Global Methane Tracker 2026

International Energy Agency

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Abstract

Around the world, many countries have made reductions in methane emissions a policy priority as part of their efforts to limit near-term global warming, enhance energy security, and improve air quality. The energy sector – including oil, natural gas, coal and bioenergy – accounts for around 40% of methane emissions from human activity and has some of the best opportunities to cut these emissions. The annually updated Global Methane Tracker provides essential data on methane emissions across the energy sector and the opportunities to bring them down.

The Tracker presents the IEA's latest sector-wide emissions estimates – based on the most recent data from satellites and measurement campaigns – and discusses different abatement options along with their associated costs. This year's edition includes a chapter on the efforts among numerous countries to develop marketplaces for fuels with near-zero methane intensity. It is accompanied by a template framework to help countries respond to satellite-detected large-emissions events, as well as an update to the IEA's interactive data tool on methane, which includes enhanced policy tracking for governments and national oil companies.

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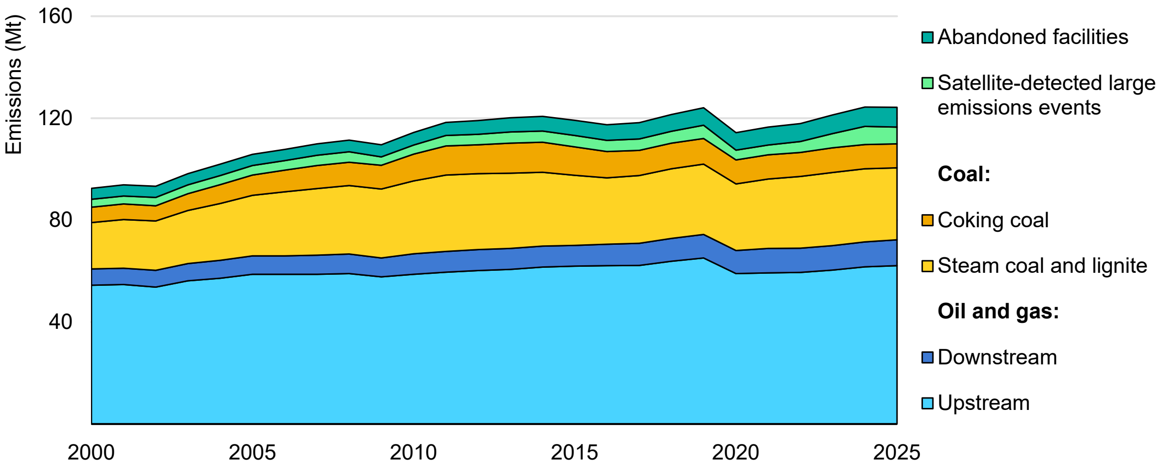
Key findings

No sign that global energy-related methane emissions fell in 2025 despite progress in some areas

The fossil fuel sector accounts for around 35% of methane emissions from human activity, yet there is still no sign that methane emissions from fossil fuel operations are falling, despite well-known and proven mitigation pathways. Oil, gas and coal production output reached record highs in 2025, and the International Energy Agency (IEA) estimates that methane emissions from these activities total 124 million tonnes (Mt) a year: oil is the largest source at 45 Mt, followed by coal at 43 Mt, and natural gas at 36 Mt. A further 20 Mt comes from bioenergy production and consumption, largely from the incomplete combustion of traditional biomass used for cooking and heating in developing economies.

Although IEA-estimated fossil fuel emissions remain at very high levels, satellite and inventory data from 2025 point to progress in some countries. This includes fewer super-emitting events detected from oil and gas operations in Algeria, and Argentina, as well as studies suggesting that the growth in coal mine emissions in the People's Republic of China (hereafter "China") has been dampened in recent years as a result of tighter regulations and structural changes in production. Globally, improvements in upstream emissions intensity for oil and natural gas have offset rising output.

Methane emissions from fossil fuels, 2000-2025



Note: Mt = million tonnes. Satellite-detected large emissions events include oil, gas and coal sectors and abandoned facilities, exceeding 1 tonne per hour and conservatively scaled to annual estimates for regions with at least 10 days of observation coverage (see Documentation for further information).
Source: IEA estimates based on measured, satellite, and inferred data.

