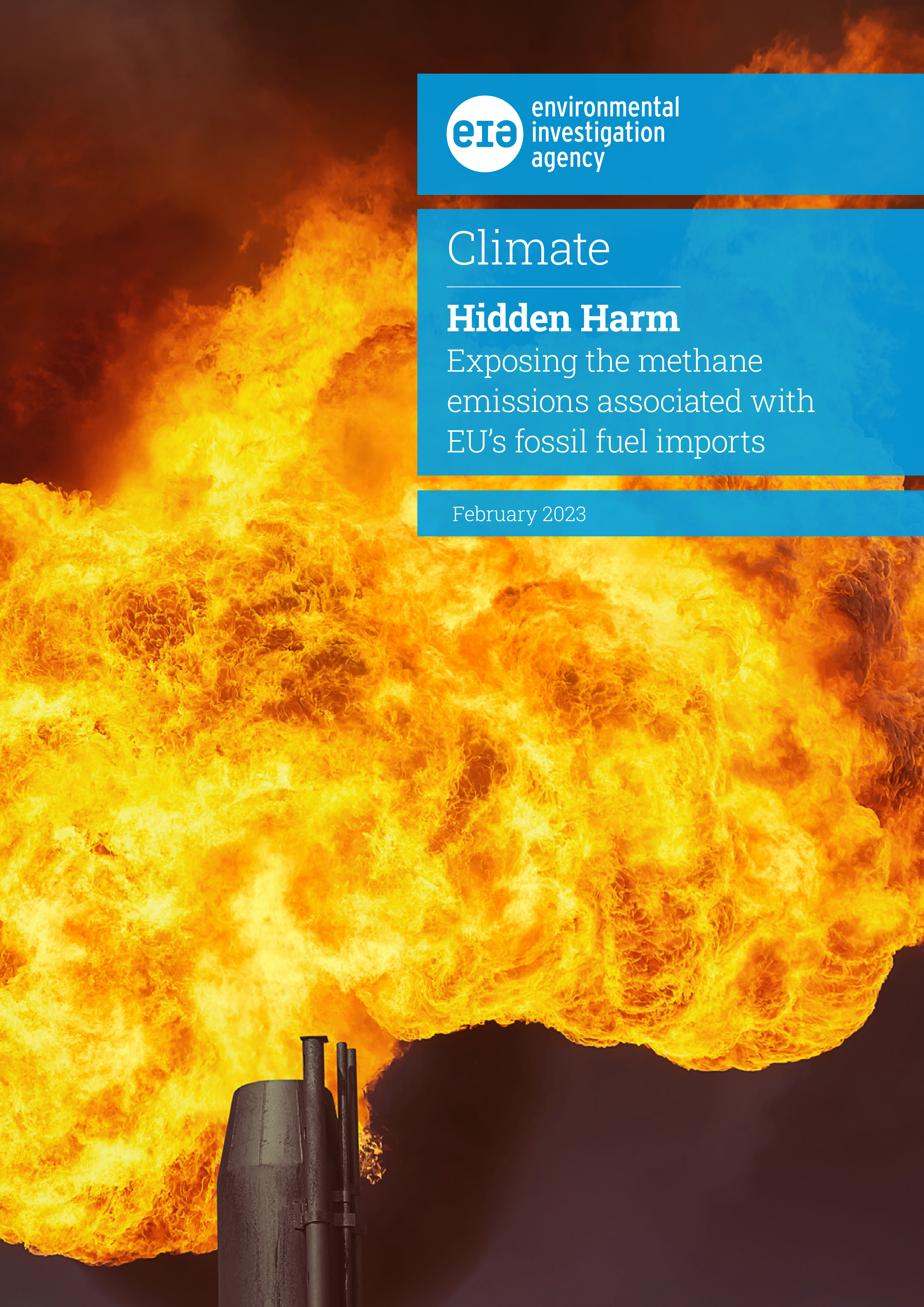
environmental investigation agency

Climate

Hidden Harm

Exposing the methane emissions associated with EU's fossil fuel imports

February 2023



ACKNOWLEDGEMENTS

This report was written and edited by the Environmental Investigation Agency UK (EIA).

EIA wishes to thank its numerous supporters whose long-term commitment to the organisation's mission and values helped make this report possible.

ABOUT EIA

We investigate and campaign against environmental crime and abuse.

Our undercover investigations expose transnational wildlife crime, with a focus on elephants and tigers, and forest crimes such as illegal logging and deforestation for cash crops like palm oil. We work to safeguard global marine ecosystems by addressing the threats posed by plastic pollution, bycatch and commercial exploitation of whales, dolphins and porpoises. Finally, we reduce the impact of climate change by strengthening and enforcing regional and international agreements that tackle climate super-pollutants, including ozone depleting substances, hydrofluorocarbons and fossil fuels.

EIA UK

62-63 Upper Street,
London N1 0NY UK
T: +44 (0) 20 7354 7960
E: ukinfo@eia-international.org
eia-international.org

EIA US

PO Box 53343
Washington DC 20009 USA
T: +1 202 483 6621
E: info@eia-global.org
eia-global.org

Environmental Investigation Agency UK
UK Charity Number: 1182208
Company Number: 07752350
Registered in England and Wales

Front cover and above: Flaring is used to burn combustible components of waste gases during fossil fuel operations and results in emissions of CO_2, black carbon, methane and other air pollutants.

CONTENTS

Introduction

Methane emissions are a threat to global climate and human health. Atmospheric methane concentrations are at their highest ever, having risen by almost 10 per cent in the past 20 years.[1]

As the second most important greenhouse gas (GHG), more than 80 times more powerful than carbon dioxide (CO_2) over a 20-year period, methane has contributed to 25 per cent of the global warming experienced today.[2]

Methane contributes to the formation of tropospheric ozone, a potent local air pollutant that causes serious health problems, contributing to illnesses and premature deaths as well as to losses in agricultural harvests.[3] Cutting methane emissions by 45 per cent by 2030 has the potential to prevent 255,000 premature deaths and 775,000 asthma-related hospital visits each year, as well as increasing global crop yields by 26 million tonnes per year.[4]

Anthropogenic methane emissions arise from three main sectors: energy, agriculture and waste. The energy sector comprises methane emissions from oil, gas and coal. In its *Special Report on Global Warming of 1.5°C*, the Intergovernmental Panel on Climate Change (IPCC) found that "... pathways that limit global warming to 1.5°C with no or limited overshoot involve deep reductions in emissions of methane...." [5] The Global Methane Assessment, launched jointly by the Climate & Clean Air Coalition (CCAC) and United Nations Environment Programme (UNEP), called for reductions of global methane emissions by 45 per cent by 2030 in order to limit global warming to 1.5°C this century.[6]

Against the backdrop of the European Green Deal commitment to reduce GHG emissions by at least 55 per cent by 2030, the European Commission proposed a *Regulation on Methane Emissions Reduction in the Energy Sector* ("EU Methane Regulation") in December 2021. The general objective of the Regulation is "to preserve and improve the environment by reducing methane emissions from fossil energy produced or consumed in the Union." [7] The words "or consumed" are particularly crucial, as most of the energy consumed in the EU comes from imported fossil fuels and the methane emissions related to these imported fossil fuels are released long before they reach EU borders.

Reducing emissions from fossil energy consumed in the EU will require meaningful measures to address both domestic sources of methane emissions as well as those associated with imports. Despite this, the Commission limited its provisions on monitoring and mitigation of methane emissions to EU domestic actors only, absolving importers of any meaningful measures in order to access the EU market.

This report exposes the EU methane emissions problem associated with imports, demonstrating the need to extend the EU Methane Regulation across the supply chain - imports included - in order to meet EU climate objectives and set the world on a path to cutting methane emissions by 45 per cent by 2030.

Above: Methane is released during various mining activities, through the degasifications and ventilations systems, or through vents and fissures in abandoned and closed mines.

Above: About three-quarters of total methane emissions in the oil and gas operations occur upstream.

