Pricing methane emissions from the energy sector

Considerations of options for the EU

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Abbreviations

CBAM	Carbon Border Adjustment Mechanism
CH_4	Methane
CMM	Coal mine methane
CO	Carbon monoxide
CO_2	Carbon dioxide
EPS	Emission Performance Standard
ETS	Emissions Trading System
ETS2	Upstream Emissions Trading System (buildings and road transport)
EU ETS	EU Emissions Trading System
EU-MER	EU Methane Regulation
GHG	Greenhouse Gas
Gt	Gigatonnes
GWP	Global warming potential
IEA	International Energy Agency
LDAR	Leak detection and repair
LNG	Liquefied natural gas
MRV	Monitoring, reporting and verification
Mt	Million tonnes
N_2O	Nitrous oxide
NOx	Nitrogen oxides
TEPS	Tradeable Emission Performance Standard
UBA	German Federal Environment Agency (Umweltbundesamt)
UNFCCC	United Nations Framework Convention on Climate Change
WTO	World Trade Organisation

Executive summary

Stronger policies to reduce CH_4 emissions are urgently needed. To this end, **the EU should price CH_4 emissions from the energy sector.** This would complement the EU Methane Regulation (EU-MER) by providing an economic incentive to reduce CH_4 emissions beyond the mandated level while acting as an insurance against the political risk of the EU-MER CH_4 intensity thresholds being set at an unambitious level.

Nevertheless, an EU CH_4 pricing mechanism is unlikely to come into effect before 2030. Its main benefit would lie in its role as a transitional instrument, with the **greatest impact expected in the 2030s**, while the EU still consumes significant amounts of fossil fuels, and a large share of the imports under legacy contracts will not yet be covered by the EU-MER CH_4 intensity thresholds. Our analysis has identified **two practicable options:**

- The **de facto EPS** established by the EU-MER CH_4 intensity thresholds could be **complemented with a Bonus-Malus element** based on a CH_4 intensity benchmark set at a more ambitious level than the EU-MER thresholds. The producers and importers of fuels with a CH_4 emission intensity higher than the EPS benchmark would incur a surcharge, those with a lower intensity would receive a payment. The mechanism could be implemented by amending the EU-MER.
- An alternative would involve **expanding** the **EU ETS and CBAM** to cover energy-related CH_4 emissions. It would require extending the cap and other arrangements already tested during previous scope extensions of the EU ETS.

Extending the EU ETS and CBAM appears to be the most promising option, as it builds on a well-established and widely accepted instrument and could be implemented easier and more rapidly. Moreover, the EU ETS option would likely generate additional public revenues, while the alternative could require a net inflow of funds. Political acceptance of a mechanism that transfers EU public funds to fossil fuel producers based outside the EU is questionable.

One general concern affecting both options relates to **data quality and the robustness of MRV**, as accurate and robust MRV is an essential precondition for a stable, well-functioning carbon market. However, since the energy-related CH_4 emissions would only account for 1-4% (9-60 Mt CO_{2e}/year) of the 2030 ETS cap, the risk of ETS market distortions is limited. A second concern relates to the **international coverage** and **WTO compatibility** of the CH_4 pricing instrument. Given that the EU imports the majority of the fossil fuels it consumes, mitigating CH_4 emissions embedded in imported fuels is crucial and arguably more important than the domestic effects of CH_4 pricing. Solutions exist to cover imports with an emission price, either by extending the CBAM or by including traded volumes in the scope of a bonus-malus EPS. However, for both options, political feasibility and acceptance by major trading partners still need to be proven. Although there are reasons to be optimistic about the WTO compatibility of the CBAM, only a WTO decision can provide certainty.

We conclude that **the EU should consider expanding the EU ETS to cover CH_4 emission from the energy sector** from 2030 onwards. This requires immediate action on the **next steps**. The next review of the EU Emissions Trading is scheduled to take place in 2026. If the review concludes that there is a compelling case for including energy-related CH_4 emissions, the path would be cleared for a corresponding amendment to the EU ETS Directive. This change would likely come into force at the start of the next trading period that begins in 2030.

Introduction

This paper discusses whether an EU-wide mechanism to price methane (CH_4) emissions from the energy sector should be introduced and explores feasible design options.

In Chapter 1, we discuss the **"whether**" question: First, we discuss general arguments for and against CH_4 emissions pricing, and how the latter can be pre-empted by appropriate design choices and flanking measures.

In Chapter 2, we consider the **interfaces between the** recently adopted **EU Methane Regulation** (EU-MER) **and a potential CH_4 pricing scheme**. Particular emphasis is placed on the CH_4 intensity thresholds that are to be developed in the late 2020s and gradually phased in during the 2030s. Chapter 2 also analyses the likely state of the domestic and external CH_4 emission sources in the early 2030s, the earliest time by which a pricing scheme could be implemented, and provides a rough estimation of their overall volume in that time.

Chapter 3 discusses the question of "**how**": After defining some evaluation criteria, we identify and evaluate two feasible options: Firstly, the integration of CH_4 emissions from the energy sector into the EU ETS and CBAM, and secondly, the extension of the de facto introduction of an emission performance standard through the EU-MER with a bonus-malus element.

Finally, we draw some **conclusions** and formulate **recommendations** for policy makers and civil society organisations.

We define the "**energy sector**" as the following activities: Coal mining; oil and gas extraction, processing, storage, and transport to the final user; and hydrogen production. This definition of the energy sector does not include the combustion of coal, gas, oil or hydrogen by final users. Therefore, it does not cover CH_4 emissions caused by leakages within the premises of final users, nor CH_4 emissions that occur when methane is incompletely burned by final users. However, the CH_4 emissions associated with inefficient flaring at oil and gas extraction sites are covered.

The CH_4 emissions from other sectors, such as waste, agriculture, and land use, land-use change and forestry, are not covered in this paper, nor are the energy sector's emissions of other greenhouse gases (GHGs) other than CH_4.

We discuss these issues **at the EU level** for two reasons: First, the EU has ambitious climate targets that require bold policies to reduce emissions of all greenhouse gases from all sectors. Second, within the EU, most energy and climate regulations are adopted at the EU level, including the main pricing tools that drive the decarbonisation of energy and industry.

1 The case for pricing CH_4 emissions from the energy sector

Rapidly reducing CH_4 emissions is an essential element of any sound strategy to mitigate climate change. After CO_2, methane is the second largest contributor to human-caused climate change. Anthropogenic methane emissions currently contribute nearly 30% (circa 0.5 °C) to anthropogenic global warming.[1] This comparison is based on methane's global warming potential (GWP) over 100 years, which is the standard way to compare the climate impact of various GHGs. However, methane's GWP over 20 years is more than three times higher. Therefore, reducing CH_4 emissions provides a unique opportunity to limit global warming in the medium term, buying precious time for humans and ecosystems to adapt and to implement the longer-term structural changes needed to wean Europe's economy off fossil fuels.

In addition to accelerating global warming, CH_4 is also a major air pollutant. Along with NO_X, CO and non-methane volatile organic compounds, CH_4 is an important precursor for the formation of ground-level ozone, which in turn has significative negative impacts on human health, crops and ecosystems. In Germany, approximately one third of ground-level ozone arises through the oxidation of CH_4, and about 85% of this oxidation is linked to CH_4 emitted outside Europe.[2]

According to the International Energy Agency's (IEA) Global Methane Tracker 2024,[3] the energy sector was the second largest source of anthropogenic CH_4 emissions, not much behind agriculture and clearly ahead of waste. Of the approximately 128 Mt CH_4 emitted globally by the energy sector, about 118 Mt are associated with fossil fuels, the rest comes from biomass. The 118 Mt CH_4 emitted by the fossil fuel sector correspond to more than 3,5 Gt $CO_{2\ eq}$.[4] By way of comparison, this is significantly higher than the CO_2 emissions from fossil fuel use in all of Africa and Latin America.[5] Notably, due to the lack of comprehensive data, the CH_4 emission data of the IEA's Global Methane Tracker do not include the CH_4 emissions from abandoned coal mines, oil wells, and gas wells, although the same source quotes studies showing that the amounts are likely to be significant.

According to the official data reported by the EU Member States in their national GHG inventories, the CH_4 emissions from the energy sector are estimated to have strongly declined from 158 Mt $CO_{2\ eq}$ in 1990 to 64 Mt $CO_{2\ eq}$ in 2020, mainly thanks to mitigation measures in the

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[1] German Federal Environment (UBA), Unterschätztes Treibhausgas Methan: Quellen, Wirkungen, Minderungsoptionen 2022, based on IPCC 2021: https://www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/uba_pos_methanminderung_bf.pdf

[2] UBA 2022, see previous footnote.

[3] See: https://www.iea.org/reports/global-methane-tracker-2024. Unless stated otherwise, all data in this section about the relevance of the energy sector stem from this source.

[4] This calculation is done using the CH_4/CO_2 equivalence conversion rate established by the most recent IPCC Assessment Report (AR) with reference to the GWP over 100 years for CH_4 of fossil origin. Following new scientific evidence, successive IPCC Assessment Reports have revised upward the GWP of CH_4 several times, from 21 in the IPCC AR2 of 1995 to 29.8 for CH_4 of fossil origin and 27.8 for CH_4 of biological origin in the most recent IPCC AR 6 of 2021. The EU Methane Regulation (see below) adopted in June 2024, refers to the 29.8 equivalence factor. However, previous legislation still in force may refer to outdated factors. For example, the Renewable Energy Directive of 2018 (Annex V, Part C, Point 4) refers to a conversion factor of only 25. As noted in Chapter 3.2 of this paper, the CH_4/CO_2 equivalence factor applied to calculate the emissions of the shipping sector that will soon be included in the EU ETS system is 28.

[5] In 2023, the total CO_2 emissions from fossil fuels in all countries of Africa, South America and Central America including Mexico and the Caribbean amounted to 3.15 Gt CO_2. Data from EDGAR, the European Commission's Emissions Database for Global Atmospheric Research: https://edgar.jrc.ec.europa.eu/

areas of coal mining, oil and gas extraction, and gas infrastructure.[6] Based on this data, the CH_4 emissions from the energy sector accounted for slightly more than 2% of the total GHG emissions of the EU in 2020. When aiming for climate neutrality, 2% of total GHG emissions may not be neglected.

Furthermore, CH_4 emissions from the energy sector actually play a larger role than this figure suggests. Firstly, while the reported large reduction of CH_4 emissions is credible, the absolute values are likely to be greatly underestimated. A recent peer-reviewed study based on ground- and drone-based measurements of CH_4 emissions from onshore oil production sites in Romania found emission rates to be 2.5 times higher than those reported in Romania's UNFCCC inventory.[7] Three studies have found that Germany's UNFCCC inventory might underestimate CH_4 emissions caused by its lignite mines by staggering factors ranging from 28 to 220.[8] Secondly, most of the CH_4 emissions associated with the energy consumed in the EU are not considered in the UNFCCC inventories, since they occur outside the EU, namely in the countries where the coal, oil and gas imported into the EU are extracted.

The good news is that the energy sector provides significant mitigation opportunities at a comparably low, and in some cases even at negative, cost. CH_4 emissions from the energy sector are easier to reduce than those from agriculture and waste. Quick action to reap these low-hanging fruits is essential to achieving the climate targets. A significant reduction would also be consistent with an overall decline in global fossil fuel production and consumption, which is necessary to remain on track to climate neutrality: For example, the IEA's Net Zero Emission by 2050 Scenario requires CH_4 emissions from fossil fuel production and use to be reduced by about 75% from 2020 to 2030.

Unfortunately, however, the measured trend is in the opposite direction[9]. After the significant, pandemic-related reduction in 2020, the global CH_4 emissions associated with fossil fuels have increased every year. In 2023, the emissions from coal and gas were close to their historically highest pre-pandemic levels.[10]

To conclude this section: We urgently need stricter policies to reduce CH_4 emissions from the energy sector.