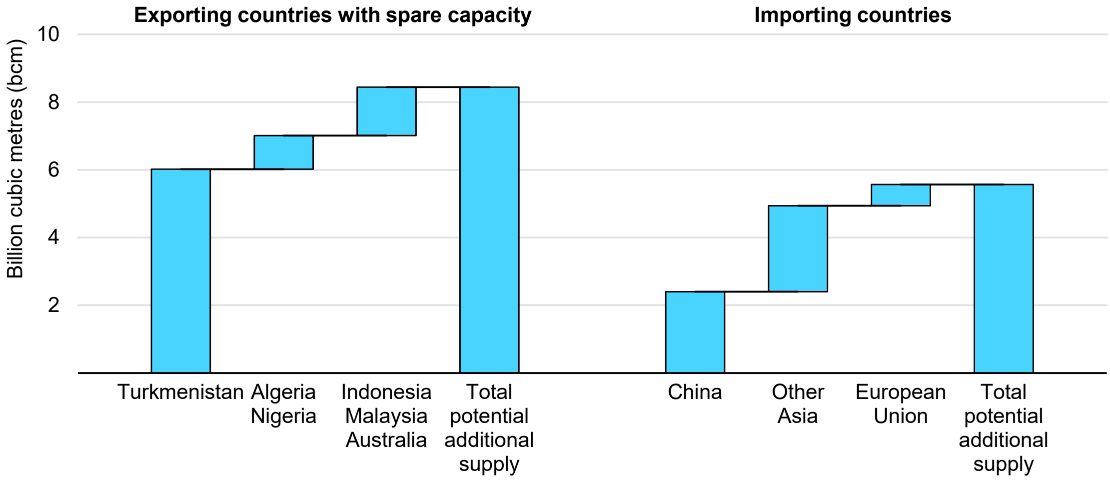
Tackling methane and flaring delivers energy security benefits

The ongoing crisis in the Middle East is reshaping the global energy system and disrupting around 20% of global liquefied natural gas (LNG) trade flows (around 110 bcm of gas passed through the Strait of Hormuz in 2025). As countries seek alternative sources of gas to replace lost volumes, it is worth noting that large quantities of produced gas are not being put to productive use, owing to methane leaks, and flaring and venting from oil and gas operations. While not all of this waste can be recovered, reducing flaring and methane emissions has the potential to bring significant additional volumes to market.

We estimate that nearly 100 billion cubic metres (bcm) of natural gas could be made available annually through a global effort to cut methane from oil and gas operations, with a further 100 bcm unlocked through the elimination of non-emergency flaring worldwide.

It would take time to deploy the equipment and infrastructure needed to achieve cuts of this magnitude. But in the immediate future, if countries with spare export capacity and gas importers were to implement abatement measures across their upstream and downstream operations, we estimate that nearly 15 bcm could be made available in a sufficiently short period of time to provide some relief to gas markets.

Potential additional natural gas supply from abatement of gas-related methane emissions



Note: For exporting countries, potential supply reflects upstream emissions that could be captured where spare liquefied natural gas (LNG) or pipeline export capacity exists. For importing countries, it reflects emissions from import terminals, transmission networks and limited domestic production.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

Around 70% of fossil-fuel methane emissions come from the top 10 emitting countries

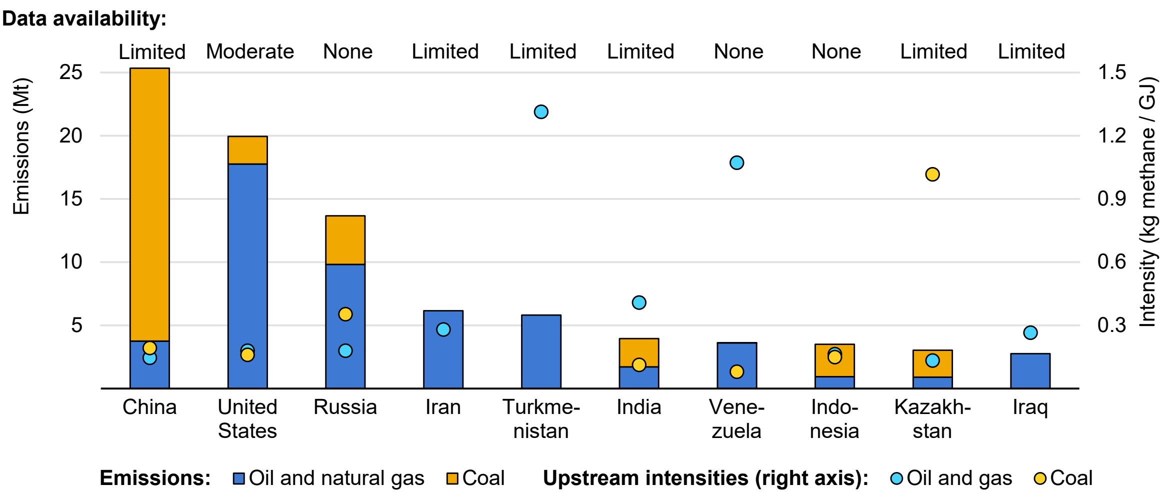
The availability, quality and reporting of methane emissions data have increased significantly in recent years but remains very uneven between countries. While uncertainty remains high, the IEA estimates that more than 85 Mt of emissions tied to fossil fuels operations in 2025 came from the 10 biggest emitters of methane. China is the largest emitter, driven by coal operations, followed by the United States and the Russian Federation (hereafter “Russia”).

The IEA estimates that the global average upstream methane intensity of oil and gas production has fallen by around 10% since 2019, but performance varies widely across countries. The best performers score more than 100 times better than the worst. Norway records the lowest upstream intensity, while producers in the Middle East, including Saudi Arabia and the United Arab Emirates (UAE), also perform relatively well. By contrast, Turkmenistan and Venezuela have by far the highest methane intensities.

Coal mine methane intensities are higher on average than those of oil and gas, but they are also highly variable. The most intensive coal-sector emissions are found in the Caspian Sea region, while India, Indonesia and Australia all record intensities that are well below the global average.