EU dependence on imported fossil fuels

The EU is a major consumer of fossil fuels. In 2020, 411.5 million tonnes (Mt) of oil was consumed, representing 35 per cent of final energy consumption in the EU; 399.6 billion cubic meters (bcm) of gas was consumed, representing 24 per cent of final energy consumption in the EU; and 426.6 Mt of coal, representing 12 per cent of final energy consumption in the EU.[8]

Several EU countries produce fossil fuels. In 2020, the EU produced 55.68 bcm of gas with production led by the Netherlands (24.08 bcm), Romania (8.91 bcm) and Italy (4.013 bcm).[9] The same year, the EU produced 18.7 Mt of oil, with Italy (5.39 Mt), Denmark (3.52 Mt) and Romania (3.33 Mt) being the biggest producers.[10] The EU produced 338.15 Mt of coal in 2020, of which 244.46 Mt was brown coal and 56.53 Mt was hard coal, led by Germany (120.45 Mt), Poland (108.48 Mt) and Romania (12.03 Mt).[11]

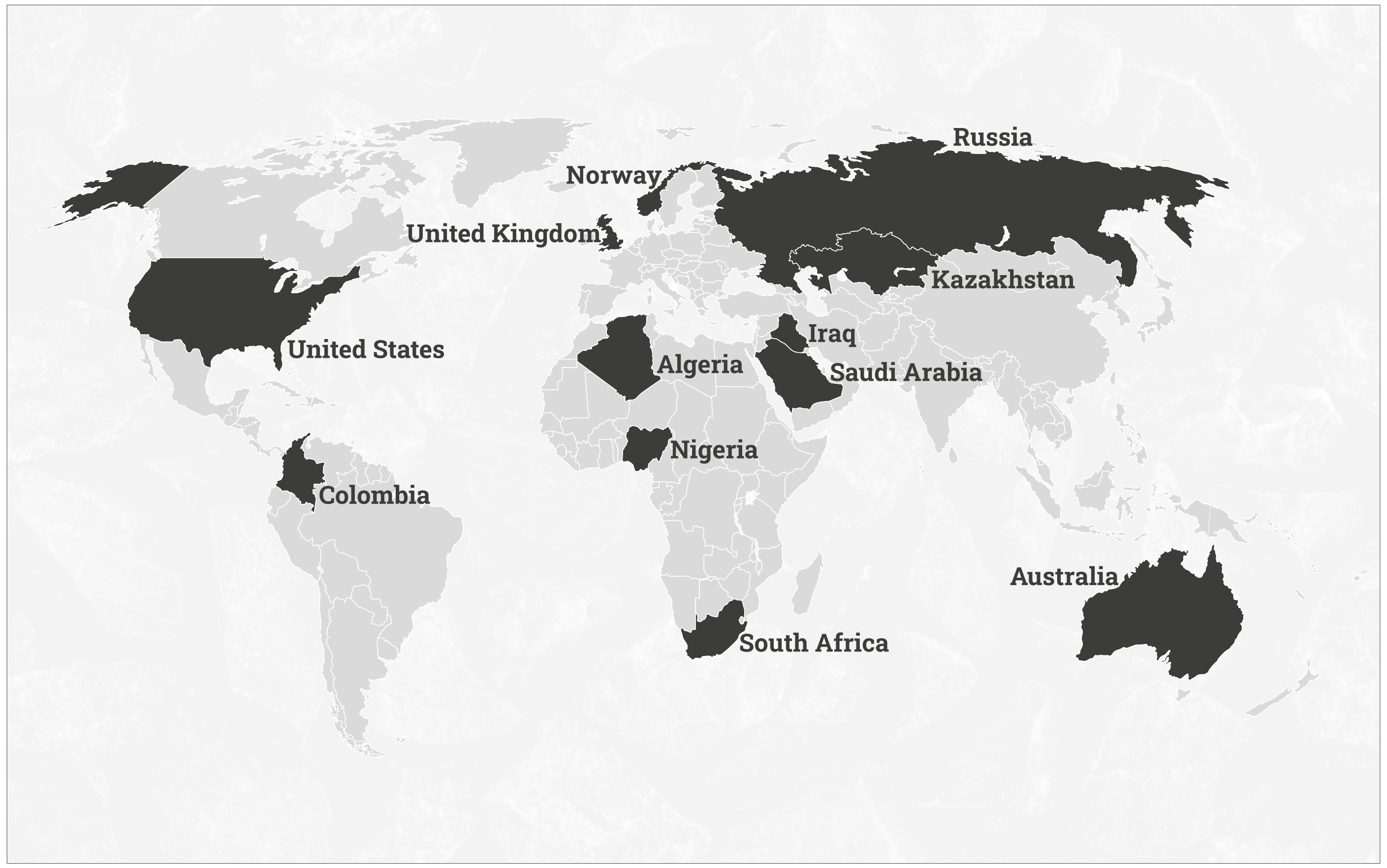
Despite its domestic production, the EU relies heavily on fossil fuels imports, importing 70 per cent of the coal, 97 per cent of the oil and 90 per cent of the gas it consumes.[12] So heavy is this reliance that **the EU consumes more than half of all globally traded gas**.[13]

Russian suppliers dominate the import of coal, oil and gas into the EU (see Table 1). About a quarter of the total length of global pipelines are in Europe, with the Druzhba Oil Pipeline linking Russia to Germany being the longest pipeline in the world.[14] The EU is also a major importer of liquified natural gas (LNG), transported on ships.[15]

***Table 1:** EU fossil fuel imports in 2020*

Gas		Oil		Coal (hard)	
Total gas imports: 400.59 bcm[16]		Total oil imports: 746.52 Mt[17]		Total coal imports: 87,73 Mt[18]	
Russia	155.19 bcm (38.9%)	Russia	170.56 Mt (22.8%)	Russia	43.05 Mt (49.1%)
Norway	74.56 bcm (18.61%)	United States	52.56 Mt (7%)	United States	13.37 Mt (15.2%)
Algeria	29 bcm (7.2%)	Norway	47.81 Mt (6.4%)	Australia	11.92 Mt (13.6%)
United States	15.68 bcm (3.9%)	Saudi Arabia	44.29 Mt (5.9%)	Colombia	4.73 Mt (5.4%)
United Kingdom	15.15 bcm (3.8%)	United Kingdom	40.26 Mt (5.4%)	South Africa	1.09 Mt (1.2%)
Others	27.6%	Kazakhstan	37.55 Mt (5%)	Others	15.5%
		Nigeria	34.6 Mt (4.6%)		
		Iraq	29.11 Mt (3.9%)		
		Others	44%		

***Figure 1:** Main countries exporting fossil fuels to the EU*



During the past two decades, from 2000-20, EU dependency on fossil fuel imports has increased from 65.7 to 83.6 per cent for gas, from 29.8 to 35.8 per cent for coal and from 92.8 to 96.2 per cent for oil.[19]

The Russian war in Ukraine triggered the urgent need for the EU to diversify its energy sources to reduce its dependence on Russian fossil fuels. These changes will be particularly driven by the provisions of the REPowerEU plan, released by the European Commission in May 2022.[20] REPowerEU aims to end EU dependence on Russian fossil fuels as quickly as possible, in principle by 2027, with a two-third cut in Russian gas imports by the end of 2022, while also securing a long-term sustainable energy supply to Europe.[21] REPowerEU outlines a package of measures to reduce energy demand, diversify supplies and accelerate the transition to renewable energy sources, updating certain targets that were set under Fit For 55.

For example, the European Commission has proposed to increase the headline 2030 target for renewables from 40 per cent to 45 per cent under Fit for 55, setting a goal of 10 million tonnes of domestic renewable hydrogen production and 10 million tonnes of hydrogen imports by 2030 to replace fossil fuels in hard-todecarbonise industrial sectors such as cement, steel and petrochemicals.

REPowerEU also includes the creation of an "EU Energy Platform" which aimed to secure energy supplies of gas, LNG and hydrogen to refill gas storage facilities in time for winter 2022-23 and beyond.[22] As the EU works with international partners to diversify supplies, the map of exporting countries to the EU will change in the coming months and years.

For gas, Norway planned to deliver 90 bcm of gas to the EU in 2022, compared to 74.56 bcm in 2020, representing about 24 per cent of EU demand.[23] In a joint EU-Norway declaration, the European Commission further supported Norway's exploration of new fields to continue to supply to Europe beyond 2030, without stating the exact quantity of gas exports in the coming years.[24]

The United States (US) has also ramped up its gas exports to the EU: between January and April 2022, it exported 74 per cent of its LNG to Europe, compared with an annual

Figure 2: *Monthly gas imports to the EU between January 2021 and September 2022 (bcm)*

