaring. Already current satellites can provide daily coverage of flaring activities globally. However, to accurately estimate flare efficiencies through satellite observation, accurate information on quantity and composition of the gas passing through flares is necessary.

5.59 Should the provision of information on quantities and composition of gas sent through flares be mandated to enable efficiency monitoring?

- [x] Yes
- [ ] No

Please justify your answer.

While gas composition and flow rates are key parameters in determining flare efficiency, there are a number of other factors that need to be managed to ensure a flare is operating correctly and efficiently, for example maintenance.

EU legislation should be aligned with existing standards, e.g. the EU Emissions Trading System which contains a requirement to address flare meter measurement uncertainty which covers maintenance, calibration, gas composition.

Super-emitters and energy imports

As satellite data improves, it could be viable to create a detection protocol for particularly problematic venting and flaring sources globally. This could be absorbed into the ‘super emitter detection service’ envisaged for the International Methane Emission Observatory (IMEO). The Methane Guiding Principles advocate creating an inventory of venting activities, for example.[26]

[26] Methane Guiding Principles, (2019). Reducing Methane Emissions: Best Practice Guide Venting, Retrieved on 17.12.2020 from https://methaneguidingprinciples.org/wp-content/uploads/2019/11/Reducing-Methane-Emissions-Venting-Guide.pdf

5.60 Would you support the creation of an inventory of venting activities?
at most 1 choice(s)

- [ ] Yes
- [ ] No

Please justify your answer.

5.61 Which data sources should such an inventory comprise?

5.62 Do you consider effective verification of data feasible?

5.63 Where would you see such an inventory best hosted?

5.64 How appropriate do you think the following measures would be in reducing venting and flaring associated with energy imported into the EU?

	Very appropriate	Appropriate	Neutral	Not very appropriate	Inappropriate	No opinion	**Please explain your choice. If you consider it very appropriate or appropriate, please describe possible implementation.**
Supporting emission abatement from venting and flaring through financial aid in developing countries							
Supporting emission abatement from venting and flaring through sharing of best practices and regulatory support in developing countries							
Require certification of associated venting and flaring for energy imported into the EU							
Set a target for EU companies importing energy into the EU for associated venting and flaring							
Ban imports of energy for which absence of associated venting and flaring cannot credibly be demonstrated.							
Impose carbon border pricing on imports into the EU for countries that do not apply effective or enforceable venting and flaring penalties							

Other, please specify.

6. Mitigation costs and benefits

The benefits from improved measuring and reporting of methane emissions through EU legislation would be an increased understanding of where and how emissions occur in the energy sector. This understanding can form the basis for effective mitigation and would lead to the achievement of larger reductions in methane emissions in that sector, with all the associated beneficial consequences in environmental, health and safety terms.

Fugitive emissions from leaking equipment, infrastructure or closed and abandoned sites as well as emissions from venting and incomplete combustion of methane represent the majority of methane emissions in the energy sector, so enshrining into EU law mitigation measures based on best practices targeting those areas of methane emissions could potentially lead to significant methane emission reductions in the energy sector.

For owners of the energy, mitigation techniques such as leak detection and repair or reduced venting and flaring can lead to benefits in terms of extra revenues from the gas saved and subsequently sold. Technologies that can prevent vented and fugitive emissions are reasonably well-known. In many cases, investment in abatement technologies is

economic, as the gas saved quickly pays for the installation of better equipment or the implementation of new operating procedures. That said, the economic incentives are not always there, even when the business case seems to be apparent. Companies may decide to prioritise on more lucrative investments and/or they may not be taking into account environmental costs into their investment calculations. And there are certainly a number of cases where it could be considered that the business case for emission abatement is simply not there, such as in the case of closed or abandoned sites, or of unprofitable operations.

Information on the magnitude and distribution of costs associated with measuring, reporting and mitigation of methane emissions would be helpful to ensure the prioritisation of cost-effective measures where feasible, as well as to attempt to strike the right balance between regulatory, compliance (direct and indirect, e.g. through loss of competitiveness), social, environmental costs and other relevant costs, in order to effectively inform policy-making.