High emissions intensities are not inevitable: they can be reduced cost-effectively through a combination of robust operational standards, policy action and technology deployment. Best practice in all three areas is already well established.

Methane emissions and intensities of the top 10 emitting countries, 2025



Notes: Upstream methane intensity = upstream fossil fuel methane emissions divided by total fuel supply in energy terms, assuming that methane has an energy density of 55 megajoules per kilogram (MJ/kg).
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

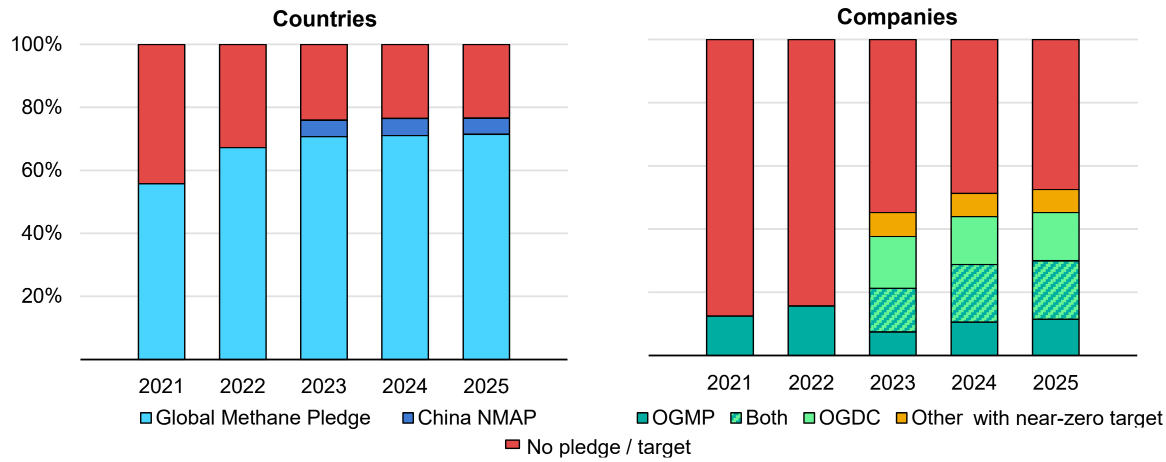
Coverage of pledges and targets continues to expand

In 2021, more than 100 countries joined the European Union and the United States to launch the Global Methane Pledge (GMP), a collective commitment to reduce global methane emissions by 30% by 2030. Today, 159 countries plus the European Union participate, covering nearly three-quarters of global oil and gas production and around 65% of sectoral methane emissions. Several – including Colombia, the European Union and Nigeria – have introduced comprehensive methane regulations to implement their pledges. China is not part of the GMP, but in 2023 it adopted a National Methane Action Plan covering the energy, agriculture and waste sectors.

The past five years have also seen considerable progress in industry engagement on methane. The launch of the Oil and Gas Decarbonisation Charter (OGDC) in 2023 builds on earlier efforts such as the Oil and Gas Climate Initiative (OGCI) and the steady expansion of the United Nations Environmental Programme (UNEP)'s Oil and Gas Methane Partnership 2.0 (OGMP 2.0). In 2021, less than 20% of global oil and gas production was covered by company commitments to near-zero emissions; today, more than half is. Most of the industry appears to be following the lead of governments: less than 10% of global production is covered solely by voluntary industry pledges.

To help achieve existing commitments to cut emissions, countries can learn from jurisdictions with proven policies and regulations, companies can share best practices, and all can benefit from better, more transparent data.

Global oil and gas production covered by country and company pledges



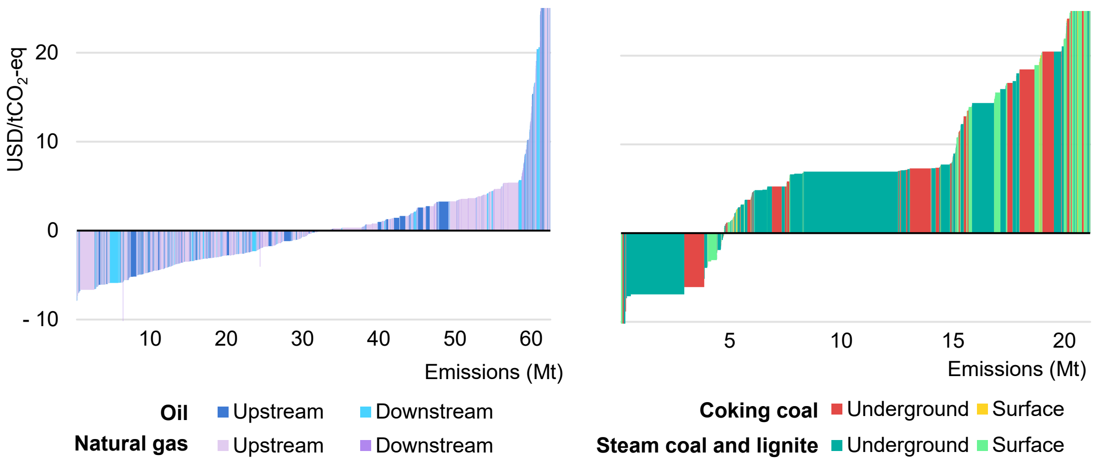
Notes: Share of production under reduction targets. China NMAP = China National Methane Action Plan. OGMP = Oil and Gas Methane Partnership 2.0. OGDC = Oil and Gas Decarbonization Charter (56 companies). Other with near-zero target includes companies that have pledged near-zero methane emissions outside of an industry initiative.