1.1 Arguments for a CH_4 emissions pricing mechanism

In the EU, the vast majority of GHG emissions – mainly CO_2 emissions from fossil fuel use – already are or will soon be subject to emissions pricing. Emissions from large combustion plants with a capacity exceeding 20 MW, which includes most power plants, as well as emissions from a range of energy-intensive industries and intra-European flights, have been priced through the EU Emissions Trading System (EU ETS) for nearly two decades. From 2027 onward, the so-called ETS2 will provide a price signal covering CO_2 emissions from the combustion of fossil fuels not covered by the EU ETS, primarily road transport, heating systems and

[6] EU Methane Action Plan, 2022: https://energy.ec.europa.eu/document/download/f9a49150-903e-46a6-aec7-f2c21272e9e0_en?filename=EU_Methane_Action_Plan.pdf

[7] Stavropoulou, Foteini, Katarina Vinković, et al.: High potential for CH_4 emission mitigation from oil infrastructure in one of EU's major production regions, Atmos. Chem. Phys., 23, 10399–10412. See: https://doi.org/10.5194/egusphere-2023-247

[8] Sabina Assan: Germany's coal mine methane emission factor, Ember (2024): https://ember-climate.org/insights/in-brief/de-undermines-cmm-emissions/

[9] European Space agency: The 2024 Global Methane Budget reveals alarming trends. See: https://www.esa.int/Applications/Observing_the_Earth/The_2024_Global_Methane_Budget_reveals_alarming_trends

[10] See: https://www.iea.org/reports/global-methane-tracker-2024.

small industrial and commercial plants. Starting from 2026, the EU ETS will also cover CH_4 emissions from international shipping.

However, the CH_4 emissions from the energy sector as such (see definition above) are not covered by any of these mechanisms.

The following general arguments speak in favour of introducing a pricing mechanism covering CH_4 emissions from the energy sector:

- **Economic welfare:** Pricing CH_4 emissions serves to internalise their external cost and ensures that emitters from different sectors and sources have an equivalent incentive to reduce emissions. Where external costs are not or not fully internalised, consumers and investors face a skewed incentive, and their decisions will lead to suboptimal outcomes. To be specific: As investors did not have to pay for the bulk of their emissions, they overinvested in fossil fuel extraction and were able to offload some of the costs onto society – leading to foregone economic welfare as well as distributional injustice.
- **Fairness and efficiency across sectors:** As carbon pricing is being extended across the EU, about 80% of EU GHG emissions will soon be covered by either the EU ETS or the ETS2. This highlights the importance of introducing a pricing mechanism for the remaining emissions, as ultimately all emission sources will have to contribute to climate neutrality. Having an equivalent incentive across sectors and emitters is a matter of fairness, but also of economic efficiency: In an integrated market with equivalent incentives, the market will distribute the mitigation effort across all covered sectors and emitters, so that the target is achieved at the lowest possible cost. Excluding a certain part of mitigation options will thus drive up the overall cost of reducing emissions and/or slow down the mitigation.
- **Flexibility for emitters:** The reason for the superior cost-effectiveness of pricing is that it gives flexibility to emitters, who can choose to either pay the price on emissions or avoid payment by reducing emissions. In theory, all emitters choose the cheaper option – thereby also reducing overall emissions where it is cheapest.[11] At the same time, the regulator does not need to gather information on the emitters' abatement potential or its cost.
- **Discover and incentivise mitigation options:** Within the covered sectors, emission pricing can incentivise mitigation across different processes and throughout the value chain, including upstream and downstream options (unlike command and control policies). By giving emitters an incentive to reduce emissions, they can also help to discover (new) mitigation options, and foster innovation for novel ways of reducing emissions. Importantly, the incentive from emission pricing is not contingent on the achievement of a target – as long as there is a positive price on emissions, emitters have a continued incentive to reduce emissions and seek out new ways for doing so (dynamic efficiency).
- **Revenue:** Depending on the specific implementation option chosen and its design, CH_4 pricing may yield revenue, which can then be used for different public policy goals (climate-related or otherwise): as an EU own resource, as a contribution to international climate finance, to support domestic climate finance, or for flanking measures, e.g. in the form of transition assistance or compensation.

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[11] Lackner, Maureen and Camuzeaux, Jonathan and Kerr, Suzi and Mohlin, Kristina, Pricing Methane Emissions from Oil and Gas Production (April 28, 2021). Environmental Defense Fund Economics Discussion Paper Series, EDF EDP 21-04, http://dx.doi.org/10.2139/ssrn.3834488

- For pricing to have these desirable properties, some conditions need to be met – emissions of the pollutant should ideally be uniform, i.e. leading to the same damage irrespective of the time and place of emissions; emitters should have mitigation options available to them and be informed of this mitigation potential and its cost; costs should diverge between emitters, and there needs to be robust monitoring, reporting and verification of emissions. For the case of CH_4 emissions, the uniformity is given – more controversial is the "MRV'ability" of emissions.[12]

1.2 Counterarguments to be considered and pre-empted through design

At the same time, some arguments could be raised against CH_4 pricing, which should be taken into account and, to the extent possible, pre-empted in its design.

- **Cost for consumers and social justice**: Pricing instruments achieve their effects by changing relative prices. For final consumers, this means that the prices of some goods or services will inevitably increase – whereas others may fall. This is also to be expected if the compliance obligation (i.e. those actors that are liable to pay the price initially) is placed upstream, as economic actors in a competitive market will pass these costs on to consumers. In the case of methane emissions from fossil fuels, pricing these emissions will in principle lead to an increase in the price of products containing fossil fuels, including motor and heating fuels or electricity, as well as all products for whose manufacture fossil fuels are needed. The extent of this effect, including its comparison with other factors driving prices up or down, is uncertain. Economically, this increase in prices to final users is desirable, necessary and justified, as it reflects a real cost that producers and consumers have not previously had to include in their decisions because they were externalised – imposed on society as a whole. Incorporating this cost in the price calculation leads to better economic choices by consumers. However, a common feature of many pricing instruments is that they disproportionately burden low-income households, as they spend a higher proportion of their income on energy-related goods and services and have less capacity to adapt to rising prices.
  This drawback can be addressed with redistribution mechanisms directly integrated into the pricing mechanism, which channel back part of the revenue to the most affected or most vulnerable households. At the EU level, the Social Climate Fund was established as part of the Fit-for-55-package to fulfil exactly this function for the existing EU ETS and the forthcoming ETS2 and could be expanded to include compensation for CH_4 pricing. Comparable mechanisms exist in several Member States connected to domestic pricing instruments. Research has shown that, in the case of CO_2 emissions, a relatively modest share (10% of ETS auctioning revenue) would be sufficient to compensate the poorest 50% of energy-intensive households in Europe.[13]
- **Emission Leakage and competitiveness**: CH_4 emissions from the energy sector mainly occur at the extraction sites. If CH_4 pricing is applied only domestically, fossil fuels extracted in the EU would incur an additional cost, which would not apply to imported fuels. As a result, the EU – which already imports more than 70% of its oil

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[12] Ibid.

[13] Görlach, Benjamin, Michael Jakob, Katharina Umpfenbach, Mirjam Kosch et al. (2022): A Fair and Solidarity-based EU Emissions Trading System for Buildings and Road Transport. Kopernikus-Projekt Ariadne, Potsdam.

and almost 60% of its domestic gas supply [14] – would become even more dependent on imported fossil fuels. Depending on the origin of these fuels and the amount of CH_4 emitted during their production, this might even result in a net increase in emissions if (comparatively cleaner) domestically produced fuels are replaced with (more emission-intensive) imported fuels. In addition to potentially causing methane leakages, this would also counteract the EU's efforts to reduce its dependency on fossil energy imports to increase its security of supply.

To counter this problem, it is crucial that any solution for CH_4 pricing also applies to the emissions embedded in imported fossil fuels. This could be achieved, for instance, by including CH_4 emissions embedded in imported fuels under the EU's border adjustment mechanism (CBAM), by setting up a mechanism equivalent to CBAM for fossil fuel imports, or, in the case of an emission performance standard, by including imported fuels under the scope of the regulation in the same way that domestically produced fuels are covered.

- **Administrative effort and bureaucracy:** Any new regulation requires an additional administrative effort on the part of the government agencies overseeing its implementation and increases the bureaucratic burden on the affected companies and institutions. However, in the case of CH_4 pricing for energy-related emissions, there are several arguments as to why the additional burden, over and above that implied by existing regulations, may be limited.

  First, depending on the pricing option chosen, the existing administrative infrastructure can be utilised that the EU Commission and the competent authorities in Member States have built up to administer the existing and planned carbon pricing instruments (EU ETS, ETS2, CBAM). This includes the trading platform and its regulation, the Union emission registry, and the regulatory infrastructure around them. Second, fossil fuel exploration and trading is a fairly concentrated business with relatively few actors who would be affected by the regulations. Also, fossil fuel exploration in Europe is already well covered by other regulations and resulting reporting obligations, so the additional bureaucratic burden would be limited. Third, domestic producers and importers are already required to monitor their CH_4 emissions under the EU Methane Regulation, including the maximum intensity value that domestic producers and importers need to comply with as of 2030. Lastly, there is scope to further reduce the administrative effort for CH_4 pricing by building on best practices established under the EU ETS, concerning e.g. electronic reporting systems or standardised procedures and templates for monitoring, reporting and verification (MRV) and other compliance obligations, ideally integrated with existing company level environmental or energy management systems.

- **Duplication of existing regulation:** In the context of the EU, the criticism can be expected that the EU only recently introduced a comprehensive instrument (EU-MER) to reduce CH_4 emissions from the energy sector. Introducing a pricing mechanism could therefore be seen as an instance of double regulation, creating an unnecessary administrative burden and leading to frictions and inefficiencies in the policy mix. Yet, as we argue in the following chapter, there is a significant amount of CH_4 emissions from the energy sector, especially from upstream activities taking place outside the EU, which the EU-MER addresses only partially and belatedly, if at all. Moreover, the EU-MER lacks flexibility and does not use economic incentives to reach its goals. We therefore argue that a pricing mechanism can either complement the EU-MER, or be integrated into it.

[14] See: https://www.iea.org/regions/europe/natural-gas

2 Interfaces with the EU Methane Regulation

With recent the entry into force of the EU Methane Emissions Regulation[15] (EU-MER), the EU established its regulatory framework for CH_4 emissions from the energy sector. In this chapter, we analyse its contents, focusing on its interfaces with a potential CH_4 pricing mechanism.

The EU-MER imposes detailed MRV obligations on the operators of active oil and gas wells, coal mines, and gas infrastructure, including pipelines, storage facilities and LNG terminals. For sites and installations inside the EU, these MRV obligations apply directly. However, since most of the CH_4 emissions associated with energy consumed in the EU occur in the countries from which the EU imports fossil fuels, the EU-MER additionally requires all crude oil, natural gas or coal supply contracts entered into or extended by EU importers after 4 August 2024 to include MRV equivalence clauses. This means that these fossil fuels are "*subject to monitoring, reporting and verification measures applied at the level of the producer that are equivalent to those set out in this Regulation*." For contracts concluded before 4 August 2024, the importers must "*undertake all reasonable efforts*" to require MRV equivalence.[16]

Moreover, the EU-MER mandates a series of measures applicable exclusively to sites within the EU. These include detailed provisions concerning leak detection and repair (LDAR), as well as sharp restrictions on venting and flaring in operated assets. Furthermore, the EU-MER includes obligations concerning closed and abandoned oil and gas wells as well as coal mines: The EU Member States must establish detailed inventories of all such sites and must ensure that mitigation plans, including measures such as the definitive plugging of abandoned oil and gas wells, are implemented.