For the moment, the only known publically available source of information on the costs of mitigation of methane emissions in the energy sector is the International Energy Agency (IEA), which publishes a methane tracker database which contains country and regional estimates for methane emissions as well as abatement costs for oil- and fossil gas-related methane emissions by mitigation measure[27]. It indicates that 73% of global methane emissions can be abated with available technologies and methods and 40% at no net cost (at 2019 natural gas prices). For Europe the estimates are similar, 72% of methane emissions can be abated in total, 37% at no net cost. This includes a range of mitigation measures targeted at different parts of energy supply chains. The IEA estimations are focussed on oil and fossil gas-related abatement costs. The Commission's own modelling shows a cost-effective mitigation potential for methane emissions of 37% by 2030 from 2005 levels, a substantial part of which is in the energy sector[28].

However, there are no known publically available sources of actual costs of emission abatement in the energy sector reflecting actual costs at the level of companies/operators. For example, there is no public knowledge available today of the costs of achieving OGMP (or indeed IPCC GHG inventories) higher tier standard of measurement and reporting of emissions even for a standard company oil and/or gas company. Nor are there any such sources of cost information for leak detection and repair in the EU or elsewhere, or of the cost-implications of introducing legislation limiting flaring to safety reasons.

[27] https://www.iea.org/articles/methane-tracker-database

[28] Climate Target Plan impact assessment, https://eur-lex.europa.eu/resource.html?uri=cellar:749e04bb-f8c5-11ea-991b-01aa75ed71a1.0001.02/DOC_2&format=PDF

6.1 Do you generally consider that the overall benefits – including economic, social, environmental and other relevant benefits - of putting in place legislative measures to ensure robust and effective measurement, reporting and mitigation of methane emissions in the energy sector generally outweigh the costs to industry?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer.

6.2 Please specify below for the following cases whether you would consider generally, that the benefits of putting in place legislative measures to ensure robust and effective measurement, reporting and mitigating of methane emissions outweigh the costs? Please indicate yes/no and provide details where possible.

	Benefits outweigh costs?
Upstream gas	
Upstream oil	
Midstream gas	
Midstream oil	
Downstream gas	

Downstream oil	
Operating coal mines	
Closed/abandoned coal mines	
Biogas/biomethane plants	

6.3 Other than the IEA data, what sources can you point to which provide what you would consider useful information on the levels of costs and/or benefits of putting in place legislative measures to ensure robust and effective measurement, reporting and mitigating of methane emissions in any of the above areas of the energy sector?

In the context specifically of fossil gas, contrary to producers, transmission, storage, and distribution systems operators (including many LNG terminals) are regulated businesses and do not own the gas they handle. They do not benefit directly from methane emission abatement, as the value of the saved gas would not accrue to them. The treatment of costs related to methane emission monitoring and abatement by National Regulatory Authorities determines the incentives (i.e. revenue) of regulated entities.

6.4 In the EU, are there any instances whereby regulated entities are required by law to monitor and abate their methane emissions and yet that these costs are not included as allowed costs and considered as part of the general duties of the operator to maintain the infrastructure?

at most 1 choice(s)

- ☐ Yes
- ☐ No

If yes, please state the Member State(s).

6.5 In such Member States, are there any other incentives to monitor and abate methane emissions?

at most 1 choice(s)

- ☐ Yes
- ☐ No

If yes, please specify.

6.6 If such costs have so far not been recognised by the National Regulatory Authority, has this substantially impacted the level of monitoring and abatement activities of regulated entities?

at most 1 choice(s)

- ☐ Yes
- ☐ No

Please elaborate.

6.7 If such costs have so far not been recognised, why should EU legislation require that they be recognised in the future?

7. Legislating mitigation of emissions from biogas/biomethane

Fugitive emissions from processing biogas/biomethane (as in biogas upgrading) plants from anaerobic digestion of biomass represent one of the non-negligible sources of methane emissions from the EU energy sector, and it should therefore be considered whether further obligations to measure, report and mitigate such emissions shouldn’t also

be included in the policy proposals to regulate methane emissions in the energy sector. Currently, methane emissions from biogas/biomethane facilities (incl. leakage, venting and flaring) are being reported in the EU GHG inventory, and as such are subject to the overall reduction requirement of the EU effort sharing legislation.