Around 30% of methane emissions from fossil fuel operations could be reduced at no cost

In oil and gas, abatement solutions include upgrading equipment that emits by design – for example, replacing wet compressor seals with dry ones – and deploying vapour-recovery units to capture low-pressure methane flows. For coal, emissions can be reduced by capturing and using methane from mines, or by destroying it through flaring or oxidation technologies.

Around 70% of methane emissions from fossil fuels – nearly 85 Mt – can be abated with existing technology, including three-quarters of emissions from oil and gas and about half of coal emissions. More than 35 Mt could be avoided at no net cost, based on average energy prices in 2025. This is because the required capital and operating costs of abatement are lower than the market value of the gas captured and sold or used. The economics look even more attractive in 2026, as fuel prices come under upward pressure from the conflict in the Middle East.

Marginal abatement cost curves for methane emissions from fossil fuels, 2025



Notes: USD = United States dollar. tCO_2-eq = tonnes of carbon dioxide equivalent. Mt = million tonnes.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

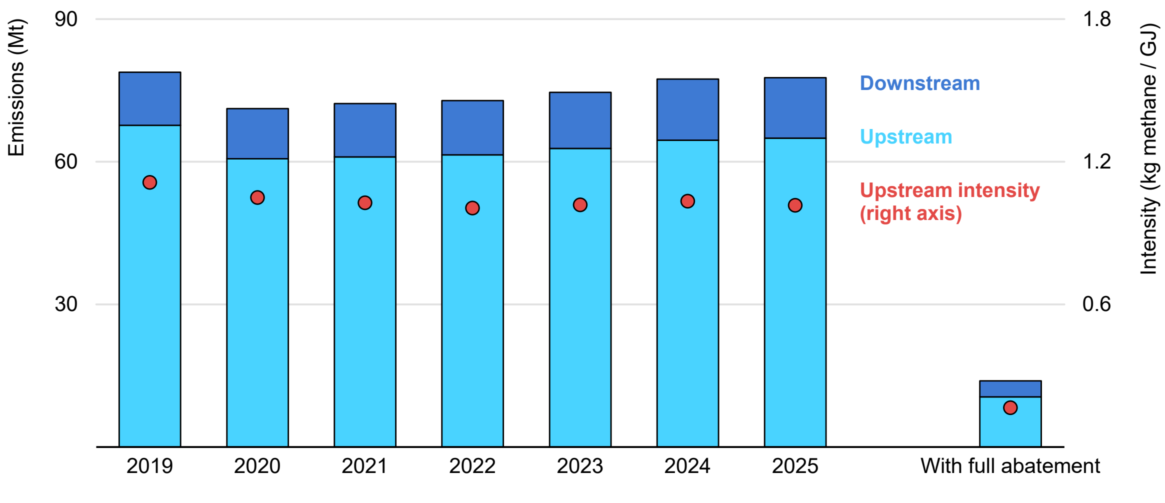
Upstream activities cause 80% of oil and gas methane, making them the top priority for action

Stopping upstream emissions from oil and gas operations is among the most effective ways to reduce methane. More than 50 Mt can be abated with existing technology. Implementing these measures would lower the global average upstream methane emissions intensity of oil and natural gas production to less than 0.2% from around 1% in 2025.[1]

The most cost-effective options available today for reducing emissions include leak detection and repair (LDAR); replacing pumps and other methane-emitting equipment with electric devices; using vapour-recovery units (VRUs) to capture vented gas; and using associated gas, for example to power microturbines for power generation. Nearly 30 Mt of upstream oil and gas emissions could be abated at no net cost under 2025 energy prices.

Applying tried-and-tested policies to cut methane from upstream oil and gas operations is one of the most effective steps policymakers can take. The European Union and Canada have recently introduced robust upstream regulations, while Kazakhstan, Brazil and Ghana are all in the process of doing so.

Global methane emissions from oil and gas operations and emissions intensity of upstream operations, 2019-2025



Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

[1] Methane intensity is calculated here in energy terms as total methane emissions from upstream operations divided by marketed oil and gas production, assuming methane has an energy density of 55 megajoules per kilogram (MJ/kg). This metric is not directly comparable with the OGCI definition, which is calculated as the ratio of methane emissions from operated upstream assets to marketed gas volumes, expressed as a percentage.