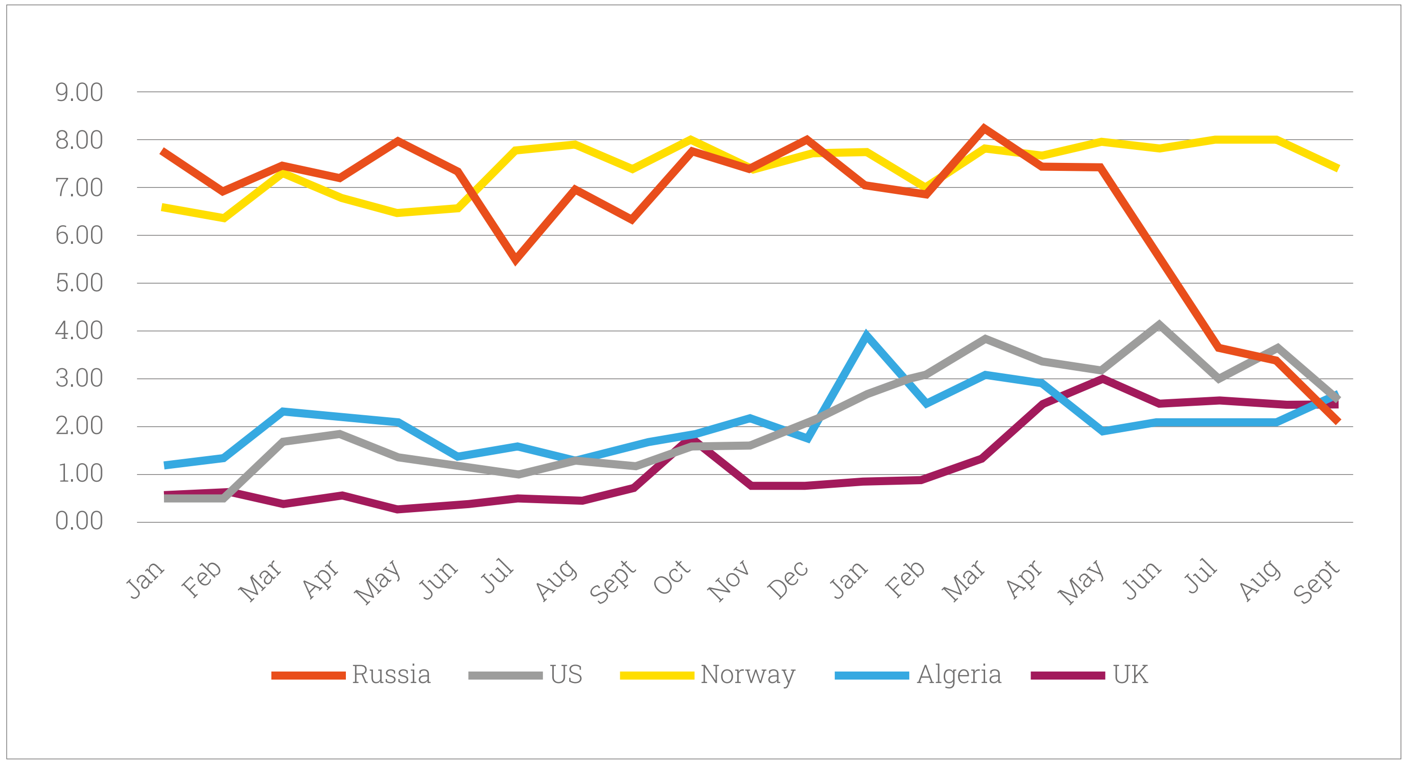
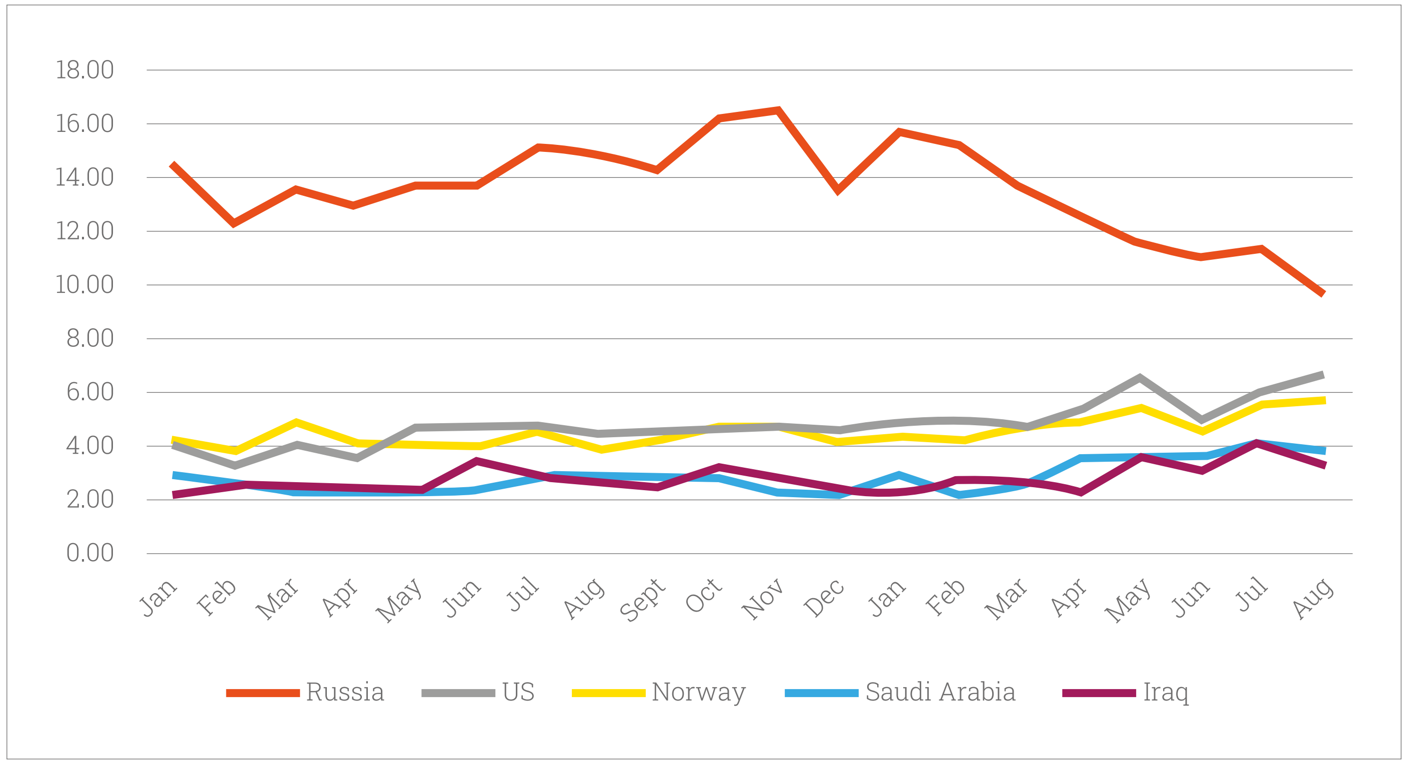


Figure 3: *Monthly oil imports into the EU from January 2021 to September 2022 (Mt)*



average of 34 per cent in 2021.[25] The EU further signed an agreement with the US to import an additional 50 bcm of LNG annually until at least 2030, which means the US will export about 65.68 bcm of gas, compared to 15.58 in 2020.[26]

Imports from the UK have also increased considerably, from 0.73 bcm in September 2021 to 2.49 bcm in September 2022. Likewise, Algeria exported 1.6 bcm of gas to the EU in September 2021, increasing to 2.63 bcm in September 2022 (see Fig 2).

On top of the agreements that are already in place, the EU is exploring new deals with current or new partners to further diversify gas supplies. Nigeria, Niger and Algeria have signed a memorandum of understanding to build the Trans-Saharan Gas Pipeline that will stretch across the Sahara Desert, with up to 30 bcm of gas transported from Nigeria via the other two countries to be sent to Europe each year.[27] The European Commission also signed a deal with Azerbaijan to double imports of gas by 2027, with Azerbaijan already increasing deliveries of gas to the EU from 8.1 bcm in 2021 to an expected 12 bcm in 2022.[28]

Over the same period, Russian oil exports have significantly dropped, from 14.85 Mt in August 2021 to 9.79 Mt in August 2022, while imports from the US, Norway, Saudi Arabia and Iraq have increased.

Coal imports have not only diversified but have increased since the beginning of the Russian war in Ukraine as a way of responding to reduced gas supplies. In June 2022, European countries imported 7.9 Mt of thermal coal, twice as much as imported in June 2021. The US increased its coal exports by 27.9 per cent between 2021-22[29] and Colombia doubled coal exports to the EU from 0.55 Mt in February 2021 to 1.1 Mt in February 2022.[30]

Overall, REPowerEU sends mixed signals. According to the European Commission, full implementation of Fit for 55 would lower gas consumption by 30 per cent by 2030, representing a reduction of 116 bcm compared to 2020. Higher-than-expected gas prices are expected to reduce annual EU gas consumption by another 40 bcm[31] by 2030 while REPowerEU is expected to cut an extra 100 bcm from gas consumption over the same period. This would reduce EU gas consumption from 399 bcm in 2020 to around 143 bcm in 2020. And yet investments are planned for new pipelines and LNG terminals.

Additionally, REPowerEU is expected to decrease coal demand by 36 per cent by 2030 compared to 2020 levels, going from 527.3 Mt to 379.5 Mt, and oil by 28 per cent by 2030 compared to 2019 levels, from 649.6 Mt to 467.7 Mt.[32] While these figures would represent welcome reductions of fossil fuel consumption in the EU, they underscore the fact that the EU does not anticipate weaning itself off fossil fuels any time soon. This begs the question as to how the EU can reduce methane emissions associated with its fossil fuel consumption in the meantime.

Right: According to EPA projections, coal mining will account for approximately 10 per cent of global methane emissions in 2030.

Methane emissions from imported fossil fuels to the EU

Fossil fuels imported into the EU are responsible for significant GHG emissions, particularly in the producing countries and along the supply chain, with methane being a key culprit.

While the EU plans to reduce its demand, the lack of measures to reduce methane emissions associated with imports is a significant oversight that must be addressed.

As a major importer of fossil fuels, the EU is a key driver of global methane emissions. Methane is emitted across the gas supply chain, particularly upstream, due to unintentional leaks or as a result of venting and flaring. Unintentional leaks result from improperly fitted connection points, deteriorated seals and gaskets, pressure changes, mechanical stresses and poor maintenance or operating practices.[33] Oil and gas companies also deliberately vent or burn off (flare) natural gas, that is primarily composed of methane, during various operational or maintenance processes e.g. to manage pressure build up.