Entities violating EU-MER provisions will be subject to penalties imposed by the competent authorities or, in some cases, the courts of the Member States. The penalties will be determined on the basis of national rules that each Member State must establish by 5 August 2025 in conformity with Art. 33 of the EU-MER. Although its provisions are relatively detailed, Art. 33 leaves substantial scope for implementation by national legislators when establishing the rules and for interpretation by the executive and/or judicial authorities responsible for enforcing them in each specific case. This could lead to significant variance in the level and frequency of the fines and other penalties, depending on the Member State and the specific circumstances.[17]

2.1 The CH_4 intensity framework

In addition to these mandatory rules, the EU-MER provides for a significantly different framework based on a **maximum CH_4 intensity of the production of crude oil, natural gas and coal** from 2030 onwards. A potential EU CH_4 pricing mechanism would interact with these intensity thresholds, which, as argued below, could become a reference point when designing the pricing mechanism. Therefore, for the sake of our argument, it is relevant to understand the CH_4 emission sources these thresholds will cover, the process by which they will be established, and at what point in time.

[15] Regulation (EU) 2024/1787 of the European Parliament and of the Council of 13 June 2024 on the reduction of methane emissions in the energy sector and amending Regulation (EU) 2019/942. See: http://data.europa.eu/eli/reg/2024/1787/oj

[16] For a discussion of the meaning and the implication of this "reasonable efforts" clause, see: Piria, Raffaele, Stephan Sina and Lina-Marie Dück 2024: Implementing the EU Methane Regulation, Working paper N° 3. Penalties and selected legal issues. Ecologic Institute, Berlin. See: https://www.ecologic.eu/19713

[17] For a detailed analysis of the EU-MER penalty regime, see our paper referred to in the previous footnote.

Only **certain CH_4 emissions sources** will be subject to the **CH_4 intensity thresholds**. The thresholds will cover CH_4 emissions "*at the level of the producer*" and refer to fuels "*placed on the EU market*" by EU producers and importers (Art 29 EU-MER). This means that the thresholds will cover only CH_4 emissions occurring at active coal mines, and oil and gas extraction sites, including flaring, regardless of whether the sites are located inside or outside the EU. They will not, however, cover midstream and downstream CH_4 emissions, such as those occurring at pipelines, gas storage systems or LNG terminals. Nor will they address CH_4 emissions from production sites that are no longer active.

The **process by which these thresholds will be established** consists of five steps [Art 29 (1-5)]:

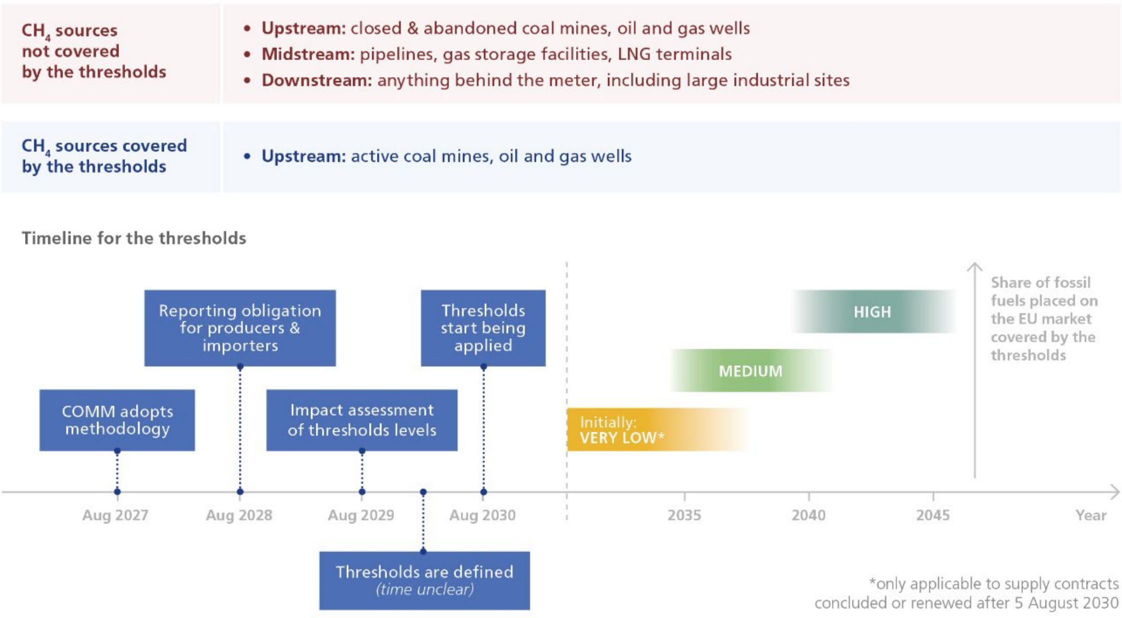
- By **August 2027**, the European Commission must adopt a methodology for calculating the CH_4 intensity of the production of crude oil, natural gas and coal.
- Based on this methodology, EU-based producers and importers must report the CH_4 intensity of the coal, oil and gas they place on the EU market annually starting in **August 2028**.
- By **August 2029**, the Commission must present an **assessment of** the potential **impact of various levels of maximum CH_4 intensity values** (hereinafter referred to as thresholds) for the various fuels to the EU legislators (European Parliament and Council). This assessment must consider impacts on the EU's security of energy supply and competitiveness, as well as potential market distortions. It should also include a market assessment with regard to the CH_4 intensity of current and future supplies to the Union and individual MS.
- Based on the assessment, and consistent with the methodology mentioned above, the Commission must adopt delegated **acts setting out the thresholds** associated with the production of crude oil, natural gas and coal placed on the EU market. These thresholds must specify different classes, taking into account the sources, production processes, and site conditions. The thresholds must "*be set at levels that promote reductions of the global methane emissions in relation to the crude oil, natural gas and coal placed on the Union market, while preserving the security of energy supply at Union and national level, ensuring a balanced distribution of the volumes of crude oil, natural gas and coal placed on the Union market as well as non-discriminatory treatment, and protecting the competitiveness of the Union's economy*". While the Commission is the only institution authorised to draft the text of such delegated acts, both the European Parliament and the Council have veto rights. The EU-MER does not specify a deadline for the adoption of these delegated acts. However, given that the thresholds should be defined well in advance of the August 2030 deadline described in the next bullet point, and considering the risk of delays inherent to the veto rights, the Commission should, and probably will, try to adopt the delegated acts either at the same time or shortly after the assessment mentioned above. Taking into account the European Parliament elections in May 2029 and the nomination of a new EU Commission shortly afterwards, the Commission might aim to have them adopted before the elections.
- "*By **5 August 2030** and every year thereafter, Union producers and importers placing crude oil, natural gas and coal on the Union market under supply contracts concluded or renewed after 5 August 2030 shall demonstrate to the competent authorities*" [Article 29(2) EU-MER] that the CH_4 intensity of the fossil fuels they place on the EU market is below the threshold. Therefore, the thresholds must be established well

before 2030 to allow producers and importers to adapt their contract negotiations accordingly.

Accordingly, the thresholds will **come into effect** only gradually, **starting in the early 2030s**. This process is likely to be slow: With a deadline announced so far in advance, the producers and suppliers who anticipate difficulties meeting the respective thresholds will have sufficient time to renew their contracts shortly before 5 August 2030 to avoid being immediately subject to this clause. Therefore, in practice, the share of fossil fuels placed on the EU market subject to the threshold will initially be very low and then gradually increase. Given that some long-term supply contracts last longer than a decade, some of the fossil fuels placed on the EU market may remain free from this obligation well into the 2040s.

The following figure provides an overview of the CH_4 emission sources (not) covered by the CH_4 intensity thresholds and of the time for its implementation.

Figure 1: Coverage and timeline of the EU-MER CH_4 intensity thresholds



Given the time necessary to develop, adopt and implement complex EU legislation, it is unlikely for the CH_4 pricing scheme for the energy sector to come into effect before the EU-MER CH_4 intensity thresholds come into force in August 2030. For the sake of simplicity, we proceed from the assumption that a pricing scheme could be introduced from 2030 onward. Therefore, its design should be aligned with a world where the EU-MER has been implemented for several years and where those thresholds start applying as shown in the figure and described in detail above.

In the following two sections, we outline what this means for the CH_4 emissions sources of the domestic energy sector, and for those located outside the EU, respectively. Our assumption is that by then the EU will have broadly met its 2030 climate and energy targets and will be seeking to make further progress towards the 90% GHG reduction target that the European Commission recently proposed for 2040.

2.2 Pricing domestic CH_4 emission sources

By 2030, six years after the entry into force of the EU-MER, the domestic CH_4 emissions from the EU energy sector should have been reduced considerably. However, the EU-MER does not aim to, and will not trigger, a reduction of the CH_4 emissions to zero. In this section, we outline the CH_4 emissions sources that could be covered by a CH_4 pricing mechanism in the 2030s and beyond:

- **Active coal mines**: Despite the progress of coal phase-out in many Member States, several coal mines will likely still be operating during the 2030s, and possibly even beyond. All MRV obligations mandated by the EU-MER for coal mines should be implemented by 2026 at the latest. Art 20(1) of the EU-MER mandates "*a measurement accuracy with a tolerance of 0,5 kilotonne of methane per year or of 5 % of the reported amount, whichever value is lower*". Thus, by 2030, there should be a substantial amount of MRV data that could be used to support the introduction of a pricing mechanism.
The mitigation measures provided for active underground coal mines will come into effect gradually: flaring with a destruction and removal efficiency below 99% and CH_4 venting from drainage systems will be prohibited from 1 January 2025 [Art 22(1)]. Venting of methane through ventilation shafts will be prohibited in coal mines emitting more than 5 and 3 tCH_4/kt of coal mined starting 1 January 2027 and 2031, respectively. Coal mines emitting less than 3 tCH_4/kt of coal mined are not subject to any mandatory restrictions [Art 22(2)]. In Poland alone, 52.8 Mt of hard coal were mined in underground coal mines in 2022[18]. If just half[19] of that volume were to be mined in 2031 at an intensity of, for instance, 2.8 tCH_4/kt of coal mined, thus in full compliance with the EU-MER, the remaining CH_4 emissions would amount to 2,2 $MtCO_{2\ eq}$ per year.
A possible CH_4 pricing mechanism could cover the remaining CH_4 emissions from active coal mining, taking into account the implementation of the EU-MER. In underground coal mines, the MRV system in place to demonstrate that the mine is emitting less than 3 tCH_4/kt of coal mined will already measure the remaining CH_4 emissions and can therefore be used for the participation of this emitter in a CH_4 pricing mechanism. The example above, based only on the CH_4 emissions from Polish underground coal mines, suggests that the volumes of remaining CH_4 emissions from active coal mines are comparably small, but not insignificant. They would become smaller if the future CH_4 intensity threshold for coal mines is set at a more ambitious level than the current limit of 3 tCH_4/kt of coal mined. Moreover, the CH_4 pricing mechanism could cover all remaining emissions from active surface coal mines, which are subject to the same MRV requirements as the underground coal mines but are not subject to any mandatory mitigation measure according to the EU-MER. CH_4 emissions from Germany's lignite mines alone were estimated to be between 1 and 9 $MtCO_{2\ eq}$ in 2022.[20]
The amount of remaining CH_4 emissions from domestic coal mines will also depend on the level of the CH_4 intensity thresholds. The more ambitiously they will be set,

[18] Source Euracoal, Poland profile: https://euracoal.eu/info/country-profiles/poland-8/
[19] This is not a forecast, but just an assumption that allows a rough estimate of the order of magnitude of the volume of CH_4 emissions from domestic underground coal mines that could be subject to a CH_4 pricing scheme in the early 2030s.
[20] Sabina Assan: Germany's coal mine methane emission factor, Ember (2024): https://ember-climate.org/insights/in-brief/de-undermines-cmm-emissions/

the smaller the amount of remaining CH4 emissions once all supply contracts will be covered by the thresholds.[21]