While regulation of measurement and reporting of such emissions could be included together in the upcoming regulation of methane emissions in the energy sector, at least parts of the requirements on the mitigation of methane leakage in biogas/biomethane plants could also be included in the Renewable Energy Directive (RED).

In order to be counted towards the RED targets, biogas/biomethane has to demonstrate compliance with the RED sustainability criteria - which includes minimum greenhouse gas savings thresholds - either via the use of default greenhouse gas savings values contained in the RED for different substrates or when these are insufficient for demonstrating compliance, operators have the opportunity to deliver calculations of actual greenhouse gas emissions savings of their production, following a strictl and detailed methodology defined in the RED and subject to a specific system of sustainability compliance which includes sustainability certification, also defined in the RED.

The RED's methodology to calculate actual values includes the requirement to take into account emissions from leakages occurring during the processing stage. The default values of the RED also already have some incentives for minimising methane leaks by offering higher default savings values for closed rather than open digestates.

What is not shown in the RED however is default methane leakage values broken down by source of emission and for different types of anaerobic digestion plants. Explicitly including such default values in the RED would enable operators to incorporate them in their overall greenhouse gas emissions calculations as part of the existing requirement in the RED to include leakage (of methane) as part of process emissions, and to do so without having to calculate actual values corresponding to their specific production process. The methane loss values assumed in the RED's default values should also be reviewed to ensure that they are in line with the most recent estimations available, and also to ensure that they are set at relatively conservative levels so that they can incentivise operators to put in place more effective technologies or leak mitigation measures leading to less leakage than those default values, and to deliver evidence of those actual values according to a specific methodology, which would also need to be developed.

Regulating in the RED has the additional advantage of being applicable equally to all producers of biogas/biomethane – whether based in the EU and elsewhere - wishing to have their production counted towards the renewable energy targets of the RED.

7.1 Do you consider that biogas/biomethane producers should be obligated by law to reduce their fugitive methane emissions?
at most 1 choice(s)

- ☐ Yes
- ☐ No

If no, please justify your answer.

7.2 Do you agree that the RED should be further developed as suggested above, thereby complementing any reporting and/or mitigation measures also included in the methane energy sector regulation?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer.

7.3 Do you consider that separate mitigation measures should also be developed in the upcoming regulation on methane in the energy sector in complement to the RED?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer.

7.4 Are you supportive of the idea to regulate such emissions in the RED by explicitly including default values for processing methane leakages at conservative levels to incentivise mitigation and the delivery of lower actual values?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer.

7.5 Are you supportive of the idea to develop a methodology to estimate actual values of methane losses in biogas/biomethane plants, and to be included as part of sustainability compliance in the RED?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer.

8. Legislating mitigation of emissions from coal

The IEA Methane Tracker estimates the global total of methane emissions from the coal sector at 39Mt per year, representing 9% of global methane emissions. In Europe specifically, 34% of methane emissions in the energy sector are fugitive emissions from the coal sector[29], amounting to some 1.1Mt of reported emissions for the EU-27 (57% of which come from Poland).[30] These fugitive emissions come from surface mines, underground mines, post-mining activities, and abandoned mines. Underground mines represent the largest source of reported emissions from the coal sector (87%)[31].

In underground mines, methane leakage is an important health and safety issue as it can lead to explosions for certain concentrations of methane in the air. Production releases methane trapped in coal seams, called coalmine methane (CMM). Once production is halted and the mine is abandoned, it continues to release methane, referred to as abandoned mine methane (AMM), over a long period of time.

Since 1990, certain EU countries have massively reduced methane emissions from coal mining, such as Germany, the UK and also the Czech Republic. In comparison, no changes have been recorded in Romania, while in Poland, methane emissions from coal have been reduced by only around 17%[32]. Some projections consider that the decrease in coal production will lead to a decrease in coal-related methane emissions[33]. However, recent studies have shown that these emissions might be currently underestimated, and are likely to increase in the future because of continued abandoned mine methane emissions, and exploitation of deeper and gassier deposits due to the exhaustion of shallow coal reserves [34].

Mitigating coalmine methane can be challenging as methane concentration of emissions in operating mines is often very low and can fluctuate in quality and quantity. The lower the concentration of methane, the more technically difficult and costly it is to abate[35].