Abandoned coal mines and unsealed oil and gas wells are also a major source of methane emissions. Of the estimated 135 Mt of energy-related global methane emissions each year, the International Energy Agency (IEA) estimates that "42 Mt are from coal mine methane, 41 Mt are from oil, 39 Mt are from extracting, processing and transporting gas, 9 Mt from the incomplete combustion of bioenergy and 4 Mt leaks from end-use equipment." [34] The Oxford Institute for Energy Studies, based on IEA data, shows the scale of GHG intensities from highest to lowest emitting sources of oil and gas and, in every case (except for the lowest 10 per cent of oil), methane is the largest component of emissions.[35]

Moreover, underreporting of methane emissions is a major problem. The IEA estimates that global methane emissions from the energy sector are about 70 per cent greater than the sum of UNFCCC reports submitted by national governments.[36] This demonstrates the lack of any effective framework for monitoring, reporting and verification, which is compounded by an absence of effective methane mitigation policies.

According to the IEA, global methane emissions from oil and gas operations could be cut by 50 per cent if all countries implemented "tried and tested policies that have already been used effectively in multiple settings".[37]

Above: Flares emit a host of air pollutants which are linked to several health conditions.

Table 2: Total methane emissions associated with fossil fuel production from major exporters to the EU.[38]

Country	Sector	Total methane emissions (kt)
Russia	Gas, oil and coal	18,364.8
United States	Gas, oil and coal	16,701.8
Norway	Gas and oil	31.05
United Kingdom	Gas and oil	245.96
Algeria	Gas	934.12
Saudi Arabia	Oil	2,316.75
Kazakhstan	Oil	1,279.82
Nigeria	Oil	1,487.72
Iraq	Oil	2,713.41
Australia	Coal	1,754.49
Colombia	Coal	161.48
South Africa	Coal	1,225.35

Tables 3-5 (page 12) reveal estimated methane emissions associated with EU imports of fossil fuels in 2020 from leading exporters, underscoring the EU's role in driving global methane emissions. In total, methane emissions associated with fossil fuel imports from the major exporters to the EU in 2020 are estimated to be 8,083 kt, equivalent to 202 Mt carbon dioxide-equivalent (CO_2e) and a significant percentage of the annual 9,000 kt overall associated with EU imports.[39]

The failure of the European Commission to include meaningful measures to reduce methane emissions from imported fossil fuels in its proposal for an EU Methane Regulation is damning.

During the extraction, production, processing, transport and use of fossil fuels, infrastructure is prone to leak. About three-quarters of total methane emissions in the oil and gas operations occur upstream and nearly all of methane emissions from coal operations,[49] which means that methane emissions associated with fossil fuel imports are mostly emitted before reaching the EU borders. This is particularly critical when we know that "due to the higher global warming potential of methane, as little as three per cent leakage along the natural gas supply chain can cancel out the GHG emission benefits of natural gas vs coal in power generation." [50] In other words, the "transitional" energy source (gas) can be worse for the climate system than the energy source it is replacing (coal) – a climate scandal of immense proportions.

Recent estimates have shown that, given the significant underreporting, methane emissions along many gas supply chains are higher than three per cent. For example, in the Permian Basin in the US, satellites measurements have found that 3.7 per cent of the gas produced leaked into the atmosphere.[51]

The IEA estimates that EU oil and gas imports contributed about 9,000 kt of methane emissions in 2020, equivalent to 225 Mt carbon dioxide-equivalent (CO_2e),[52] surpassing the annual CO_2 emissions from more than 60 coal-fired power plants.[53] This compares to an estimated 1,033 kt of methane emissions from oil and gas produced in the EU in 2019,[54] equivalent to 25.8 Mt CO_2e. It should be noted that comparisons to CO_2 based on the 100-year GWP, underrepresent the true impact of methane emissions over the next critical decade, which are far greater due to their short atmospheric lifetime.

Table 3: Emissions associated with EU gas imports from major exporters (2020).
Sources: total gas production,[40] gas exports to the EU,[41] methane emissions from gas production.[42]

Country	Total gas production (bcm)	Gas export to the EU (bcm)	Share of export to EU (%)	Methane emissions from gas production (kt)	Methane emissions associated with EU import (kt)
Russia	638.5	155.19	24	8,589.93	2061.58
Norway	111.5	74.56	67	39.728	26.62
Algeria	81.5	29	35	934.12	326.94
United States	914.6	15.68	1.70	9,923.26	168.69
United Kingdom	39.5	15.15	38	151.39	57.53
Total emissions associated with EU gas imports in 2020:					**2,641.36**

Table 4: Methane emissions associated with EU oil imports from major exporters (2020).
Sources: total oil production,[43] oil export to the EU,[44] methane emissions from oil production.[45]

Country	Total oil production (in Mt)	Oil export to the EU (bcm)	Share of production going to EU (%)	Methane emissions from oil production (kt)	Methane emissions associated with EU import (kt)
Russia	513	170.56	33.25	7,538.90	2506.68
United States	686	52.56	7.66	5,341.78	409.18
Norway	93	47.81	51.41	15.6	8
Saudi Arabia	518	44.29	8.55	2,316.75	198.08
United Kingdom	48	40.26	83.88	126.19	105.85
Kazakhstan	87	37.55	43.16	1,279.82	552.37
Nigeria	89	34.6	38.88	1,487.71	578.42
Iraq	202	29.11	14.41	2,713.41	391.22
Total emissions associated with EU oil imports in 2020:					**4,749.80**

Table 5: Methane emissions associated with EU coal imports from major exporters (2020).
Sources: total coal production,[46] coal exports to the EU,[47] methane emissions from coal production.[48]

Country	Total coal production (in Mt)	Coal export to the EU (in Mt)	Share of production going to EU (%)	Methane emissions from coal production (kt)	Methane emissions associated with EU import (kt)
Russia	327.7	43.05	13.14	3,972.19	521.94
United States	441	13.37	3.03	2,314.40	70.13
Australia	425.9	11.92	2.80	1,754.49	49.12
Colombia	49.3	4.73	9.59	161.48	15.48
South Africa	252.2	1.09	0.43	1,225.35	5.3
Total emissions associated with EU coal imports in 2020:					**661.97**

Satellite monitoring

Satellites have been essential for determining the magnitude of methane emissions, but only to a certain extent.

By measuring the atmospheric concentration of methane, satellites can be used to assess methane emissions at a national and regional level and can also target specific industrial facilities and ultra-emitting events. Considering the millions of oil and gas facilities worldwide, satellite monitoring holds the potential to increase efficiency considerably but it is not without its limitations.

Various different types of satellites for methane monitoring exist. Currently, the most accurate methane detection system with global coverage is the TROPOspheric Monitoring Instrument, which orbits aboard the Copernicus Sentinel-5 from the European Space Agency (ESA). It maps a range of atmospheric gases around the globe every 24 hours. However, it cannot be used to pinpoint specific facilities.[55] Another type of satellite includes those operated by GHG Sat, which launched six satellites designed for industrial site measurements.[56] New satellites will be launched in the coming years offering even finer resolution.

Above: Recent satellite, aerial and ground-based technologies are shedding light on the scale of methane emissions from oil and gas infrastructure and coal mines.

These satellites have been providing dramatic images of chronic leaks, ultra-emitting events and venting and flaring emissions. In a recent study, Kayrros, a leading energy and environment geo-analytics company, analysed methane emissions from six major oil- and gas-producing countries: Russia, Turkmenistan, the US, Iran, Kazakhstan and Algeria. Of those six countries, four are major exporters to the EU. Using satellite data, Kayrros identified 1,800 ultra-emitting events during 2019-20, of which about 1,200 came from oil and gas facilities.[57] Those ultra-emitting events represent 8-12 per cent of oil and gas methane emissions from national inventories, with an important part of this production for export.

In 2019, the EU received 36 per cent of all LNG cargoes from the US,[58] 35 per cent of Algerian gas production,[59] about 80 per cent of total oil production of Kazakhstan[60] and about 24 per cent of Russian gas production. Between 2019-20, Kayrros detected 13 ultra-emitting events along the Yamal-Europe pipeline, with rates up to 164 tonnes per hour.[61] The Yamal-Europe pipeline is 2,000km long and accounts for about one-sixth of Russia's annual gas export to Europe.[62] Kayrros further found another 33 ultra-emitting events on the Brotherhood pipeline to the EU, with rates of up to 291 tonnes per hour.[63] With high demand from the EU leading to a production increase in those countries, the EU bears considerable responsibility for those ultra-emitting events.

Kayrros also quantified the benefit of eliminating ultra-emitters; by capturing the gas, Russia could save about $4 billion and Algeria approximately $400 million. On top of the economic benefits, Kayrros further found that eliminating ultra-emitters would be equivalent to removing 20 million vehicles from the road for one year. Monitoring and mitigating ultra-emitting events across the supply chain for oil and gas is therefore a quick win for companies and climate.

However, methane emissions are not only the result of ultra-emitting events (or their close cousin, super-emitting events). They also occur during the normal operations of extraction, production and transport of fossil fuels as chronic leakage. Driven by EU consumption, these methane emissions should also be considered by the EU.