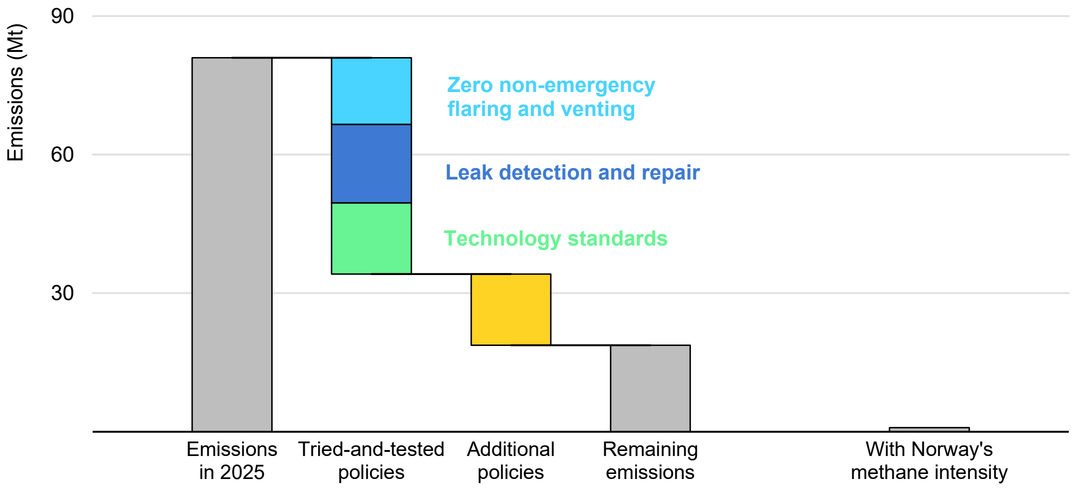
Implementing tried-and-tested policies globally could cut oil and gas methane emissions by more than half

Various tried-and-tested policies for cutting methane have been successfully applied in different jurisdictions and contexts. These include limiting flaring and venting, requiring LDAR programmes, and introducing technology standards. These policies do not require a fully established baseline or inventory.

If every country were to implement these tried-and-tested policies, we estimate that global methane emissions from oil and gas operations would shrink by more than half. If additional policies that rely on more precise emissions data – such as emissions pricing, financing instruments and performance standards – were also adopted globally, methane emissions from oil and gas could be cut by more than 75%.

Some countries have already implemented such policies successfully, offering a model for others seeking to reduce their methane emissions. Norway, for example, banned non-emergency flaring in 1971 and introduced a tax on natural gas venting and flaring in 2015. As a result, it has successfully maintained very low levels of flaring and methane emissions and today boasts the lowest emissions intensity of any country.

Potential methane emissions reductions from tried-and-tested policies, 2025



Notes: Mt = million tonnes. Additional policies includes certain equipment replacements for oil and gas operations as well as monitoring and plugging abandoned wells.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

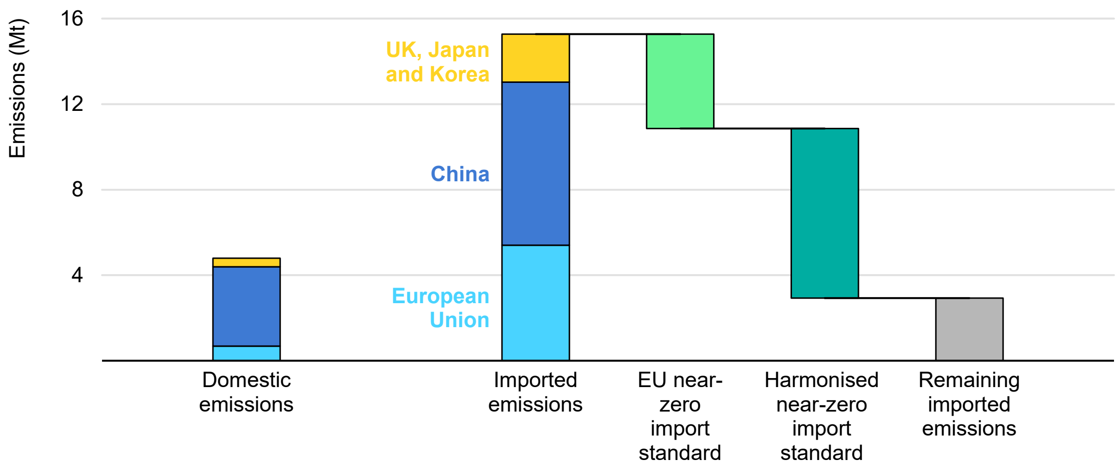
Momentum is building for a consistent approach to import standards for methane intensity in fuels

The COP30 Statement on Drastically Reducing Methane Emissions in the Global Fossil Fuel Sector urges producing and importing countries to deepen cooperation on methane emissions and to work toward developing a global market for fuels with near-zero methane intensity. Some importing countries and regions have started to address the emissions associated with their energy consumption. Starting in 2030, the European Union Methane Regulation will require all imported oil, gas and coal to meet a defined methane-intensity threshold. Japan, Korea and the United Kingdom have also taken steps to better understand and address methane emissions associated with imported fossil fuels.

More than 40% of global oil and 25% of natural gas and coal is traded internationally. For many importers, most of the emissions associated with their fossil fuel consumption originate abroad. In the European Union, the United Kingdom, Japan, Korea, and China, the methane tied to imported oil and gas (15 Mt in 2024) dwarfs that from domestic production (5 Mt in 2024).