- **Closed and abandoned coal mines**: For closed and abandoned underground coal mines, the EU-MER contains detailed MRV requirements and the obligation to "*develop and implement a mitigation plan to address methane emissions*" from these sources (Art 26). However, while the EU-MER mandates that these mitigation plans must describe the technical feasibility and provide a timeline for the mitigation at each site (Annex VIII), it does not define any quantitative benchmark concerning the amount of tolerable remaining emissions. Closed and abandoned surface coal mines are subject to the same MRV requirements as active ones (Art 19-20), but without the obligation to implement mitigation measures. The cost of these measures must be carried by the companies responsible for the sites. If a Member State is unable to identify a responsible party, the costs must be carried by that Member State.
  A possible CH_4 pricing mechanism could cover the remaining CH_4 emissions from closed and abandoned coal mines. This would create an economic incentive for the responsible party to reduce the CH_4 emissions beyond the mitigation measures mandated case by case by the competent authorities. Even where the mitigation costs must be carried by the state, a pricing mechanism would provide a rationale to implement mitigation measures more rapidly, which would be easier to approve, for instance, by controllers. As in the case above, the mandatory MRV requirements should provide a reliable basis for quantifying the emissions subject to the mechanism. The volumes of emissions that would be covered by the pricing mechanism would depend on the thoroughness of the mitigation measures already enacted. Notably, the CH_4 intensity thresholds will only apply to fuels placed on the EU market after July 2030 and therefore will not affect closed and abandoned coal mines.
- **Active oil and gas extraction**: During the 2030s, there will still be significant oil and gas extraction activities in the EU and in the European Economic Area.[22] All MRV obligations for oil and gas extraction activities mandated by the EU-MER should be implemented well before 2030 (Art 12). This will create substantial MRV data, which could be used in a future pricing mechanism. Moreover, all the LDAR measures mandated by the EU-MER should have been implemented by 2030 (Art 14). Both the minimum (99%) efficiency requirements for new flaring devices (Art 17) and the general prohibition of venting and of routine flaring (Art 15) will have been in force for several years. Given all these measures, one can assume that the CH_4 emission intensity of domestic oil and gas extraction will be reduced to levels below the global average, but not eliminated entirely.
  A possible CH_4 pricing mechanism could cover the remaining emissions from oil and gas extraction. An estimate of the likely volumes of remaining CH_4 emissions is beyond the scope of this paper. Regarding the CH_4 intensity thresholds, the same argument applies as for domestic coal mines: the more ambitious the thresholds, the smaller the volume of remaining CH_4 emissions possibly subject to a CH_4 pricing mechanism. As in the case of coal, there is no plausible scenario in which the EU would export significant amounts of oil and gas extracted domestically.

[21] This argument would not be true if one considers the purely hypothetical case that coal from domestic mines would be exported outside the EU. Exported coal would not be covered by the CH4 intensity threshold, which only applies to fossil fuels "placed on the Union market". However, given the lower cost of coal from other world regions, this is not plausible.

[22] Both the EU-MER and the EU ETS apply also to the countries of the European Economic Area, which includes Norway with its major oil and gas production activities.

- **Inactive and abandoned oil and gas wells**: By August 2025, the Member States must publish "*an inventory of all inactive wells, temporarily plugged wells and permanently plugged and abandoned wells on their territory or under their jurisdiction*". By May 2027, they must implement "*a mitigation plan to remediate, reclaim and permanently plug*" these wells (Art 18). Some derogations are provided for the (probably very few, if any) Member States with more than 40,000 of such oil and gas wells, who are allowed a more gradual timeline of implementation, and for some other reasons. However, it can be assumed that by the time a potential CH_4 pricing mechanism could come into effect in the early 2030s, the overall CH_4 emissions from these sources will have been strongly reduced. Assuming that permanent plugging will reduce CH_4 emissions to below the level of detection of the measuring instruments used, as it is recommended in the US[23], any remaining CH_4 emissions from permanently plugged oil and gas wells could no longer be subject to a CH_4 emission pricing mechanism.
- **Gas infrastructure**: All EU-MER provisions applicable to active oil and gas wells also apply to underground gas storage, operations in LNG facilities, and all facilities pertaining to gas transmission and distribution systems, excluding metering systems at final consumption points and elements located on the property of final customers [Art 1(2)]. Most of this infrastructure is operated by regulated entities under the EU Gas Internal Market Directive. In this case, the EU-MER provides for the energy regulators to recognise the costs incurred and investments made by the operators to comply with the EU-MER when fixing or approving tariffs that determine the revenue of the operators. Non-compliance in this sector is therefore very unlikely, as the operators can fully pass on the costs of compliance to the rate payers. Otherwise, the considerations made above with regard to active oil and gas wells are generally also valid for gas infrastructure.

Summarising: Assuming a proper implementation of the EU-MER, a future EU-wide emission pricing mechanism for CH_4 emissions from the energy sector coming into effect in 2030 would cover the CH_4 emissions remaining after the mitigation measures mandated by the EU-MER until 2030 have been implemented and after the impact of the CH_4 intensity thresholds has been taken into account. The scope of emissions to be priced depends directly on the ambition of the EU-MER provisions, including the thresholds for emission intensity: the more ambitious these are, the smaller the volume of remaining CH_4 emissions that could be subject to a CH_4 pricing mechanism. However, this effect is limited by the fact that, as concluded in Chapter 2.1 of this paper, the CH_4 intensity thresholds will only gradually, and probably not very rapidly, come into effect during the 2030s and possibly even into the 2040s.

Quantifying the **volume of remaining domestic CH_4 emissions that could be subject to a CH_4 pricing mechanism** in the 2030s would help assess the benefits and impacts of such a mechanism, as well as the merits of different options. A precise quantification is beyond the scope of this paper. However, we propose a methodology for estimating this volume and provide a **rough estimation** of **the order of magnitude**, to provide context for the discussion of different pricing options.

[23] See U.S. DOE, NETL, and FECM: Methane Measurement Guidelines for Marginal Conventional Wells (2024). https://netl.doe.gov/sites/default/files/2024-06/DOE-NETL%20Methane%20Measurement%20Guidelines%20for%20Marginal%20Conventional%20Wells%20April%202024.pdf

This quantification can be done in three steps:

1) As documented in Chapter 2 above, based on the examples of oil fields in Romania and lignite mines in Germany, there is evidence that the reported volume of 64 Mt $CO_{2\,eq}$ methane emissions from the energy sector reported in national GHG inventories of at least some EU Member States is likely to be heavily underestimated. The MRV measures mandated by the EU-MER and the increasing monitoring capabilities, including satellite observations, will improve precision. For our purpose, it is necessary to make an assumption about the overall level of underestimation that these improvements will reveal. The examples cited above highlight specific cases where particularly egregious underestimations could be detected. In other cases, there may be no underestimation at all, or to a lower degree. Here, we consider a range of potential levels of underestimation between 40% and 150%. Accordingly, the overall amount in the baseline year 2020 would increase to a range of 90-160 Mt $CO_{2\,eq}$. As the EU-MER implementation gradually provides better data, this range should significantly narrow over the next few years.

2) It is necessary to make assumptions about the CH_4 emission reductions that will be achieved regardless by 2030, as a consequence of the EU-MER implementation and of other factors, such as the reduction of fossil fuel consumption and extraction, but without a pricing mechanism coming into play. We are not aware of estimates based of the final text of the EU-MER, but the impact assessment that accompanied the EU-MER proposal assumed a baseline reduction of 45% (before EU-MER effects), referring to the combination of the oil, gas and coal sectors.[24] Here, we assume a total reduction, including all EU-MER measures implemented until 2030, in a range between 70% and 80%. Applying this range to the minimum and maximum values obtained in the first step, we obtain a range of 18-80Mt $CO_{2\,eq}$ per year in 2030.

3) In the next step, we must assume the share of CH_4 emissions that could effectively become subject to an emission pricing mechanism. The largest sources of energy-related CH_4 emissions (coal mining, oil and gas extraction) could certainly be covered, while downstream emissions at the level of final users likely could not. As a guesstimate, we assume here that between 50% and 75% of the remaining emissions could be covered. Applying this range to the minimum and maximum values obtained in the previous step, we obtain a range of around 9-36 Mt $CO_{2\,eq}$ per year, which provides a rough order of magnitude of the volume of domestic (intra-EU) CH_4 emissions that could be covered by a CH_4 pricing scheme in the early 2030s.

In the further examination of the introduction of a CH_4 pricing mechanism, one important task would be to refine these assumptions and verify the estimates.

The **order of magnitude** of 9-60Mt $CO_{2\,eq}$ looks relatively **small, yet significant**: compared to current emissions, its lower end is of the same order of magnitude as the 2023 emissions from the manufacture of ceramics (9.7 Mt $CO_{2\,eq}$) or the parts of the chemical industry that fall under the EU ETS (about 40 Mt $CO_{2\,eq}$).[25] Compared to the overall 2030 cap in the EU ETS (825 Mt $CO_{2\,eq}$, of which 774 Mt for the current scope and 51 Mt for maritime transport), it amounts to roughly 1-4% of the combined cap in an EU ETS extended to CH_4 emissions.[26]

[24] Tables A.5.1 and A.5.2 of the Impact Assessment Report Accompanying the Proposal for a Regulation of the European Parliament and of the Council on methane emissions reduction in the energy sector and amending Regulation (EU) 2019/942.
[25] See: https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1
[26] German Environment Agency: Alignment of the EU ETS 1 with the new EU climate target for 2030 and reform of the Market Stability Reserve (MSR 1): https://www.umweltbundesamt.de/sites/default/files/medien/11850/publikationen/factsheet_cap_msr_2023_en_v2.pdf

2.3 Pricing CH_4 emissions embedded in imported fossil fuels

As mentioned above, most of the CH_4 emissions associated with energy consumed in the EU occur at the extraction sites in the country of origin. Therefore, an effective regime must also tackle the emissions embedded in the fossil fuels imported by the EU. The EU-MER first addresses this by establishing the information base: it requires that all contracts for crude oil, natural gas or coal supplies concluded or renewed by EU importers after 4 August 2024 must contain MRV equivalence clauses. For contracts concluded before this date, the importers must “undertake all reasonable efforts” to require MRV equivalence. However, none of the mitigation measures (LDAR, restrictions on venting and flaring, permanent plugging of inactive oil and gas wells, etc.) mandatory within the EU are required for extraction sites outside the EU. Yet the CH_4 intensity thresholds discussed in Chapter 2.1 of this paper will also apply to imported fuels.

However, as seen above, for several years post 2030, a significant share of the imported coal, oil and gas volumes will remain under legacy contracts signed before 5 August 2030 and thus not covered by the CH_4 intensity clause. Consequently, the CH_4 intensity thresholds will come into effect only gradually during the 2030s and probably into the early 2040s. This reinforces the case for introducing a CH_4 pricing mechanism covering CH_4 emissions embedded in imported fossil fuels.

Though an increasing share of fossil fuels imports will be covered by the CH_4 intensity threshold, there are several arguments why a methane pricing mechanism can not only co-exist with the threshold, but complement and enhance it:

- Depending on the choice of instrument and its design, a pricing mechanism can provide the economic incentive to ensure the threshold is achieved, with the strength of the incentive determined by the distance-to-target. It can also allow for greater flexibility – ensuring that the target is achieved on aggregate, but allowing emissions to be reduced where it is cheapest to do so.
- Depending on the design, the pricing mechanism can also create an incentive for further emission reductions beyond the threshold: since the threshold itself ceases to have an effect when the intensity of imported fuels is at or below the threshold, pricing mechanisms may provide a sustained incentive to push down emissions further.
- The pricing mechanism and the threshold may also function as mutual fallback mechanisms – ensuring that mitigation also happens if either of the two fails to function as planned or lacks ambition.

2.4 The link between the EU-MER CH_4 intensity thresholds and the case for a CH_4 emission pricing mechanism

When defining the CH_4 intensity thresholds according to the procedure described in Chapter 2.1 above, the European Commission will face a dilemma.

On one hand, ambitious thresholds would accelerate climate mitigation and reduce the risk of CH_4 leakage linked to the EU-MER obligations, which only apply to coal, oil and gas extraction activities within the EU. Accordingly, as seen above, the EU-MER requires that the thresholds are set at levels that “*promote reductions of the global methane emissions.*”

On the other hand, ambitious thresholds would mean that a significant share of the fossil fuels available on the global markets could no longer be imported into the EU, at least until the necessary investments to reduce their CH_4 intensity have been implemented, where this is technically possible. If this share is large, the EU would face increased import prices and, in the worst case, the thresholds could jeopardise its security of energy supply. The EU-MER stipulates that the thresholds should be set at levels that preserve this security.