Satellite monitoring can further be used to spot major flaring events. According to the World Bank's Global Gas Flaring Reduction Programme, in 2021 about 144 bcm of gas was burned through gas flaring.[64] If it was a country, 'flaring' would be the fifth largest gas-consuming country globally after the US, Russia, China and Iran.[65] The same report identified that of the 10 largest flaring countries in the world, six of them are major oil and gas exporters to the EU – Russia, Iraq, US, Algeria, Nigeria and Libya.

The World Bank's Global Gas Flaring Reduction Partnership developed a new metric, the Imported Flare Gas Index, which shows how countries importing crude oil are exposed to gas flaring (see Fig 4). Estonia is the country with the highest imported gas flare index, due to oil imports from Libya, with other EU countries not far behind.

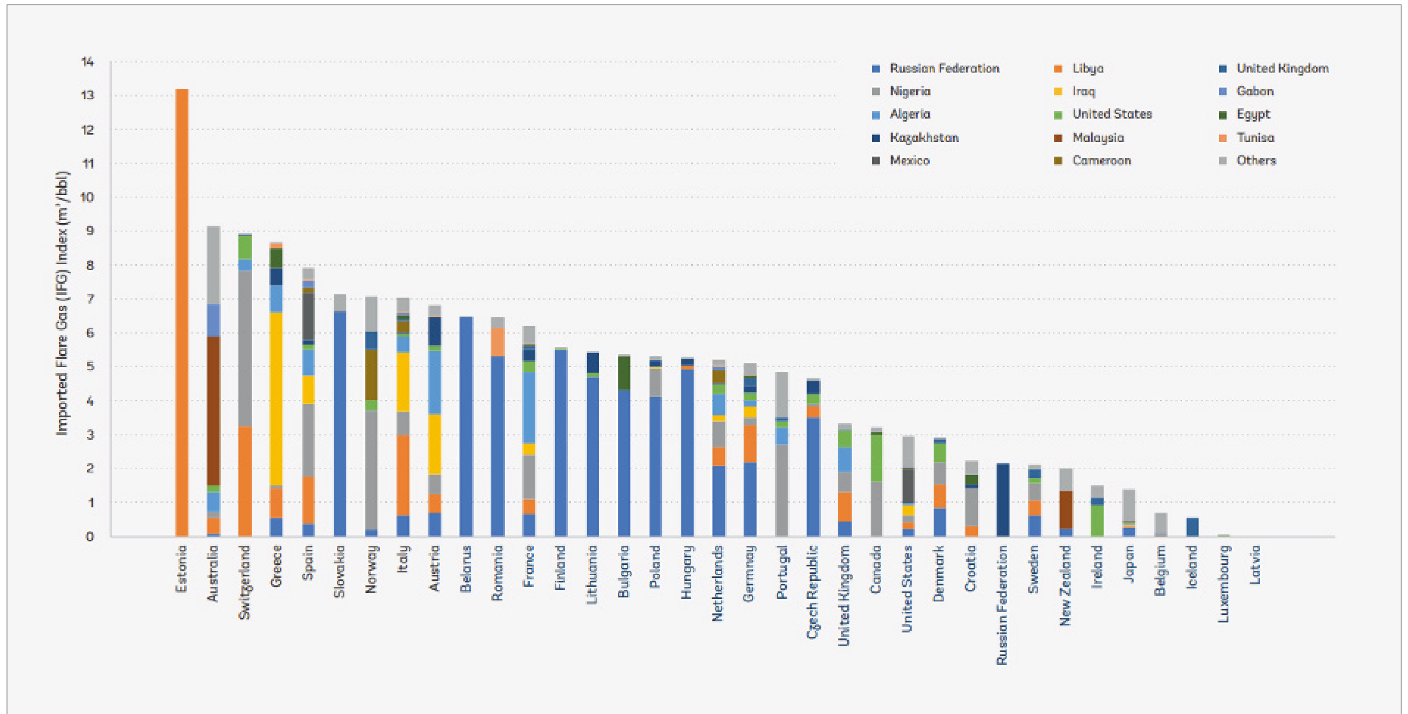
Importing oil from countries which use flaring intensively is problematic. Flaring inefficiencies often lead to only partial combustion of the methane – referred to as methane slippage – while flaring itself is wasteful practice that contributes to CO_2 emissions. FlareIntel, a digital tool which allows anyone to explore gas flares around the world, has shown that imported gas to the EU has an average gas flaring rate 33 times higher than rates associated with domestic production.[67]

Despite being an essential tool for monitoring methane emissions, satellites have shortcomings. When compared to other technologies, satellites have a higher detection limit and are unable to detect certain areas such as offshore platforms or snowy regions.[68] There are also delays caused by the need to convert atmospheric measurements into usable information about surface-level activities. Their emissions estimates can hold large uncertainties and data gaps and will, for this reason, never be as accurate or precise as ground-based measurement.[69]

For these reasons, methane regulations need to encourage direct measurements of source-level methane emissions, complemented with measurements of site-level methane emissions. Using drones, planes or helicopters combined with infrared and thermal imaging techniques can provide granular information.[70]

The Royal Society of Chemistry found that direct measurement can be more accurate and gives more precise detail in the emissions data than engineering calculations and emission factors.[71] Direct measurements are the "only method which can verify emission estimates" and "the data collected from measurement studies are crucial for updating emission factors and data used in engineering calculations." [72] On-the-ground measurement can also report back more regularly than satellites, whichpass over an area infrequently.

Figure 4: *The Imported Flare Gas Index [66] Source: NOAA, Payne Institute and Colorado School of Mines, EIA, UN Comtrade, GGFR*



Methane emissions from LNG

To make transportation and storage easier, natural gas is often cooled to -162°C to create liquefied natural gas (LNG). In 2021, LNG imports were 20 per cent of total EU gas imports, mostly imported by Spain, France, Italy, the Netherlands and Belgium. Between January and September 2022, LNG was mainly imported from the US (44 per cent), Russia (17 per cent) and Qatar (13 per cent).[73]

The EU is planning to increase its LNG imports to reduce its dependence on Russian gas. However, LNG is no cleaner than any other form of gas and contributes significantly to the EU's methane emissions. As with gas transported in its original form, strong leak detection and repair policies are required to minimise leaks from LNG. Without these, total GHG emissions from exported LNG could be comparable or even higher than those from coal.[74]

However, there is no effective monitoring, reporting and verification framework in place for LNG.[75] Methane emissions from US-sourced LNG are particularly complicated to estimate because, in the US, gas is produced from a large number of wells in different basins rather than from one particular field, which makes tracking and monitoring more complicated.[76] Strengthened monitoring of methane emissions along the whole LNG supply chain is therefore needed, with results made publicly available to accurately measure the impact of LNG imports into the EU.

Moreover, replacing gas from Russia with LNG from other countries does not mean fewer emissions. US shale gas production represented 79 per cent of total US gas production in 2020.[77] An increase in LNG demand by the EU will increase the production of shale gas, while estimates show that shale gas comprises more than half of the total increased global methane emissions.[78] And the US is not the only problem – when directly compared to Russia's gas, LNG from Qatar or Australia emits between 60-175 per cent more GHG emissions.[79]

Above: The increase of LNG imports will diversify the suppliers of fossil gas, with the main exporters being the US, Qatar and Nigeria.

Proposal for an EU Methane Regulation

After releasing the *European Strategy to Reduce Methane Emissions* in 2020, the European Commission published its proposal for an EU Methane Regulation in December 2021.

In the Strategy, the Commission stated that the "EU should also play a role in ensuring methane emissions reduction at global level. While the EU contributes only to 5 per cent of global methane emissions within its borders, it can use its position as the largest global importer of fossil fuels … to support similar action from global partners." [80]

The benchmark for a successful EU Methane Regulation has always been how it addresses the upstream segment of the supply chain. However, the only measure on imports put forward is the requirement for importers to annually report if regulatory or voluntary measures to control methane emissions are in place, if measurement and reporting of methane emissions are taking place and the name of any entity undertaking independent verification.[81] In other words, there are no obligations to actually measure, report or verify methane emissions, much less to actually mitigate them.

In the Impact Assessment, the Commission offers two explanations for its failure to propose measures on imports. It first argues that it considers that the "environmental and social benefits are uncertain, as the enforcement and verification of emission reductions outside the EU would be challenging." [82] The EU has, however, frequently adopted mandatory measures on imports accompanied by enforcement and verification frameworks. For example, the EU Timber Regulation prohibits the sale of illegally harvested timber and products derived from such timber on the EU market.[83] Another example is the EU F-Gas Regulation, which places obligations on the destruction of HFC-23, a highly potent GHG, in the production of F-gases that are imported into the EU.[84]

The other explanation offered by the Commission is that mandatory measures on imports "could entail security of risk supply for the EU with potential direct economic impacts".[85] The following section explores this claim in detail.

Above: On 13 December 2021, ahead of the release of the EU Methane Regulation, the Gastivists Collective organised a Guerrilla Projection Action in Brussels to call for the text to include imports.