At present, there are no EU-wide specific regulations limiting coalmine methane emissions, in operation or after their closure. In some Member States, national legislation is in place to reduce the fugitive methane losses from coal production[36]. In Germany, coal mine methane and abandoned mine methane are treated as a renewable resource and are eligible for feed-in-tariffs when used to generate electricity. In the UK, legislation has provided tax breaks for

CMM projects[37]. In France, mine methane is also used for electricity generation and benefits from renewable energy tariffs[38].

The EU has funded a number of research and development projects to introduce improved tools for methane emissions control[39]. The forthcoming Commission proposal to reform the Research Fund for Coal and Steel also supports research in this field. In addition, the initiative for Coal Regions in Transition, now part of the Just Transition Platform, can serve as a forum for discussing good practices and best available techniques.

[29] Climate and Clean Air Coalition (CCAC) Scientific Advisory Panel, (2020), UNFCCC 2017

[30] Ember, Poland's second BEŁCHATÓW, 2020; UNFCCC 2018 data

[31] UNFCCC 2017 reported data on greenhouse gas emissions: EEA Report No 6/2019, Annual European Union greenhouse gas inventory 1990–2017 and inventory report 2019, Submission under the United Nations Framework Convention on Climate Change and the Kyoto Protocol, 27 May 2019

[32] Ibid

[33] Global Non-CO2 Greenhouse Gas Emission Projections & Mitigation Potential: 2015-2050, EPA, 2019

[34] Global methane emissions from coal mining to continue growing even with declining coal production, N. Kholod et al, Journal of Cleaner Production, 2020,

[35] IEA, World Energy Outlook 2019

[36] Global Methane Initiative (2013). European Commission Global Methane Reduction Actions, Ref. Ares (2013)2843722-06/08/2013.

[37] N. Kholod et al., Legal and Regulatory Status of Abandoned Mine Methane in Selected Countries: Considerations for Decision Makers, 2018

[38] French Electricity Act 2000

[39] Global Methane Initiative (2013). European Commission Global Methane Reduction Actions, Ref. Ares (2013)2843722-06/08/2013.

8.1 In light of the above, do you consider that the EU regulation to reduce methane emissions in the energy sector should cover coalmine methane?

at most 1 choice(s)

- ☐ Yes and it should cover both CMM from operating and closed/abandoned mines;
- ☐ Yes and it should cover only CMM from operating mines;
- ☐ No

If no, please justify your answer.

Certain EU Member States are currently already measuring and reporting fugitive methane emissions in the coal sector using higher tier methods based on mine-specific measurements and calculations. According to IPCC Guidelines however, it is not yet feasible to collect mine-specific higher tier measurement data for surface mines. But there are still a number of EU Member States that do not report their data according to direct measurements, and rely instead on estimations.

8.2 Do you consider that the current levels of reporting of coalmine methane and abandoned mine methane emissions in the EU are sufficient?

8.3 Should all EU Member States be obligated to achieve highest tier levels of reporting for all underground mines within a certain time schedule?

8.4 Are there any reasons why full 'higher tier' reporting for all underground mines may not be feasible?

8.5 In the interest of more accurate estimation of emissions, should reporting on underground mine methane emissions include details on coal rank, extraction method and depth?

at most 1 choice(s)

- ☐ Yes

- [ ] No

Please justify your answer.

Coalmine methane mitigation

In active underground mines, atmospheric methane concentration is continuously controlled. Methane drainage can be used to lower the percentage of methane in the air: capturing the gas to prevent it from entering mine airways. Methane can be captured before, during and after mining by pre- and post-mining drainage techniques, respectively.

The recovered methane can be used (most commonly for power generation, direct thermal, and pipeline injection), vented or flared when utilisation is not possible. Ventilation air from underground mines contains diluted concentrations of methane and is referred to as ventilation air methane (VAM). It can be mitigated by oxidation, with or without energy recovery (methane molecules are broken down in an exothermic reaction), or used as a supplementary fuel (i.e: combustion air for boilers, turbines)[40].

Although CMM activities would increase local and regional NOx emissions near project sites, at the EU-wide scale the overall effects of grid electricity displacement result in net reductions in overall NOx emissions[41].