When facing this dilemma, the Commission will probably also consider the veto rights of the European Parliament and of the Council. Particularly within the latter, concerns about import prices and security of energy supply have traditionally been relevant. When one of the two institutions exercises its veto right, the affected delegated act must be redrafted and resubmitted to the Parliament and the Council, resulting in delays and additional efforts.

The delays would be particularly problematic given the time at which the Commission is expected to adopt the delegated act. As seen in Chapter 2.1, the EU-MER does not indicate a specific date for the adoption of the delegated act setting the threshold levels, but it can be assumed that it will be presented by the Commission simultaneously with the impact assessment of different threshold levels, due by August 2029. The EU Parliament elections are scheduled to take place in May 2029. In August 2029, the current Commission will be at the very end of its mandate, and the new Commission President will likely have already been nominated. Adopting a delicate delegated act affecting EU energy imports at this time would have little political precedent. Delaying it would create difficulties in meeting the important deadline of 5 August 2030 to enforce the CH_4 intensity values. Therefore, the Commission could be tempted to adopt the delegated act a few months before the deadline, in time for the Parliament to consider it just before the EU Parliament elections in May 2029. In this case, if either of the two institutions exercises its veto right, the delay would be particularly long.

For all these reasons, it can be assumed that the Commission may hesitate to propose particularly ambitious thresholds. As discussed above, the less ambitious the thresholds, the stronger the case for CH_4 pricing. Conversely, if a CH_4 pricing mechanism for the energy sector has been developed and adopted by 2030, the negative side effects of (relatively) unambitious CH_4 intensity thresholds would be cushioned.

This is, in our view, a strong argument for initiating a debate on a pricing mechanism covering CH_4 emissions from the energy sector.

3 How could CH_4 emission pricing be implemented in the EU?

In Chapter 2, we discussed why the EU should consider introducing a CH_4 emission pricing mechanism covering CH_4 emissions from the energy sector, how design choices can help to pre-empt certain counterarguments, and how such a mechanism would interact with the recently adopted EU Methane Regulation (EU-MER).

The target timeline for our consideration is 2030 and the following years. By this time, an EU CH_4 pricing mechanism could realistically be up and running, and it coincides with the time when the CH_4 intensity thresholds mandated by the EU-MER will begin to apply. A CH_4 pricing mechanism could complement the EU-MER, and there are important arguments in favour of starting a debate on the potential design of such a mechanism.

In this chapter, we analyse two main options: extending the EU ETS to CH_4 emissions from the energy sector, or establishing a separate pricing mechanism in the form of an Emission Performance Standard, building on the CH_4 thresholds established by the EU-MER. In the following, we first describe how each of these two options would work, then discuss core design challenges and conclude with an assessment based on the evaluation criteria established in the following section.

In theory, an EU-wide tax on CH_4 emissions could be a third option. We have not analysed this option, as it appears utterly unrealistic for political reasons: since EU measures concerning taxation require unanimity in the Council, attempts to reform the outdated Energy Tax Directive of 2003 have already failed twice, after years of ultimately unproductive negotiations in the Council.[27]

3.1 Evaluation criteria

The evaluation is guided by the following set of criteria:

- **Political and legal feasibility:** To what extent does it seem feasible to reach political agreement on this option, and to enshrine it in EU law? What are potential political hurdles or legal barriers that would need to be overcome, or which would put the feasibility at risk? Are there any precedents where similar efforts have been attempted and succeeded, and on which legal basis could the proposed instrument build?
- **Technical and administrative feasibility:** in terms of technical and administrative effort, how realistic does it appear to implement this option in the available timeframe (i.e. until 2030)? How extensive are the data needs, and can the necessary data be collected and verified with the necessary level of detail and accuracy? How extensive is the expected effort for monitoring, compliance and administration of the instrument, and would it seem justified in relation to expected benefits?
- **Capacity to generate a significant and clear price incentive:** does the mechanism create a clear economic incentive to reduce CH_4 emissions, to induce emitters to undertake feasible and cost-effective mitigation measures, and does it contribute to the polluter-pays-principle, i.e. ensure that external costs of pollution are

[27] European Parliamentary Research Service (EPRS): Briefing: Revision of the Energy Taxation Directive: Fit for 55 package. https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)698883

internalised and that the cost is shouldered by the emitter? Does the price incentive respond to underlying (techno-economic) drivers and ensure that mitigation targets are achieved?

- **Likelihood that a liquid, transparent market will emerge:** this criterion is only relevant for trading solutions (i.e. ETS or tradable performance certificates) – how likely is it that a functioning market will emerge in which a price is established that responds to/reflects underlying fundamental price drivers, and which the covered entities can access without discrimination and at reasonable cost?
- **Capacity to generate revenue**: does the mechanism include elements to raise revenues for public budgets, how large are the potential revenues and how well can they be anticipated?
- **WTO compatibility:** can the mechanism be applied to EU fuel imports, and are there any indications that the mechanism might violate WTO rules?

Another important issues that require careful attention when designing an emission pricing mechanism are the MRV procedures necessary to support it, as well as the achievable level of accuracy. The list of evaluation criteria above does not include this aspect because, at the level of detail at which this paper discusses different options, we do not see significant differences between the various pricing models discussed. As noted earlier, the implementation of the EU-MER will significantly enhance MRV for CH_4 emissions from the energy sector. However, compared to CO_2 emissions from fossil fuel combustion – typically covered by emission pricing mechanisms – a lower degree of accuracy for CH_4 emissions is inevitable.

However, **the essential requirement for an emission pricing mechanism is not utmost accuracy**: within limits, stochastic measurement errors, or imprecisions that tend to produce errors in the same direction, can be tolerated provided that they are taken into account when designing the mechanism. The essential MRV requirement for an emission pricing mechanism is **rather that the MRV procedures should mirror international best practice and not be susceptible to manipulation or fraud**.

3.2 EU ETS and CBAM

3.2.1 Description of the approach

This approach would see the scope of the EU Emissions Trading System (EU ETS) extended to include the direct CH_4 emissions from the energy sector, i.e. from coal mining, oil and gas extraction, and operation of gas and oil infrastructure (pipelines, oil and gas storages, LNG terminals). Since these activities are currently not covered under the EU ETS, in practice this would require adding additional activities to Annex I of the ETS Directive[28], which defines the coverage of the EU ETS. Currently, the EU ETS covers emissions from the *combustion* of fossil fuels in any facility above 20 MW capacity, including from the energy sector, as well as process emissions, but it generally does not include emissions from the extraction of fossil fuels.

There are several relevant precedents that this scope expansion could build on:

- The EU ETS is already scheduled to extend to CH_4 emissions, albeit only from a narrow segment: as part of the extension of the EU ETS to international shipping, the EU ETS will also cover **CH_4 emissions from international shipping** as of

[28] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC. The consolidated version is available at: http://data.europa.eu/eli/dir/2003/87/2024-03-01

2026 (as per Regulation (EU) 2015/757 on maritime transport activities).[29] Initially, only CO_2 emissions are covered and reported for international shipping. As of 2024, the reporting obligations are expanded to include CH_4 and N_2O emissions, with a view to including them in the compliance trading from 2026. The Monitoring Guidelines for maritime transport activities further specify (p. 35) that this extends to emissions from the combustion of all fuels used as well as to CH_4 emissions caused by slippage. For CH_4 emissions, the guidelines stipulate a CH_4/CO_2 equivalence of 28.[30]

- For stationary installations, there have been previous **scope extensions to include gases other than CO_2**: with the start of the third trading period in 2013, N_2O emissions from the production of nitric acid, adipic acid and glyoxal and glyoxylic acid were included under the scope of the EU ETS, likewise for PFCs from aluminium production. In these instances, however, the scope extensions did not result in new or different installations being covered, but simply in including further greenhouse gases (and activities) from installations that were already subject to the EU ETS.
- The **capture and combustion of coal mine methane** (CMM) was eligible as a project-based source of offset credits through the Joint Implementation mechanism, a flexible mechanism under the Kyoto Protocol. This mechanism operated briefly during the initial years of EU emissions trading, and was used in projects located in EU countries.[31] As a result, methodologies to measure and monitor CMM emission reductions exist whereby coal mine methane is captured and used for electricity and heat generation. However, only a handful of projects were implemented under this scheme in the EU (three in Germany[32], two in Poland[33]) – CMM therefore played a marginal role in comparison to other types of offsets.[34]
- Some **installations that emit CH_4** are already covered by the EU ETS, but do not have to account for their CH_4 emissions. Such installations include facilities producing hydrogen and synthesis gas, oil refineries, and combustion facilities with a capacity above 20 MW, which are used, for instance, in gas infrastructure. Oil and gas extraction, as well as coal mines themselves, are not covered under the ETS, whereas adjacent power plants are. While these would be separate installations according the EU ETS categorisation, they may be run by the same operator.
- Other **pipeline grids** are covered in principle by the EU ETS, notably the entire chain for capture, transport and storage of CO_2. This includes accounting for slippage or leakage of CO_2 that was intended for storage. However, since there is no grid to speak of in the EU countries, these provisions remain hypothetical at present – but may serve as inspiration or as a blueprint for an eventual CH_4 coverage.

In parallel to the inclusion of CH_4 emissions from fossil energy under the scope of the EU ETS, the scope of the EU's Carbon Border Adjustment Mechanism (CBAM) would be extended to

[29] Regulation (EU) 2015/757 of the European Parliament and if the Council of 29 April 2015 on the monitoring, reporting and verification of greenhouse gas emissions from maritime transport, and amending Directive 2009/16/EC (with subsequent amendments). See: https://eur-lex.europa.eu/eli/reg/2015/757/oj

[30] Guidance Document: The EU ETS and MRV Maritime. General guidance for shipping companies. Guidance document No. 1, Final Version, 4 July 2024 https://climate.ec.europa.eu/document/download/31875b4f-39b9-4cde-a4e2-fbb8f65ee703_en?filename=policy_transport_shipping_gd1_maritime_en.pdf

[31] Joint Implementation (JI) was the less known, and much smaller, complement to the Clean Development Mechanism (CDM). While CDM applied to transactions between industrialised countries (countries listed in Annex-I of the Kyoto Protocol) and emerging economies (non-Annex-I-countries), Joint Implementation applied to transactions between industrialised countries, for instance between EU Member States.

[32] See: https://www.globalmethane.org/documents/toolsres_coal_overview_ch14.pdf

[33] See: https://www.globalmethane.org/documents/toolsres_coal_overview_ch27.pdf

[34] See: https://ji.unfccc.int/JI_Projects/ProjectInfo.html

include CH_4 emissions embedded in the coal, oil and gas imported into the EU (and would thus change from a *Carbon* Border Adjustment Mechanism to a *Climate* Border Adjustment Mechanism). Doing so can make a more significant contribution to reducing CH_4 emissions than the inclusion of energy-related CH_4 under the EU ETS, as the vast majority of energy-related CH_4 emissions attributable to the EU's energy consumption occurs outside the EU borders, during the mining, processing and transport of fossil fuels imported to the EU. At the same time, the EU ETS and CBAM can only progress together: for the CBAM to be compatible with WTO rules, it can only apply to emissions that are also subject to a domestic carbon price. Including CH_4 emissions under the scope of the CBAM can thus only be realised if, in parallel, the EU ETS scope is extended to cover domestic CH_4 emissions.

In contrast to the extension of the scope of the EU ETS, however, there are fewer precedents for expanding the scope of the CBAM. The existing CBAM regulation[35] clearly indicates that the current scope – covering imports of cement, electricity, fertilisers, iron and steel, aluminium and hydrogen – is merely the beginning. Article 30 of the CBAM regulation stipulates that, following a first review of the instrument before the end of 2025, the expansion of the CBAM scope may be considered. Following this, subsequent biannual reviews may revisit the issue of scope expansion. Formally, including CH_4 emissions from fossil fuels under the scope of the CBAM would merely require adding them to Annex I of the CBAM regulation: in terms of gases, the CBAM in its current form already reaches beyond CO_2 and covers N_2O (from fertiliser production) as well as PFCs (from aluminium production). There is thus no obvious reason why the CBAM could not also cover CH_4.