The average upstream methane emissions intensity of oil and gas imports varies widely by country: based on IEA estimates, it is around 1.3% for China, 1% for the European Union and United Kingdom, and 0.6% for Japan and Korea. If these fell to 0.2% – the level that could be achieved globally if all technically available measures were deployed – emissions would decline by more than 12 Mt.

Potential methane emissions reductions from import standards in selected economies in full-compliance scenario



Notes: Mt = million tonnes. Potential emissions reductions are estimated based on 2024 trade and emissions intensity data.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

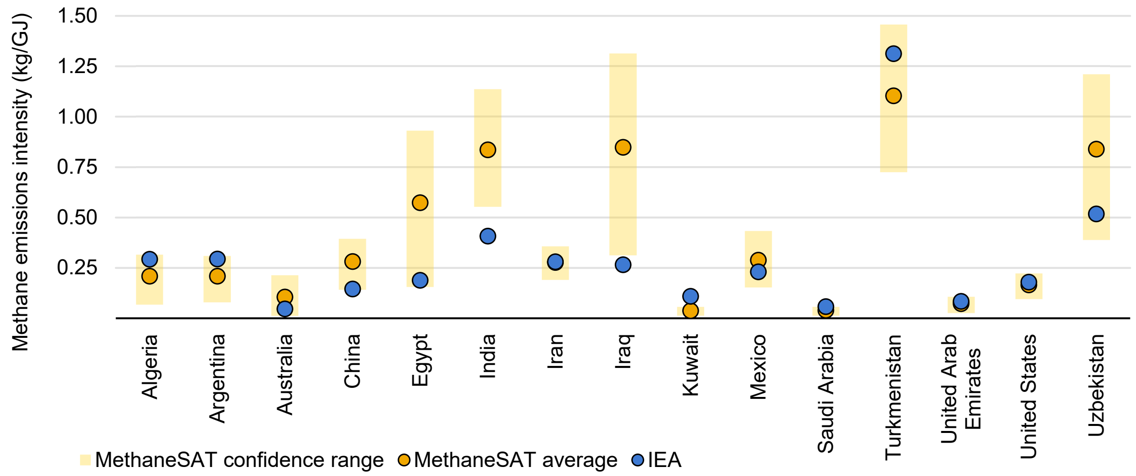
Detection and data processing continue to improve

Dozens of satellites in orbit can provide insights on methane emissions. These range from global flux mappers like the Tropospheric Monitoring Instrument (TROPOMI) and the Global Observing Satellite for Greenhouse Gases and Water (GOSAT-GW), which offer frequent, wide-area coverage but can detect only the largest plumes, to high-resolution "point source" satellites like Tanager-1 and GHGSat, which can identify smaller emissions, but over more limited target areas.

One example of a methane-focussed satellite is the Environmental Defense Fund's MethaneSAT. Although the satellite stopped operating about a year after launch, analysis of the data it collected continues to yield new insights. Its observations covered major onshore oil and gas producing basins in 16 countries and they provide some of the most robust estimates of basin-level emissions intensities to date.

In countries where MethaneSAT covered more than 25% of oil and gas production (10 of the 16 countries with data), the production-weighted basin-level intensity estimates derived from its data align closely with the IEA's country-level upstream intensity estimates.

MethaneSAT and IEA estimates of methane emissions intensities by country, 2025



Notes: kg/GJ = kilogrammes per gigajoule. MethaneSAT estimates are derived using the weighted average of basin-level intensities based on satellite inversions from observations in 2024 and 2025. MethaneSAT data for Azerbaijan not shown as observations cover onshore production only, which is a small fraction of total production in the country.

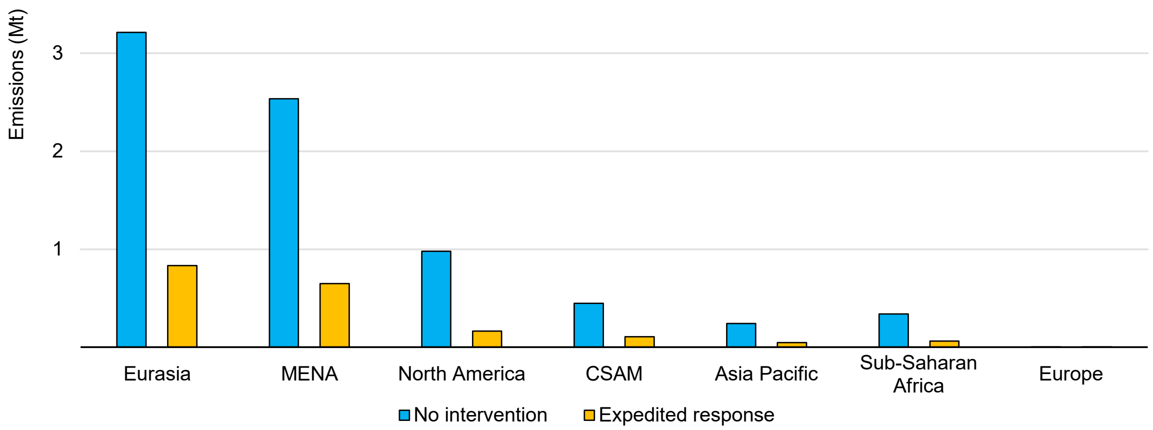
Sources: MethaneSAT intensities provided by the Environmental Defense Fund. IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