Reducing methane emissions

Capturing methane emissions from leaky pipelines or methane disposed of by venting and flaring is an opportunity for the industry to save supply without having to extract more.

It is an immediate solution that does not require extensive investment and it is particularly relevant in the current context, as the EU is looking for new suppliers to decrease its dependence on Russian fossil fuels.

The IEA has found that if exporters to the EU were to put in place measures to limit flaring, they could increase gas exports by more than 45 bcm using existing infrastructure. This is equivalent to almost one-third of Russian gas exports to the EU in 2021.[86] A study from Capterio and the Columbia Center on Sustainable Investment found that by capturing gas from flaring, venting and leaking just from North Africa (Algeria, Libya, Tunisia and Egypt), Europe could start to substitute up to 15 per cent of Russian gas within 12-24 months. Capturing this wasted gas would represent an income of $29 billion per year, on top of the climate and health benefits of limiting methane emissions.[87]

REPowerEU includes a proposition to benefit from option with the "You Collect/We Buy" scheme. It aims at promoting the capture of methane instead of intentionally releasing it through venting or destroying it through flaring. The wasted gas would then be purchased by the EU. Although a step in the right direction, the EU should require its partners to ban routine venting and flaring and to put in place strong leak detection and repair programmes, making those practices a condition of market access, for all oil and gas consumed in the EU.

In the context of the energy crisis and rising prices, there is a fear that any rules touching on energy sources could lead to additional charges that would ultimately land on the final consumer. This fear is unfounded – methane emissions monitoring and mitigation would not lead to a price increase. In the Impact Assessment for its proposal for an EU Methane Regulation, the European Commission found that 43 per cent of projected methane emissions can be abated at zero cost by 2030, 63 per cent can be abated at less than low cost (€18/ CO_2e tonne) and 77 per cent can be abated at less than the sum of social benefits (€130/ CO_2e tonne).[88]

Similarly, UNEP's Global Methane Assessment concluded that up to 80 per cent of oil and gas measures and up to 98 per cent of coal measures can be implemented at negative or low cost.[89] And at "today's gas prices, almost all of the options to reduce flaring and methane emissions from oil and gas could be implemented at no net cost because the abatement measures cost less than the market value of the gas that would be captured."[90] The IEA reported that almost 45 per cent of oil and gas methane emissions can be avoided at no net cost while new investments to capture remaining emissions would cost $13 billion, which is less than the value of the captured methane.[91]

The narrative against implementing measures on imports also focused on the impossibility to act on Russian imports as it would threaten supplies. But this argument can no longer be sustained in the context of the war in Ukraine. The necessity to stop fuelling the war has shown that political will is enough to trigger such a change and that it is not a question of feasibility or technicality.

Methane mitigation is therefore key for climate safeguarding and for energy security. Four main types of measures can be put in place to mitigate methane emissions, according to the IEA.[92]

- **First, require leak detection and repair (LDAR).** This consists of inspecting oil and gas facilities using optical gas-imaging cameras, continuous monitoring sensors, aircraft, drones and satellites. The frequency of the programmes directly correlates to leak reduction. According to US regulators, the potential methane emission reductions due to the periodicity of LDAR are as follows: 40 per cent for annual surveys, 60 per cent for semi-annual surveys, 80 per cent for quarterly surveys and 90 per cent for monthly surveys.[93] All components found to be leaking should then be repaired as soon as possible.
- **Second, establish limits on venting and flaring (LVF)** except in certain well-defined situations, such as emergencies. As noted above, venting and flaring practices are gratuitous sources of methane and GHG emissions that that can be easily avoided.
- **Third, in addition to LDAR and LVF, adopt technology standards.** Technology standards reduce methane emissions during normal operation of certain equipment, such as compressors, ship engines and pneumatic devices, by mandating the use and replacement of higher-emitting components with lower-emitting or no-emitting alternatives. IEA found that a "range of alternative technologies can perform the same function as these components, but with lower or zero emissions" and therefore "regulations that limit emissions from certain types of equipment or that require their replacement with lower- or zero-emitting alternatives can reduce emissions significantly."[94]
- **Fourth, address inactive wells and abandoned coal mines.** Inactive wells continue to emit methane long after use unless properly remediated, reclaimed or plugged. In the US, a recent Reuters Special Report found 3.2 million inactive oil and gas wells, which together emitted 281 kt in 2018 or the equivalent of 6.3 MtCO_2e (although US regulators note that figure could be as much as three times higher).[95] A set of technologies can be put in place to properly seal and cap unused or inactive wells and coal mines and ensure they stop leaking methane, and such measures should be required.

All these measures must be accompanied by a strong monitoring, reporting and verification (MRV) framework, one embedded into the bureaucratic and industrial landscape to ensure the efficiency of the mitigation efforts and tackle the global underreporting problem.

In the context of the proposal for an EU Methane Regulation, the EU has a unique opportunity to deliver methane emissions reduction by 2030 and beyond. To do so, however, it will need to extend the provisions on MRV, LDAR and LVF applicable to its domestic actors to importers and, in so doing, reduce methane emissions along the whole supply chain associated with EU consumption.

In support, provisions to promote compliance and enforcement will be required, in particular by putting in place penalties for non-compliance to the rules – similar to approaches taken in other EU legislation.

Above: Methane management policies are an essential part of mine closure plans.

Opposite page: More than 70 per cent of current methane emissions in the oil and gas sector can be avoided with existing technologies.

Conclusion and recommendation

The EU Methane Regulation must be strengthened to be an efficient solution to the climate and health emergency which is irreparably damaging our planet.

The data is clear – the EU is driving global methane emissions and needs to take responsibility for them. Unfortunately, the text proposed by the European Commission is wholly deficient in this regard and requires significant improvement by the European Parliament and the Council to ensure the EU meets its climate targets and gives humanity a chance of staying within 1.5°C.

The technical requirements are available, at low cost, to implement strong rules across the supply chain. Tackling methane emissions, by putting in place mandatory obligations on LDAR, LVF and technology standards, supported by a robust MRV framework, should be a condition of access to the EU market.