Yet Article 30 also lists certain parameters for the scope expansion, e.g. covering indirect or transport-related emissions related to the six products currently covered by the CBAM, or emissions related to inputs (precursors) of these six goods. Adding entirely new products (as a CBAM on methane for imported oil and gas would require) is not explicitly foreseen by Article 30, but neither is it ruled out. The provisions most likely to be applicable for the case of CH_4 emissions from the energy sector are the following: Art. 30 (a) (iii), which pertains to "*goods at risk of carbon leakage other than those listed in Annex I*"; this would require that the Commission first establishes a risk of carbon (or in this case, methane) leakage for oil and gas products, following the introduction of a price on CH_4 emissions from domestic sources; and Art. 30 (a) (iv), which relates to "*other input materials (precursors) for the goods listed in Annex I*". Here, the case could be made for oil and gas as precursors for electricity, hydrogen and fertiliser production; yet this would only cover a part of the total coal, oil and gas imports (and neglect fuel imports for transport, buildings and industrial heat).

3.2.2 Core design challenges

Including CH_4 emissions under the scope of both the EU ETS and the CBAM would present the regulator with some design challenges.

- **Reliable and accurate MRV:** Fugitive as well as incomplete flared and vented CH_4 emissions cannot be quantified with the same level of reliability and accuracy as CO_2 emissions from fossil fuel combustion. CO_2 emissions can be easily calculated as a function of the fossil fuels consumed and their carbon content. In contrast, fugitive CH_4 emissions often need to be estimated based on non-continuous measurements or calculation methodologies with a varying degree of precision. While the implementation of the EU-MER and technological development will substantially increase the precision and the amount of data available regarding CH_4 emissions

[35] Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism. https://eur-lex.europa.eu/eli/reg/2023/956/oj

from the energy sector (more detail on this in the next bullet point), CH_4 emissions MRV is bound to remain less accurate than the standards applicable for the GHG emissions currently covered by the EU ETS. However, since accurate MRV is crucial for the integrity of the EU ETS as a whole, it might be challenging to maintain the credibility of the ETS price and the functioning of the market for emission allowances when integrating CH_4 emissions on an equal footing with the existing emission sources. This may be viewed as jeopardising the integrity and functioning of the instrument. At the same time, as argued in Chapter 2.2 above, the volume of the domestic (intra-EU) CH_4 emissions that would be integrated into the EU ETS would amount to about 1-4% of the combined emission cap, and would thus be unlikely to have a discernible effect on the functioning or integrity of the market.

- **Setting a cap for an uncertain total volume of fugitive emissions**: As seen in Chapter 2.2 above, there is currently considerable uncertainty about the total volume of CH_4 emissions from the energy sector. At least for some major CH_4 emission sources and countries, the data from the Member States' GHG inventories are not plausible. If the cap was based on underestimated reported levels, it would be overly tight in reality; while a cap based on a corrected estimate would be arbitrary. This problem has common grounds with the MRV of individual emitters discussed in the previous points and has a similar answer: by 2030, the earliest time the integration of CH_4 emissions from the energy sector into the ETS could be considered, the margin of uncertainty will have been substantially narrowed. For example, the most reason to suspect underestimation is the fact that the reported CH_4 emissions from lignite mines in Germany are based on a single, outdated (1989) and unverified standard emission factor. Independent in-situ measurements of geographically close Polish lignite mines showed CH_4 emission intensities 40 to 100 times higher than this factor, giving cause to doubt the credibility of the German data. Through the EU-MER implementation, lignite mine operators will have to use "*deposit-specific coal mine methane emission factors*" established on a quarterly basis and take into account emissions from surrounding strata. Drainage stations in lignite mines will have to conduct continuous source-level direct measurements. Reports on these and other measures are due by 5 August 2025 and by 31 May every year thereafter. This example shows that, by the time the cap for energy-related CH_4 emissions in the EU ETS will have to be set, much more reliable data should be available.
- **Addressing stochastic super-emitting events**: Individual super-emitting events can cause considerable CH_4 emissions. Typically, these events are associated with accidents, sudden impacts of insufficient maintenance, and abnormal process conditions.[36] They also can be caused by acts of war or terrorism. Therefore, super-emitting events cannot be foreseen and are difficult to measure.[37] As already discussed in previous research,[38] such stochastic variations can lead to complications under a shrinking overall cap. If a super-emitting event affects an ETS emitter, who is liable to account for the emissions and able to cover them, this emitter would

[36] Zavala-Araiza Daniel, Alvarez RA, Lyon DR, Allen DT, Marchese AJ, Zimmerle DJ, Hamburg SP. Super-emitters in natural gas infrastructure are caused by abnormal process conditions. Nat Commun. 2017 Jan 16;8:14012. See: https://pubmed.ncbi.nlm.nih.gov/28091528/ .

[37] Lackner, Maureen, Jonathan Camuzeaux, Suzi Kerr and Kristina Mohlin: Pricing Methane Emissions from Oil and Gas Production (April 28, 2021). Environmental Defense Fund Economics Discussion Paper Series, EDF EDP 21-04, http://dx.doi.org/10.2139/ssrn.3834488

[38] Mohlin, Kristina, Maureen Lackner, Huong Nguyen, and Aaron Wolfe: Policy instrument options for addressing methane emissions from the oil and gas sector. Environmental Defense Fund Economics Discussion Paper Series, EDF EDP 22-01, June 2022. http://dx.doi.org/10.2139/ssrn.4136535

need to purchase and surrender a considerable number of allowances.[39] This additional and unexpected demand will increase the price and, depending on the scale of the event, may exacerbate the volatility of the carbon price. The level of this impact depends on the ratio between stochastic super-emitting events and the volume of the market. The possibly largest ever super-emitting event was caused by a deliberate attack in 2022 that destroyed three pipelines of the Nord Stream Corridor in the Baltic Sea. While the leakage was initially estimated at 152,000 tCH_4, a recent peer-reviewed study estimated that 478,000 tCH_4 were released in the atmosphere,[40] which corresponds to 14.2 $mtCO_{2e}$,[41] or 1,8% of the overall 2030 cap in the EU ETS (825 Mt CO_{2e}). Such a super-emitting event could indeed have a noticeable impact on the carbon market. However, the destruction of Nord Stream was an absolutely exceptional, unique event. The five following largest 2022 super-emitting events registered by the IEA Global Methane Tracker for the same year – none of which occurred in the EU – amounted to "only" 250,000 tCO_{2e},[42] and thus of a magnitude that would hardly be able to affect the carbon market. A solution could lie in requiring operators to insure against such super-emitting events, as well as requiring insurers to build up a dedicated reserve not only in terms of financial reserves, but also in terms of emission allowances.

3.2.3 Assessment of the approach

Political and legal feasibility (e.g. unanimity requirement) would not seem problematic: the EU has extended emissions trading to new gases (as of 2013), and to new activities (aviation as of 2012, shipping as of 2024), and has recently decided to establish a new, separate ETS for buildings and road transport. With the CBAM, an ETS of sorts applies to emissions embedded in imports. Politically, these decisions have managed to cross the usual hurdles – more easily for the scope expansion of the EU ETS, less easily (but ultimately successful) for the extension of emissions trading to buildings and road transport. A key hurdle for political feasibility in the latter case was the distributional impact of carbon pricing, since a carbon price on transport and heating fuels is more visible for private households and consumers, and therefore more contentious than a carbon price on power generation and industry. In terms of legal feasibility, a core criterion is that emissions trading, unlike a tax on GHG emissions, is considered an environmental measure under EU law, and therefore (unlike a tax) does not require unanimous support from all EU Member States, but can be adopted with a qualified majority. Legal challenges, however, are more likely if emissions trading extends (or is seen to extend) beyond EU borders, which was a point of critique for the inclusion of international aviation in the EU ETS, as well as for the EU CBAM. To date, however, neither has formally been challenged in an international court, and the EU maintains that the measures are compatible with WTO rules. In essence: **political and legal feasibility do not appear to be a main barrier.**

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[39] Whether the emitter is liable will depend on whether they can successfully make the case that their inability to comply constitutes a case of *force majeure*. While the EU ETS directive has no specific previsions to waive the compliance obligation in such cases, an ETS operator could still appeal to the EU court of justice to avoid being sanctioned. Whether the emitter is able to comply will depend on the scale of the super-emitting event: for a small company and/or a large emitting event, the resulting compliance obligation may bankrupt the company.

[40] Poursanidis, Kostas, Jumana Sharanik and Constantinos Hadjistassou: World's largest natural gas leak from Nord Stream pipeline estimated at 478,000 tonnes. iScience, Volume 27, Issue 1, 2024. See: https://doi.org/10.1016/j.isci.2023.108772 .

[41] Applying a CH_4/CO_2 equivalence of 29.8. On the different equivalence factors used in EU legislation see footnote 4 above.

[42] International Energy Agency: Global methane Tracker 2023, Overview: https://www.iea.org/reports/global-methane-tracker-2023/overview#abstract

Technical and administrative feasibility (data requirements, quality and accuracy of monitoring required, cost of monitoring in relation to expected benefits): this is a challenge for any approach that seeks to address CH_4 emissions, but ETS has a higher bar to cross, as MRV also serves as the foundation for allowance trading. If emitters do not have sufficient trust in the underlying data basis, and if it is economically more attractive to exploit MRV loopholes and flexibilities rather than reducing emissions, trust in the market and the value of allowances may erode quickly. Yet by 2030, the detailed MRV requirements mandated by the EU-MER should have created a sufficiently solid basis.

Capacity to generate a significant and clear price incentive to reduce CH_4 emissions where they occur, and incur costs with the polluter: Whether the carbon price creates a clear and visible incentive depends primarily on the feasibility of accurate and timely MRV: If the emitter can expect that emissions remain undetected, the price will not be much of a deterrence. Assuming that, after years of implementation of the EU-MER, MRV is ensured with reasonable accuracy, the incentive to invest will depend on whether the costs to implement further CH_4 mitigation options (after taking into account the CH_4 intensity threshold and, for emissions sources inside the EU, the mandatory measures prescribed by the EU-MER) are lower or higher than the prevailing ETS price. Given the relatively limited scope of CH_4 emissions, the price signal in an extended ETS would continue to be set by the marginal abatement options that also define the price in the current scope of the ETS (i.e. fuel switch in the power sector, industrial abatement). ETS prices would thus likely remain in the order of 60-100 euro/tCO_2 (as observed in recent years), potentially rising above 100 euro by the end of the decade.[43] In comparison to the low cost of abatement, this would create a strong incentive to ramp up mitigation measures. The incidence of the CH_4 price would most likely lie with the final consumer (of fossil energy sources or products manufactured with them), especially if the introduction of the (domestic) price on CH_4 emissions was complemented by a CBAM on CH_4 emissions embedded in imported fossil fuels.

The **likelihood that a liquid, transparent market will emerge**, delivering a meaningful price signal driven by market fundamentals: for the scenario of extending the current EU ETS to include CH_4 emissions, this would not seem to be problematic. As seen above, energy-related CH_4 will only represent an additional activity under the scope of the overall EU ETS, accounting for about 1-4% of the total ETS scope in 2030. Given the small size and the relatively cheap abatement potential in the sector, it is not likely that CH_4 emissions would be the marginal option that determines the price for other emitters, but instead would be a price-taking activity.