Rapid mitigation of satellite-detected super-emitting events could significantly reduce global emissions

Since 2022, the Methane Alert and Response System (MARS), managed by UNEP's International Methane Emissions Observatory (IMEO), has been notifying governments and operators of large methane-emissions events, sending alerts directly to designated "focal points" – contacts responsible for coordinating a response. While there is evidence – both observed and submitted by focal points themselves – that some mitigation is taking place, there remains considerable scope for faster action in response to alerts.

The IEA, in collaboration with the IMEO, has developed a five-step sequential framework to help countries improve their responses to MARS notifications. Had all countries followed the recommended timelines for mitigating the emissions events detected by MARS in 2025, global oil and gas emissions would have been reduced by around 6 Mt – roughly equivalent to total upstream emissions from the Caspian region.

Potential emissions cuts from expedited mitigation of MARS-notified events by region, 2025



Notes: Mt = million tonnes. MENA = Middle East and North Africa. CSAM = Central and South America. Based on International Methane Emissions Observatory (IMEO) data of all actionable oil and gas plumes, methane leakage rates and persistence in 2025. "Actionable" refers to plumes that: have been validated by IMEO experts; have been detected within the last 15 days; and can be attributed to a specific facility or operator. Emissions shown are based on emissions events verified by MARS and do not reflect the distribution of emissions over regions; emissions events can be observed more easily in some regions than others (see Documentation). Potential reductions are based on implementation of mitigation measures within 30 days of receipt of the first MARS notification.

Understanding methane emissions

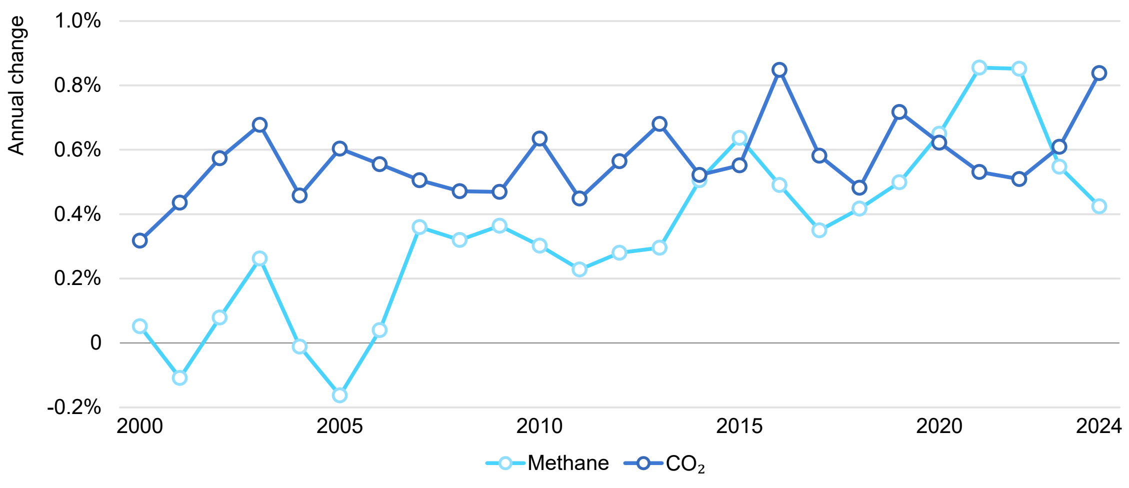
Atmospheric methane concentrations continue to rise

Methane (CH_4) is the second-most harmful greenhouse gas after carbon dioxide (CO_2), trapping outgoing heat and warming the atmosphere through a process known as radiative forcing. Though it lingers in the atmosphere for far less time (12 years, compared with centuries for CO_2), methane absorbs substantially more energy while it does. Cutting methane emissions therefore promises significant near-term climate benefits. Methane carries other hazards, too: it contributes to the formation of ground-level (tropospheric) ozone, a harmful pollutant, and methane leaks can also pose explosion risks.

Atmospheric methane concentrations today are 2.7 times higher than they were before the Industrial Revolution and methane is responsible for nearly 30% of the rise in global average temperatures since that era. Atmospheric measurements show that methane concentrations, alongside CO2, continue to increase year-on-year.

The latest Global Methane Budget (2025) estimates that annual global methane emissions reached around 610 million tonnes (Mt) in 2020, with human activity accounting for almost two-thirds of the total and natural sources making up the rest.