References

1. Saunois, Marielle et al. (2020). The Global Methane Budget 2000-2017. Earth System Science Data. Available here: https://essd.copernicus.org/articles/12/1561/2020/
2. Intergovernmental Panel on Climate Change (2013). Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change: Anthropogenic and Natural Radiative Forcing. Page 714. Available here: https://www.ipcc.ch/report/ar5/wg1/anthropogenic-and-natural-radiative-forcing/
3. Joint Research Center (2018). Global Trends of Methane Emissions and Their Impacts on Ozone Concentrations. Page 2. Available here: https://op.europa.eu/en/publication-detail/-/publication/c40e6fc4-dbf9-11e8-afb3-01aa75ed71a1/language-en#:~:text=Methane%20is%20a%20greenhouse%20gas,ambitious%20methane%20reduction%20strategies%20worldwide.
4. UNEP (2021). Global Methane Assessment: Summary for Decision Makers. Page 8. Available here: https://wedocs.unep.org/bitstream/handle/20.500.11822/35917/GMA_ES.pdf
5. Intergovernmental Panel on Climate Change (2018). Global Warming of 1.5°C: An IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty. Summary for Policymakers. Page 12. Available here: https://archive.ipcc.ch/pdf/special-reports/sr15/sr15_spm_final.pdf
6. UN Environment (2021). Global Methane Assessment: Cost and Benefits of Mitigating Methane Emissions. Executive Summary. Pages 9-10. Available here: https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions
7. European Commission (2021). 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. Page 2. Available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12581-Climate-change-new-rules-to-prevent-methane-leakage-in-the-energy-sector_en
8. Eurostat. Where Does Our Energy Come From? Available here: https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2a.html
9. Eurostat. Supply, Transformation and Consumption of Gas. Available here: https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS__custom_3977688/default/table?lang=en
10. Eurostat. Supply, Transformation and Consumption of Oil and Petroleum Products. Available here: https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_OIL__custom_3976803/default/table?lang=en
11. Eurostat. Supply, Transformation and Consumption of Solid Fossil Fuels. Available here: https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_SFF__custom_3977405/default/table?lang=en
12. European Commission (2021). 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. Page 79. Available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12581-Climate-change-new-rules-to-prevent-methane-leakage-in-the-energy-sector_en
13. Eurostat. EU Imports of Energy Products - Recent Developments. Available here: https://ec.europa.eu/eurostat/statistics-explained/pdfscache/46126.pdf Eurostat. Where Does Our Energy Come From? Available here: https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2a.html Eurostat. Energy Production and Imports – Statistics Explained. Available here: https://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_production_and_imports#The_EU_and_its_Member_States_are_all_net_importers_of_energy Eurostat (2020). Shedding Light on Energy in the EU: A Guided Tour of Energy Statistics, Section 2.3: From Where Do We Import Energy and How Dependent Are We? Available here: https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html
14. Al Jazeera (December 2021). Mapping the World's Oil and Gas Pipelines. Available here.: https://www.aljazeera.com/news/2021/12/16/mapping-world-oil-gas-pipelines-interactive
15. European Commission. Liquefied Natural Gas. Available here: https://energy.ec.europa.eu/topics/oil-gas-and-coal/liquefied-natural-gas_en
16. Eurostat. Imports of Natural Gas by Partner Country. Available here: https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_GAS__custom_3994365/default/table?lang=en
17. Eurostat. Imports of Oil and Petroleum Products by Partner Country. Available here: https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_OIL/default/table?lang=en&category=nrg.nrg_quant.nrg_quanta.nrg_t.nrg_ti
18. Eurostat. Imports of Solid Fossil Fuels by Partner Country. Available here: https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_SFF/default/table?lang=en&category=nrg.nrg_quant.nrg_quanta.nrg_t.nrg_ti
19. Eurostat. From Where Do We Import Energy? Available here: https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html
20. European Commission (May 2022). REPowerEU: A Plan to Rapidly Reduce Dependence on Russian Fossil Fuels and Fast Forward the Green Transition. Available here: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_3131
21. Florence School of Regulation. A First Look at REPowerEU: the European Commission's Plan for Energy Independence from Russia. Available here: https://fsr.eui.eu/first-look-at-repowereu-eu-commission-plan-for-energy-independence-from-russia/
22. European Commission (May 2022). REPowerEU: A Plan to Rapidly Reduce Dependence on Russian Fossil Fuels and Fast Forward the Green Transition. Available here: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_3131
23. Reuters. Norway Gas Lifeline for Europe in the Smart Move. Available here: https://www.reuters.com/breakingviews/norway-gas-lifeline-europe-is-smart-move-2022-09-09/
24. European Commission. Joint EU-Norway Statement on Strengthening Energy Cooperation. Available here: https://ec.europa.eu/commission/presscorner/detail/en/STATEMENT_22_3975
25. U.S Energy Information Administration (2022). U.S Liquified Natural Gas Exports to Europe Increased during the First 4 Months of 2022. Available here: https://www.eia.gov/todayinenergy/detail.php?id=52659#:~:text=During%20the%20first%20four%20months,EIA%20estimates%20for%20April%202022.
26. The White House (March 2022). Fact Sheet: United States and European Commission Announce Task Force to Reduce Europe's Dependence on Russian Fossil Fuels. Available here: https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/25/fact-sheet-united-states-and-european-commission-announce-task-force-to-reduce-europes-dependence-on-russian-fossil-fuels/
27. Reuters (2022). Algeria, Niger and Nigeria Sign MoU for Saharan gas pipeline. Available here: https://www.reuters.com/business/energy/algeria-niger-nigeria-sign-mou-saharan-gas-pipeline-2022-07-28/
28. European Commission (2022). EU and Azerbaijan enhance bilateral relations, including energy cooperation. Available here: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4550
29. Reuters (2022). Factbox: Europe Ramps Up Coal Imports as Energy Supply Fears Grow. Available here: https://www.reuters.com/business/energy/europe-ramps-up-coal-imports-energy-supply-fears-grow-2022-07-26/
30. Montel (2022) Colombia Doubles Coal Exports to EU Amid Russia Shortfall. Available here: https://www.montelnews.com/news/1299943/colombia-doubles-coal-exports-to-eu-amid-russia-shortfall
31. European Commission (2022). Implementing the REPowerEU Action Plan: Investment Needs, Hydrogen Accelerator and Achieving the Bio-methane Targets. Page 10. Available here: https://energy.ec.europa.eu/system/files/2022-05/SWD_2022_230_1_EN_autre_document_travail_service_part1_v3.pdf
32. European Commission (2022). Implementing the REPowerEU Action Plan: Investment Needs, Hydrogen Accelerator and Achieving the Bio-methane Targets. Page 10. Available here: https://energy.ec.europa.eu/system/files/2022-05/SWD_2022_230_1_EN_autre_document_travail_service_part1_v3.pdf
33. US Environmental Protection Agency (2016). Background Technical Support Document for the Final New Source Performance Standards. Pages 26 and 41. Available here: https://www.regulations.gov/document?D=EPA-HQ-OAR-2010-0505-7631
34. International Energy Agency (2022). Global Methane Tracker 2022. Available here: https://www.iea.org/reports/global-methane-tracker-2022/overview
35. The Oxford Institute for Energy Studies (2020). Methane Emissions from Natural Gas and LNG Imports: An Increasingly Urgent Issue for the Future of Gas in Europe. Page 18. Available here: https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/11/Methane-Emissions-from-Natural-Gas-and-LNG-Imports-an-increasingly-urgent-issue-for-the-future-of-gas-in-Europe-NG-165.pdf

36. IEA. Global Methane Tracker 2022. Available here: https://www.iea.org/reports/global-methane-tracker-2022/overview

37. IEA. Global Methane Tracker 2022. Available here: https://www.iea.org/reports/global-methane-tracker-2022/overview

38. IEA (2022). Methane Tracker Data Explorer- Emission Data. Available here: https://www.iea.org/data-and-statistics/data-product/methane-tracker-database-2022#emissions-data

39. European Commission (2021). 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. Page 6. Available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12581-Climate-change-new-rules-to-prevent-methane-leakage-in-the-energy-sector_en

40. BP. Statistical Review of World Energy. Page 36. Available here: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-natural-gas.pdf

41. Eurostat. Imports of Natural Gas by Partner Country. Available here: https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_GAS__custom_3994365/default/table?lang=en

42. IEA (2022). Methane Tracker Data Explorer- Emission Data. Available here: https://www.iea.org/data-and-statistics/data-product/methane-tracker-database-2022#emissions-data

43. Enerdata. Crude Oil Production. Available here: https://yearbook.enerdata.net/crude-oil/world-production-statistics.html

44. Eurostat. Imports of Oil and Petroleum Products by Partner Country. Available here: https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_OIL/default/table?lang=en&category=nrg.nrg_quant.nrg_quanta.nrg_t.nrg_ti

45. IEA (2022). Methane Tracker Data Explorer- Emission Data. Available here: https://www.iea.org/data-and-statistics/data-product/methane-tracker-database-2022#emissions-data

46. Statista. Leading Hard Coal Producing Countries Worldwide in 2020. Available here: https://www.statista.com/statistics/264775/top-10-countries-based-on-hard-coal-production/

47. Eurostat. Imports of Solid Fossil Fuels by Partner Country. Available here: https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_SFF/default/table?lang=en&category=nrg.nrg_quant.nrg_quanta.nrg_t.nrg_ti

48. IEA (2022). Methane Tracker Data Explorer- Emission Data. Available here: https://www.iea.org/data-and-statistics/data-product/methane-tracker-database-2022#emissions-data

49. IEA (2021). Methane Emissions from Oil and Gas. Available here: https://www.iea.org/reports/methane-emissions-from-oil-and-gas

50. European Commission (2018). In-Depth Analysis in Support of the Commission Communication COM (2018) 773: A Clean Planet for All: A European Long-Term Strategic Vision for a Prosperous, Modern, Competitive and Climate Neutral Economy. Page 51, footnote 128. Available here: https://knowledge4policy.ec.europa.eu/publication/depth-analysis-support-com2018-773-clean-planet-all-european-strategic-long-term-vision_en

51. Science Advances. Quantifying Methane Emissions from the Largest Oil Producing Basin in the U.S. from Space. Page 6. Available here: https://legacy-assets.eenews.net/open_files/assets/2020/04/23/document_ew_03.pdf

52. European Commission (2021). 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. Page 6. Available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12581-Climate-change-new-rules-to-prevent-methane-leakage-in-the-energy-sector_en

53. USEPA. Greenhouse Gas Equivalencies Calculator (website). Available here: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

54. European Commission (2021). 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. Page 6. Available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12581-Climate-change-new-rules-to-prevent-methane-leakage-in-the-energy-sector_en

55. Columbia Center on Global Energy Policy (2020). Nowhere to Hide: The Implications of Satellite-based Methane Detection for Policy, Industry and Finance. Page 5. Available here: https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/Methane_CGEP_Commentary_v3.pdf

56. GHGSat (2022). Greenhouse Gas Monitoring from Space: GHGSat Launches Three New Satellites with Space X. Available here: https://www.ghgsat.com/en/newsroom/greenhouse-gas-monitoring-from-space-ghgsat-launches-three-new-satellites-with-spacex/

57. Science (2022). Global Assessment of Oil and Gas Methane Ultra-emitters. Page 557. Available here: https://www.science.org/doi/10.1126/science.abj4351

58. Politico (2020). How Biden May Save U.S. Gas Exports to Europe. Available here: https://www.politico.com/news/2020/11/27/biden-gas-exports-europe-440678 MEI@75. Given Capacity Constraints, Algeria Is No Quick Fix for Europe's Russian Gas Concerns. Available here: https://www.mei.edu/publications/given-capacity-constraints-algeria-no-quick-fix-europes-russian-gas-concerns#:~:text=Together%2C%20however%2C%20the%20TransMed%20and,Algeria's%20gas%20exports%20in%202021

59. MEI@75. Given Capacity Constraints, Algeria Is No Quick Fix for Europe's Russian Gas Concerns. Available here: https://www.mei.edu/publications/given-capacity-constraints-algeria-no-quick-fix-europes-russian-gas-concerns#:~:text=Together%2C%20however%2C%20the%20TransMed%20and,Algeria's%20gas%20exports%20in%202021