The **capacity to generate revenue** will depend on the mode of implementation. One important parameter is the volume of the energy-related CH_4 emissions that will be covered by the ETS which we have discussed in Chapter 2.2 above. A second important parameter is whether emitters of energy-related CH_4 will receive free allocation of emission allowances, which would diminish the revenue, as allowances given out for free cannot be auctioned. In general, free allocation would only seem justifiable if a) the regulator expected a serious risk of “methane leakage”, with foreign fuel imports replacing domestic production, and b) there was no other protection against carbon leakage, notably in the form of a CBAM on embedded CH_4 emissions of fossil fuel imports. If the protection via CBAM could be introduced at the same time as the price on domestic energy-related CH_4 emissions, it would be difficult to argue for free allocation. Assuming no free allocation and an EUA price in the range of 60-100 euro (as observed during

[43] Pahle, Michael et al. 2022: The EU-ETS price through 2030 and beyond: A closer look at drivers, models and assumptions. Input material and takeaways from a workshop in Brussels. Documentation. https://www.ecologic.eu/sites/default/files/publication/2023/30003-Ariadne-Documentation_ETSWorkshop-Bruessel_December2022.pdf

the last three years of operation in the EU ETS), the following revenue ranges could be expected.

- **ETS revenue:** 9-60) Mt CO_{2e} (see Chapter 2.2 above) with a carbon price of 60-100 euro would yield 0.5-6) billion euro of annual revenue;
- **CBAM revenue**: the CBAM price trails the EUA price in the EU ETS. To estimate the potential revenue, one should estimate the amounts of coal, oil and gas imported into the EU in the 2030s and the respective CH_4 emission intensities. This estimation is beyond the scope of this paper. However, the order of magnitude could roughly be in the range of 2-4 times higher than the EU ETS revenue[44].

Compatibility with WTO: While this would require an in-depth assessment beyond the scope of this paper, at present, the EU maintains the position that its CBAM has been designed to be compatible with WTO rules and guidelines. Though several non-European WTO members have expressed concerns, to this day no legal challenges against the CBAM have been brought forward, nor has a formal complaint process been launched. Several design elements of the CBAM are intended to ensure WTO-compliance: the exclusion of exports (no rebate for exports from the EU) is not critical for CH_4 pricing, since the EU does not export fossil fuels, nor is likely to do so in the future. Another design feature relevant for WTO compliance concerns the reporting of embedded emissions: under the CBAM, importers can either resort to default values – or, if they consider their embedded emissions to be below the default values, they can also chose to document the actual embedded emissions of the imported tranche of goods, based on calculation methods laid out in Annex IV of the CBAM regulation, and including verification by an independent third-party verifier.

As discussed in Chapter 2.1 of this paper, according to the EU-MER, the EU will adopt a specific methodology to calculate the CH_4 intensity of the production of crude oil, natural gas and coal by 2027, which will apply to both domestic production and imported fossil fuels, which must comply with the EU-MER's MRV equivalence clause. If these imports are included into the CBAM, it would be helpful if both systems applied the same methodology.

3.3 (Tradable) Emission Performance Standard

3.3.1 Description of the approach

An alternative approach, which has been applied in other jurisdictions, would be a (tradable) Emission Performance Standard (EPS). With this instrument, fossil fuel vendors (producers, importers) would be accountable for the upstream CH_4 emissions associated with the fossil fuel they are placing onto the market: they would only be allowed to sell the fuel if they can demonstrate that it remains at or below a given CH_4 intensity target value (benchmark).In principle, there are different options for including elements of flexibility in this approach:

- **No flexibility**: all vendors need to comply; fuel can only be sold to EU customers if it remains at or below the EPS benchmark. Fuel above the benchmark can no longer be placed on the EU market. There is no incentive to reduce the CH_4 intensity at a level lower than the thresholds. This approach corresponds to the CH_4 intensity thresholds that will gradually come into effect during the 2030s according to the EU-MER CH_4 (see above, Chapter 2.1). Given the risk that the thresholds will

[44] On one hand, the CH_4 intensity values assumed in the calculation of the ETS revenue consider EU-MER mitigation measure that would not be applied in many countries of origin. On the other hand, the estimation of the ETS revenue also include CH4 emission from abandoned extraction sites and gas infrastructure. Which would not be priced in the CBAM.

be set at unambitious levels (see above, Chapter 2.4), this lack of incentive could undermine the EU's capability to reduce the CH_4 emissions associated with the energy it consumes.

- **Bonus**: vendors of fuel below the EPS benchmark receive a (pre-determined) bonus proportionate to the difference between the benchmark and their reported emissions, resulting in a quasi-subsidy for avoided emissions. Fuel above the EPS benchmark cannot be placed on the EU market.
- **Malus**: vendors of fuel above the EPS benchmark can sell their fuel, but need to pay a (pre-determined) penalty proportionate to the difference between the benchmark and their reported emissions, i.e. a quasi-price on emissions. Vendors of fuel at or below the EPS benchmark receive no particular support.
- **Bonus-Malus**: combination of the above: all fuels can be sold on the EU market, those above the benchmark need to pay a surcharge that corresponds to the difference between the emission intensity of the fuels sold and the benchmark, whereas sellers of fuels below the benchmark receive an equivalent payment.
- **Tradable emission performance standard (TEPS)**: vendors of fuel below the EPS benchmark are compensated in the form of credits/certificates, which they can sell to vendors of fuel that exceed the benchmark and are obliged to surrender a corresponding amounts of credits/certificates. Their price - and hence the monetary reward for remaining below the benchmark (or the penalty for exceeding it) - is not determined by the regulator, but by the interaction of supply and demand. As supply must equal demand, any volume of fuels above or below the EPS benchmark is balanced by a volume below or above it. On aggregate, the total volume traded should have a fuel intensity equal to the EPS benchmark.

Different options have different implications for the emission intensity of the fossil fuels consumed, as well as the revenue they may generate or the cost they may incur for the public budget. These implications are summarised in Table 1 below:

Table 1: Impact of different EPS options on emission intensity and public budget

Option	Average emission intensity	Impact on public budget
No flexibility	At or below the benchmark (since other options are prohibited)	None (neither revenue raised, nor expense generated)
Bonus	Below the benchmark (since only volumes below the benchmark receive support)	Negative (regulator only incurs expenses for supporting volumes below the benchmark, no revenues)
Malus	Above the benchmark (therefore the benchmark cannot serve as a mandatory maximum intensity, as foreseen by the EU-MER)	Positive (revenues from penalties for volumes above the benchmark)
Bonus-Malus	Probably close to the benchmark (depending on the balance between supported and penalised volumes)	Uncertain (depends on the balance between supported volumes and penalised ones)
TEPS	Equal to the benchmark	None (as trading happens between covered entities)

The table shows that only three of the five options (no flexibility, bonus and TEPS) guarantee that the overall emission intensity of traded fuels is equal to or lower than the benchmark. In the case of malus-only or bonus-malus, suppliers may sell fuels that exceed the benchmark and pay a penalty in return. Thus, on aggregate the emission intensity of the traded fuels will possibly (for bonus-malus) or certainly (for malus) be higher than the EPS benchmark. At the same time, the only option certain to generate substantial revenue is the malus option. In the case of bonus-malus, the inflow of revenues must pay for the outflow of bonus payments (which may even exceed the revenue received); in the other cases, there is no revenue. The one option that is certain to generate revenue is thus also the one that leads to an emission intensity higher than the benchmark.

To some extent, the different options can also be combined. A TEPS, for instance, can be combined with a variant of the malus by making a certain quantity of credits available at a set price. This would act as a price ceiling (or dampening element against price rises) and generate limited revenue; at the same time, the resulting emission intensity would be allowed to rise higher than the benchmark.

Regarding the CH_4 intensity framework mandated by the EU-MER (see Chapter 2.1 of this paper), the options above are compatible with the provisions of EU-MER to varying degrees:

- “No flexibility”, “bonus” and “TEPS” can be implemented so that the EPS benchmark value corresponds to the CH_4 intensity thresholds mandated by the EU-MER.
- For malus and bonus-malus to make sense, the EPS benchmark would have to be (significantly) below the CH_4 intensity thresholds established in the EU-MER. This would mean that fuel quantities would fall into one of three categories: fuels with an emission intensity below the EPS benchmark could be placed on the EU market, and (in the case of bonus-malus) would be eligible for support. Fuels with an emission intensity higher than the EPS benchmark, but below the EU-MER thresholds, could be placed on the market but would incur a cost (malus). Fuels with an emission intensity above the EU-MER thresholds could not be placed on the EU market.
- Since the EU-MER thresholds only gradually take effect during the 2030s, the different options could also be used as transitional mechanisms. During the early 2030s, the initially large share of imported fuels linked to legacy contracts and therefore not subject to the EU-MER thresholds would nevertheless be subject to the EPS benchmark and priced accordingly.

3.3.2 Core design challenges

- **Ensuring robust and credible MRV:** By 2030, coal, oil and gas produced in the EU or imported into the EU under contracts concluded or renewed after 5 August 2024 will be subject to MRV rules (equivalent to those) established by the EU-MER. Fossil fuels imported on the basis of older legacy contracts will not be subject to such MRV requirements. However, from August 2028 they will be subject to the same reporting obligations based on the methodology for calculating the CH_4 intensity of the production of crude oil, gas and coal, as described above in Chapter 2.1. It remains to be seen whether this methodology will find sufficiently precise and reliable solutions also applicable to the fuels not covered by the same MRV obligations.
- **Point of obligation:** The obligation to comply with the standard can be placed at the level of fuel importers/producers (i.e. where the product crosses the border and import duties apply or where the product is placed on the Union market), or further down the value chain at the level of fuel distributors/vendors. To minimise reporting obligations, it would be sensible to align the point of obligation with that relevant for the EU-MER thresholds, which apply to domestic producers and importers who

place fuels on the EU market. However, it is essential that the EPS standard also applies to fuels directly imported by consumers, such as large industrial companies that directly import fossil fuels. An alternative would be to place the obligation on the actors that are obliged for fiscal instruments (ETS2, Energy Taxation Directive/Excise Directive), which (primarily) oblige the authorised keepers of tax warehouses as the legal or natural person liable to pay taxes or demonstrate compliance.

- **Setting the benchmark:** the choice of the benchmark value determines the stringency of the EPS. As elaborated above, the benchmark value would need to be set in relation to the maximum intensity determined by EU-MER, depending on the specific design chosen. For the bonus-malus case or for malus-only, the benchmark value could be set as a fixed percentage of the maximum value (e.g. 70%). An alternative would be to adopt a benchmark with a downward trajectory, i.e. becoming increasingly stringent over time.
- **Ensuring liquid trading:** In the case of a tradable emission performance standard (TEPS), the design would need to ensure that a transparent and functioning market emerges, with sufficient liquidity to allow for efficient price discovery, to yield a price that reflects underlying fundamentals, and to limit market power of individual buyers and sellers. If trading happens mostly bilaterally, the transparency of the emerging price would be limited. Given the risk of limited liquidity and lack of transparency, price control mechanisms may be needed, e.g. adjusting the supply of tradeable units, establishing a ceiling price or providing access to offset credits.[45]
- **Revenue use:** Some of the (T)EPS may generate revenue, particularly if they involve a malus component. As with ETS revenue (see above), these revenues could be used for a number of purposes, including flanking measures to enhance the functioning of the instrument, or to enhance political support. Since the (T)EPS for CH_4 emissions from the energy sector would be a novel instrument, there is more flexibility for its use than for the ETS revenue. Thus, the revenue could represent a source of own revenue for the EU, more or less dedicated to climate finance. It could be redistributed to support additional mitigation efforts along the value chain, including both domestic investments by EU suppliers, and redistribution to supplier countries (potentially limited to LDC supplier countries).