[40] Ventilation Air Methane (VAM) Utilization Technologies, EPA, July 2019 https://www.epa.gov/sites/production/files/2017-01/documents/vam_technologies-1-2017.pdf.pdf

[41] Karl H. Schultz & Linus M. Adler for the Joint Research Centre, Environmental and Sustainability Assessment of Current and Prospective Status of Coal Mine Methane Production and Use in the European Union, 2015 https://publications.jrc.ec.europa.eu/repository/bitstream/JRC96133/lb-na-27402-en-n%20.pdf

8.6 Which of the following factors are important considerations which explain why methane from operating mines cannot be systematically recovered and used?

- [ ] Safety requirements for ventilation
- [ ] Safety requirements for mine drainage
- [ ] Cost of abatement
- [ ] Insufficient concentration of methane
- [ ] Lack of infrastructure for methane use (proximity to pipelines)

Other, please specify.

8.7 Are there instances whereby venting of CMM is unavoidable? If so, what instances? [

8.8 For instances in which release of methane is unavoidable, should EU legislation specify obligations to prevent direct venting from active coalmines? Please describe feasibility of available prevention techniques (e.g. capture, flaring, other).

8.9 Should the EU require the use of technologies to mitigate ventilation air methane emissions?
at most 1 choice(s)

- [ ] Yes, with a recovery of its energy value
- [ ] Yes, even without recovery of its energy value
- [ ] No

Please explain your choice.

Abandoned mine methane mitigation

In most parts of the EU, underground coal mining activities have been declining considerably for a number of years, principally due to the closure of coalmines for economic reasons.

Technologies to recover methane from closed or abandoned mines are available and already operational in certain parts of the EU such as flaring of excess drained gas, exploitation of drained gas for power generation, pipeline gas, chemical feedstock and others, and use or abatement by oxidation of ventilation air methane.

Emissions from abandoned mines are estimated rather than measured (with IPCC or EPA methodologies). Direct measurement of total AMM is not technically feasible[42]. Satellites such as GHGSat are able to monitor and quantify (with 40–45% precision) emissions from mine vents[43].

[42] Global methane emissions from coal mining to continue growing even with declining coal production, N. Kholod et al, Journal of Cleaner Production, 2020,

[43] Quantifying Time-Averaged Methane Emissions from Individual Coal Mine Vents with GHGSat-D Satellite Observations, D. J. Varon et al, Environmental Science & Technology, 2020, https://pubs.acs.org/doi/10.1021/acs.est.0c01213

8.10 What would you consider appropriate measures to enable AMM mitigation? Please described possible barriers to implementation.

8.11 How important would you consider the following factors to be in the decision to engage in AMM mitigation:

	Highly important	Important	Unimportant	No opinion
Public health	○	○	○	○
Technological innovation	○	○	○	○
Social benefits (e.g. employment)	○	○	○	○
Environmental benefits (local and global)	○	○	○	○
Regional development	○	○	○	○

Other, please specify.

Uncertainty about the ownership rights for methane emitted from abandoned sites can be a regulatory barrier to its capture and utilisation. Clearly defined ownership rights can help companies mitigate risks in their contractual arrangements. Countries with successful AMM projects have created an enabling environment by eliminating restrictions on transferring rights to the gas, regardless of where the gas is used.

8.12 Should AMM ownership rights be addressed in EU legislation?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer.

8.13 Are you aware of existing frameworks for AMM ownership that the Commission should take into account?

8.14 Should EU methane legislation set an obligation on mine operators to install recovery systems for future gas recovery after abandonment/closure?
at most 1 choice(s)

- ☐ Yes
- ☐ No

Please justify your answer.

9. Synergies with other sectors

The main sources of anthropogenic methane emissions in the EU are from the agriculture, waste and energy sectors. The Communication on the Methane Strategy indicated that while the most cost-effective methane emission savings can be achieved in the energy sector, there are potential synergies and trade-offs for mitigating the cost of emission reductions in agriculture and waste via energy-sector based measures. The Communication for instance highlights the production of biogas from non-recyclable, sustainable, sources of human and agricultural waste (e.x. manure) and residue streams as such an example.

9.1 Can you provide other examples of initiatives or regulatory measures in the energy sector which could also contribute to cost-effective methane emissions mitigation in other high methane emitting sectors such as agriculture and waste?

Thank you for your participation.

Submit

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