60. Caspian News (2021). EU, Kazakhstan Intend to Deepen Energy Ties. Available here: https://caspiannews.com/news-detail/eu-kazakhstan-intend-to-deepen-energy-ties-2021-3-30-0/

61. European Space Agency (2021). Monitoring Methane Emissions from Gas Pipelines. Available here: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-5P/Monitoring_methane_emissions_from_gas_pipelines

62. Euractiv (2022). Eastbound Gas Flows Resume on Russia Yamal-Europe Pipeline. Available here: https://www.euractiv.com/section/energy/news/eastbound-gas-flows-resume-on-russian-yamal-europe-pipeline/

63. European Space Agency (2021). Monitoring Methane Emissions from Gas Pipelines. Available here: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-5P/Monitoring_methane_emissions_from_gas_pipelines

64. World Bank. 2022 Global Gas Flaring Tracker Report. Page 3. Available here: https://thedocs.worldbank.org/en/doc/1692f2ba2bd6408db82db9eb3894a789-0400072022/original/2022-Global-Gas-Flaring-Tracker-Report.pdf

65. Capterio. How Can We Solve Gas Flaring and Accelerate the Energy Transition? Available here: https://flareintel.com/insights/how-can-we-solve-gas-flaring-and-accelerate-the-energy-transition#:~:text=If%20it%20were%20a%20country,Russia%2C%20China%20and%20Iran)

66. World Bank. IFG 2021 Index Results. Available here: https://www.worldbank.org/en/programs/gasflaringreduction/global-flaring-data

67. Capterio. Twelve Things the EU Should Do About Gas Flaring. Available here: https://capterio.com/insights/twelve-things-the-eu-should-do-about-gas-flaring

68. Royal Society of Chemistry (2021). Methane Detection and Quantification in the Upstream Oil and Gas Sector: The Role of Satellites in Emissions Detection, Reconciling and Reporting. Available here: https://pubs.rsc.org/en/content/articlehtml/2022/ea/d1ea00046b

69. National Academies of Sciences. Improving Characterization of Anthropogenic Methane Emissions in the United States. Available here: https://www.ncbi.nlm.nih.gov/books/NBK519293/

70. IEA (2020). Tracking Methane Emissions from Oil and Gas 2020. Available here: https://www.iea.org/reports/tracking-methane-emissions-from-oil-and-gas-2020

71. Royal Society of Chemistry (2021). Methane Detection and Quantification in the Upstream Oil and Gas Sector: The Role of Satellites in Emissions Detection, Reconciling and Reporting. Available here: https://pubs.rsc.org/en/content/articlehtml/2022/ea/d1ea00046b

72. Royal Society of Chemistry (2021). Methane Detection and Quantification in the Upstream Oil and Gas Sector: The Role of Satellites in Emissions Detection, Reconciling and Reporting. Available here: https://pubs.rsc.org/en/content/articlehtml/2022/ea/d1ea00046b

73. European Commission. Liquified Natural Gas. Available here: https://energy.ec.europa.eu/topics/oil-gas-and-coal/liquefied-natural-gas_en#production-and-imports

74. Skone et al. Life Cycle Greenhouse Gas Perspective, May 2014. Roman-White et al (2019). Life Cycle Greenhouse Gas Perspective. Leslie Abrahams et al. Life Cycle Greenhouse Gas Emissions. Adebola S. Kasumu et al (2018). Country-Level Life Cycle Assessment of Greenhouse Gas Emissions from Liquefied Natural Gas Trade for Electricity Generation. Environmental Science & Technology 52, No. 4. Pages 1735-1746. Available here: https://pubs.acs.org/doi/abs/10.1021/acs.est.7b05298 Gilbert and Sovacool. Carbon Pathways in the Global Gas Market.

75. Oxford Institute for Energy Studies (2019). Challenge to the Future of LNG: Decarbonisation, Affordability and Profitability. Page 11. Available here: https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/10/Challenges-to-the-Future-of-LNG-NG-152.pdf

76. Oxford Institute for Energy Studies (2022). Measurement, Reporting and Verification of Methane Emissions from Natural Gas and LNG trade: Creating Transparent and Credible Frameworks. Page 23. Available here: https://www.oxfordenergy.org/wpcms/wp-content/uploads/2022/01/Measurement-Reporting-and-Verification-of-Methane-Emissions-from-Natural-Gas-and-LNG-Trade-ET06.pdf

77. U.S. Energy Information Administration. Frequently Asked Questions- How Much Shale Gas Is Produced in the United States? Available here: https://www.eia.gov/tools/faqs/faq.php?id=907&t=8

78. Robert W. Howarth (2019). Ideas and Perspective: Is Shale Gas a Major Driver of Recent Increase in Global Atmospheric Methane? Available here: https://bg.copernicus.org/articles/16/3033/2019/

79. Forbes (2022). Europe's Warm Embrace of LNG Raises Methane Emissions Concerns. Available here: https://www.forbes.com/sites/uhenergy/2022/06/15/europes-warm-embrace-of-lng-raises-methane-emissions-concerns/

80. European Commission (2020). Communication from the Commission on an EU Strategy to Reduce Methane Emissions. Page 2. Available here: https://ec.europa.eu/energy/sites/ener/files/eu_methane_strategy.pdf

81. European Commission (2021). Annexes to the Proposal for a Regulation of the European Parliament and of the Council on Methane Emissions Reduction in the Energy Sector. Annexe VIII. Page 10. Available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12581-Climate-change-new-rules-to-prevent-methane-leakage-in-the-energy-sector_en

82. European Commission (2021). Impact Assessment Report Accompanying the Proposal for a Regulation on Methane Emission Reductions in the Energy Sector. Page 80. Available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12581-Climate-change-new-rules-to-prevent-methane-leakage-in-the-energy-sector_en

83. Official Journal of the European Union (2010). Regulation Laying Down the Obligations of Operators Who Place Timber and Timber Products on the Market. Available here: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010R0995&from=EN

84. Official Journal of the European Union (2014). Regulation on Fluorinated Greenhouse Gases. Available here: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0517&from=EN

85. European Commission (2021). Impact Assessment Report Accompanying the Proposal for a Regulation on Methane Emission Reductions in the Energy Sector. Page 80. Available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12581-Climate-change-new-rules-to-prevent-methane-leakage-in-the-energy-sector_en

86. IEA (2022). The Energy Security Case for Tackling Gas Flaring and Methane Leaks. Available here: https://iea.blob.core.windows.net/assets/9414ec9a-bbba-4592-b005-4af05c894bdc/Theenergysecuritycasefortacklinggasflaringandmethaneleaks.pdf

87. Columbia Center on Sustainable Investment and Capterio (2022). North Africa Can Reduce Europe's Dependence on Russian Gas by Transporting Wasted Gas through Existing Infrastructure. Available here: https://flareintel.com/insights/north-africa-can-reduce-europes-dependence-on-russian-gas-by-transporting-wasted-gas-through-existing-infrastructure

88. European Commission (2021). 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. Pages 122-123. Available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12581-Climate-change-new-rules-to-prevent-methane-leakage-in-the-energy-sector_en

89. UN Environment. Global Methane Assessment: Summary for Decision Makers. Page 10. Available here: https://wedocs.unep.org/bitstream/handle/20.500.11822/35917/GMA_ES.pdf

90. IEA. The Energy Security Case for Tackling Gas Flaring and Methane Leaks. Page 6. Available here: https://iea.blob.core.windows.net/assets/9414ec9a-bbba-4592-b005-4af05c894bdc/Theenergysecuritycasefortacklinggasflaringandmethaneleaks.pdf

91. IEA. Curtailing Methane Emissions from Fossil Fuel Operations: Pathways to a 75% Cut by 2030. Page 12. Available here: https://iea.blob.core.windows.net/assets/585b901a-e7d2-4bca-b477-e1baa14dde5c/CurtailingMethaneEmissionsfromFossilFuelOperations.pdf

92. International Energy Agency (October 2021). Curtailing Methane Emissions from Fossil Fuel Operations: Pathways to a 75% Cut by 2030. Available here: https://iea.blob.core.windows.net/assets/585b901a-e7d2-4bca-b477-e1baa14dde5c/CurtailingMethaneEmissionsfromFossilFuelOperations.pdf

93. US Environmental Protection Agency (2016). Background Technical Support Document for the Final New Source Performance Standards. Pages 42-52. Available here: https://www.regulations.gov/document?D=EPA-HQ-OAR-2010-0505-7631

94. International Energy Agency (2021). Methane Emissions in Oil and Gas: Tracking Report. Available here: https://www.iea.org/reports/methane-emissions-from-oil-and-gas

95. Reuters (2020). Special Report: Millions of Abandoned Oil Wells Are Leaking Methane, a Climate Menace. Available here: https://www.reuters.com/article/us-usa-drilling-abandoned-specialreport/special-report-millions-of-abandoned-oil-wells-are-leaking-methane-a-climate-menace-idUSKBN23N1NL

environmental
investigation
agency