3.3.3 Assessment of the approach

- In terms of **legal and political feasibility**, there are no obvious reasons to question the feasibility of this option. While the instrument involves economic incentives, it is clearly not a tax, hence adopting the instrument would not require unanimity in the Council. The instrument could be introduced in the form of an amendment of the EU-MER, including a clarification on how the newly introduced flexibility mechanisms would relate to the CH_4 intensity thresholds. Depending on the specific option chosen, the flexibility would either complement the EU-MER thresholds or replace them. The **political feasibility**, however, could prove to be more complex due to the budget implications: a bonus-only approach might be popular with the regulated companies, as it would provide only carrots and no sticks. Yet it would constitute a

[45] The Technology Innovation and Emissions Reduction (TIER) Regulation that operates in the Canadian province Alberta, and which covers CH_4 emissions as part of a wider cap-and-trade system for industrial emitters, allows emitters to meet their compliance obligation either by improving their efficiency and lowering emissions, by purchasing surplus credits from other installations that exceed their goal, by purchasing offset credits from a centrally administered offset mechanism, or by paying a fixed amount per ton of emissions into a technology fund (effectively a ceiling price). See Mohlin, Kristina, Maureen Lackner, Huong Nguyen, and Aaron Wolfe: Policy instrument options for addressing methane emissions from the oil and gas sector. EDF Economics Discussion Paper Serie, June 22. Available at: https://ssrn.com/abstract=4136535

net expense for the public budget and would therefore require a credible and continuous commitment from the EU budget or other sources to fund the mechanism, making the political feasibility questionable. By contrast, all other options – but especially the malus-only option – are likely to increase the cost of fossil fuels and will therefore either erode profits of fossil fuel importers, increase the energy prices faced by consumers, or both, potentially triggering opposition from the regulated companies and/or from the general public. At the same time, being by and large budget-neutral (bonus-malus, TEP) or representing a net source of revenue (malus-only), could make them more palatable politically.

- The **technical and administrative feasibility:** While the MRV requirements (and the effort they imply) are generally similar across all options of an EPS, the tradable option (TEPS) results in a higher administrative burden than the other options. For this mechanism, the regulator also needs to facilitate the emergence of a marketplace, requiring trading infrastructure (market platform, registry for transactions and units/credits) as well as procedures to ensure oversight of the market activity to prevent market abuse or fraud. These issues in particular make the TEPS a more intricate, higher-maintenance solution.
- The **likelihood that a liquid, transparent market will emerge** is only an issue for the TEPS, since the other options do not involve a market. For the TEPS, this may be an issue, given the limited size of the market (about 1-4% of the EU ETS in terms of GHG volume covered, see Chapter 2.2 above) and the limited number of market participants.
- In terms of their **capacity to generate a significant and clear price incentive** to reduce CH_4 emissions where they occur, the various implementation options substantially differ from each other. Market-based price formation only occurs in the case of a tradable Emission Portfolio Standard (TEPS). However, in this case, too, the price formed on the market would be determined by the distance to target (how far is the average emission intensity above the EPS benchmark), not by some measure of the external costs of CH_4 emissions. In the case of bonus, malus or bonus-malus, there is a price signal favouring emitters with lower intensity, but this incentive is directly set by the regulator: whether it is significant and clear, therefore, depends on the ambition of the regulator (and its budget constraints). For the bonus-only option, the mechanism also does not ensure that the cost accrues to the emitter in line with the polluter-pays-principle – in this instance, lower-emitting producers are supported, while higher-emitting producers are not penalised. At the same time, the bonus-only option is the only option that generates a continued incentive to reduced emissions, even if the industry at large outperforms the benchmark intensity value. For the other options, the mechanism would create an incentive to achieve the target (benchmark) intensity value, but not to surpass it.
- In terms of the **capacity to generate revenue** for public budgets, generally, only those options that involve a malus element (payment of a penalty for emission intensity in excess of the benchmark) potentially generate revenue. For a malus-only mechanism, the revenue will clearly be highest: the bonus-malus option may turn out to be budget neutral (if malus receipts and bonus payments are balanced) to net negative (e.g. if exporters reserve cleaner fuels for the EU market to take advantage of the bonus, and/or discontinue imports of more polluting fuels to avoid the malus). Likewise, a TEPS in its pure form will generate limited or no revenue, since trading occurs (primarily) between covered entities. A TEPS may generate limited revenue if compliance entities have access to credits issued by the regulator, e.g. from some sort of reserve, or to establish a ceiling price.

- The **WTO compatibility** of the approach(es) resembles that of the CBAM, in that both instruments relate to embedded emissions that accrue during the production process. A key requirement for WTO compatibility is that foreign suppliers of fossil fuels are subjected to the same treatment as domestic producers and have access to the same benefits. This particularly requires MRV that is equally reliable and robust – for instance if foreign suppliers to the EU market claim a bonus for traded fuel quantities that fall below the emission intensity benchmark.

By way of an overall assessment, the EPS mechanism (in its different varieties) not only provides producers with an incentive to reach the target intensity value as a sector, but also provides the individual producers flexibility on how to achieve the target and to coordinate the contribution of different emitters in an efficient way. Only one option (bonus-only) provides an incentive to surpass the target – yet this option suffers from other shortcomings: above all, it violates the polluter-pays-principle and does not internalise the external cost, nor does it generate revenues. And while it may encounter less resistance from covered entities, it requires a sustained commitment to mobilise the necessary public funding.

At the other end, the tradeable option (TEPS) is the most sophisticated solution and has the benefit of not requiring a political decision on the price (thus avoiding the risk of a too weak incentive). Yet the added complexity of the instrument, particularly the additional administrative effort necessary for a relatively small market volume, raises questions on whether the mechanism can be implemented quickly enough to achieve the desired effect.

Overall, of the options considered, the malus-only and the bonus-malus option would therefore appear to offer the best balance between administrative effort required, and likelihood that they will achieve the desired effect and create an effective economic incentive. Between the two, the greater political feasibility would lead us to consider the bonus-malus option as more suitable: while it is less likely to generate revenue (and may incur a net cost on the budget), it is also less likely to attract strong opposition from covered entities, both domestic and abroad.

One implication common to all options is that they would likely result in **resource shuffling** on the side of the suppliers. Where suppliers or vendors have a choice about which fuels they supply to the EU, and which they sell elsewhere, they would target those fuels with lower upstream emissions to the EU and seek to sell other fuels to other markets that do not have comparable regulations. This is a form of leakage, which is common to all instances where domestic regulations apply to segments of a global market, and which will diminish the overall effectiveness of the instrument. This effect is common to all options discussed, and therefore would not be a distinguishing feature of either of them. However, its implications would especially be notable for the bonus, malus, and bonus-malus options, resulting in a situation where foreign suppliers receive a considerable share of the bonus (by supplying low-CH_4-intensity fuels to the EU), while seeking to avoid malus payments by sending shipments of high-CH_4-fuels elsewhere.

4 Conclusions and recommendations

There are **good reasons why the EU should put a price on CH_4 emissions from the energy sector.** Doing so would close a gap in the EU regime for pricing GHG emissions, thereby enhancing both the efficiency and fairness of EU climate policy. It would support the regulatory impulse from the EU Methane Regulation (EU-MER) by strengthening the economic incentive to tackle CH_4 emissions from the energy sector. It would also accelerate the already ongoing phase-out of fossil fuels across the EU.

Irrespective of its form, a CH_4 pricing mechanism at EU level is unlikely to come into effect before 2030. Its main benefit would thus lie in its function as a transitional instrument that would be **most impactful in the 2030s**, while the EU still consumes significant amounts of fossil fuels, and a large share of the imports is still under legacy contracts not yet covered by the EU-MER CH_4 intensity thresholds. Even after these thresholds take effect, a CH_4 pricing scheme could provide an economic **incentive to reduce the CH_4 intensity at lower levels than those mandated**. This effect would be particularly strong if the thresholds lacked ambition. Therefore, as part of the overall policy mix, CH_4 pricing also has a role to play as a companion to the EU-MER, and as an insurance against the political risk that the EU-MER intensity thresholds lack ambition.

Without a CH_4 pricing mechanism, there would be only very limited economic incentives in the status quo scenario. The **CH_4 intensity thresholds** established by the EU-MER **correspond to an Emission Performance Standard**, but without flexibility in achieving the intensity target and a risk that the thresholds are unambitious. The penalty regime under EU-MER has been created with a different intention, and only creates a limited quasi-economic incentive.

Our analysis has identified **two practicable options** for how the EU could implement a pricing mechanism for CH_4 emissions from the energy sector**:**

- The **de facto EPS** established by the EU-MER CH_4 intensity thresholds could be complemented **with a Bonus-Malus element**. Its core feature would be an EPS CH_4 intensity benchmark set at a more ambitious level than the EU-MER thresholds. The producers and importers of fuels with CH_4 emission intensity below the EPS benchmark would receive a payment, while producers and importers of fuels with higher emission intensity incur a surcharge. In principle, this mechanism could be budget-neutral, as the malus payments from firms could cover the bonus support that the regulator provides. Yet resource shuffling, particularly by fuel importers, may tilt the balance to a net outflow from the public budget, requiring a source of funding. The mechanism could be implemented by amending the EU-MER. However, if the system indeed involved public funds, its legal feasibility should be confirmed and a source of funding identified. Adopting a scheme involving a net flow of public funds in favour of companies exporting fossil fuels to Europe could prove politically difficult.
- An alternative would involve integrating energy-related CH_4 emissions into the scope of the **EU ETS and CBAM**. This option would extend the main tools through which the EU already prices GHG emissions. It would require extending the cap and other arrangements already established based on the experiences from previous scope extensions.

Between the two options, **the extension of the EU ETS and CBAM appears most promising,** particularly regarding the ease and speed of implementation, as it builds on established regulatory and administrative infrastructure with a solid institutional endowment. This includes political and administrative path dependencies at the EU level, where emissions trading has been the instrument of choice for the European Commission, has won the support or acceptance of major fractions in the European Parliament, and is now a well-established and agreed-upon instrument. As with scope extensions to include additional gases (N_2O, PFC) and activities (aviation, shipping), the effort to include CH_4 under the existing regime appears manageable. Moreover, the EU ETS option would likely generate additional revenues, while the alternative (tradeable EPS) could require a net inflow of funds.

One general concern affecting both options relates to **data quality and the robustness of MRV**, given that accurate and robust MRV is an essential precondition for a stable, well-functioning carbon market. Ensuring robust MRV is indeed more challenging for (fugitive) CH_4 emissions than it is for the CO_2 emissions from combustion or process emissions. Yet the accuracy of CH_4 MRV is bound to improve over the coming years as the EU-MER reporting is established and CH_4 monitoring technologies are further developed. Moreover, energy-related CH_4 emissions will represent only a limited volume corresponding to 1-4% of the 2030 ETS cap, which limits the potential ETS market distortions that less accurate CH_4 monitoring could cause.

A second concern relates to the **international coverage** and **WTO compatibility** of the CH_4 pricing instrument. Given that the EU imports most of the fossil fuels it consumes, mitigating CH_4 emissions embedded in imported fuels is more important than the domestic effects of CH_4 pricing. Solutions exist to cover imports with an emission price, either by extending the CBAM or by including traded volumes in the scope of a bonus-malus EPS. However, a risk remains regarding both the political feasibility of such solutions and their acceptance by major trading partners, as well as potential legal cases brough to the WTO.

We conclude that **the EU should envisage expanding the EU ETS to cover CH_4 emission from the energy sector** starting in 2030.

For this to happen, the **next steps** must begin imminently. The next review of the EU Emissions Trading is scheduled to take place in 2026. Art 30 of the EU ETS Directive requires that the Commission reports to the European Parliament and to the Council by 31 July 2026 on the performance of the EU ETS and suggests amendments to the instrument. Art. 30 explicitly lists several items to be covered in the review – including an assessment of extending the EU ETS scope to CH_4 and N_2O emissions from waste incineration and landfills. While other CH_4 sources are not mentioned explicitly, the wording of Article 30 does not rule out that they could be included in the review. If the review finds a compelling case, the Commission report should also include proposed language for the changes to the EU ETS Directive. These would likely take effect from the start of the next trading period, which begins in 2030.

Our analysis has identified areas on which **additional research could support agenda setting and policy adoption**. First, a precise and substantiated estimation of the volumes of CH_4 emissions that could effectively become subject to the pricing scheme. Second, a cost-benefit analysis of integrating subsectors with relatively lower volumes of CH_4 emissions could be helpful. Third, a granular analysis of whether the MRV requirements established by the EU-MER are sufficient to underpin the chosen pricing mechanism will be needed.

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