Annual changes in atmospheric CO_2 and methane concentrations, 2000-2024

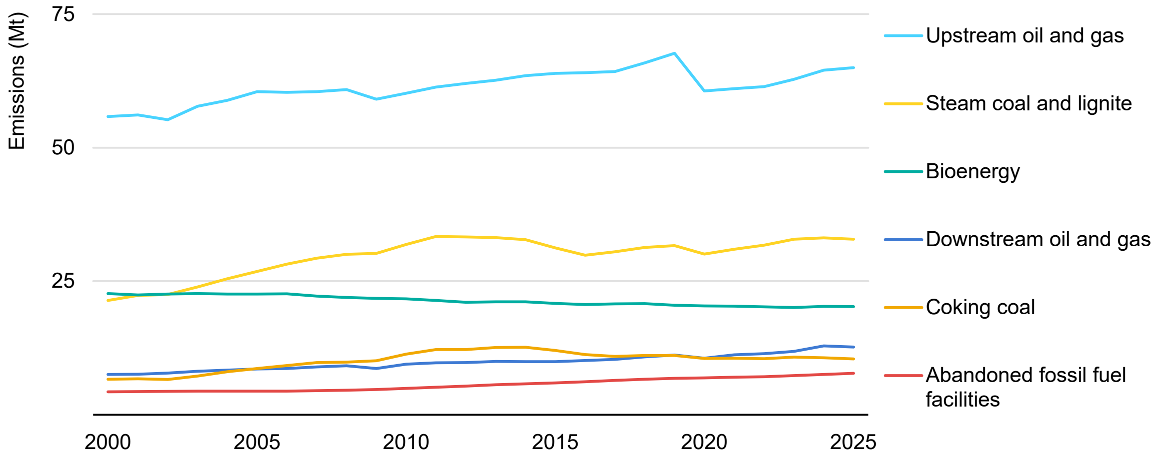


Notes: CO_2 = Carbon dioxide.
Source: IEA analysis based on data provided by NOAA Global Monitoring Laboratory.

The energy sector accounts for around 40% of methane emissions from human activity

International Energy Agency (IEA) analysis suggests the energy sector emitted nearly 150 Mt of methane in 2025. Coal production was responsible for 39 Mt, while inactive mines accounted for around 4 Mt and end-use equipment about 1 Mt. Oil operations accounted for around 44 Mt and natural gas activities for close to 34 Mt, while abandoned wells added a further 3.5 Mt. End-use equipment contributed an additional 2.5 Mt of methane leakage. Incomplete combustion of bioenergy – mainly from traditional biomass – generated about 18 Mt, with modern bioenergy adding another 2 Mt. The Global Methane Tracker documentation provides information on data uncertainties and the IEA's methane estimation approaches.

Energy-related methane emissions by source, 2000-2025



Note: Mt = million tonnes. Satellite-detected large emissions are included in oil, gas and coal totals.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

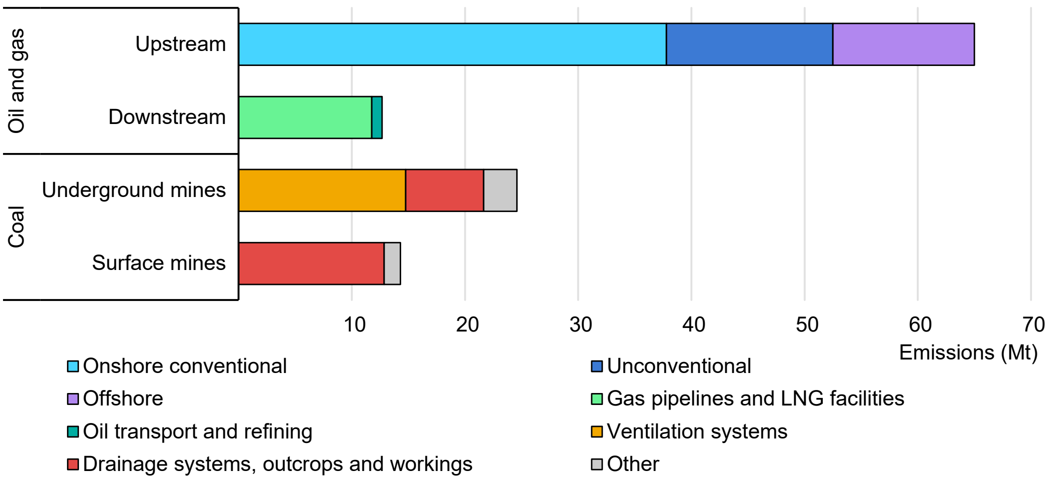
Around 80% of oil and gas emissions come from upstream activities

Emissions from fossil fuels arise at multiple points along the supply chain. Some are intentional, either by design – such as tanks that vent directly to the atmosphere – or as part of operations, for example when pipelines are depressurised for maintenance or inspection. Others are released for safety reasons, as in coal mine ventilation systems. Methane can also escape unintentionally through leaking components like valves or seals, or through incomplete combustion of natural gas, including at flaring sites.

Across the oil and gas sector, most methane emissions come from upstream activities, which account for 80% of the total. These include extraction, gathering systems and processing facilities, whether located onshore or offshore. The remaining 20% comes from downstream operations, mainly gas transport, including losses from transmission and distribution pipelines, as well as emissions linked to liquefied natural gas (LNG) shipping, storage and regasification. Additional downstream sources include storage facilities, refineries and oil transport.

Methane emissions linked to coal production vary by mine type and conditions. In underground operations, ventilation air is typically the main source, along with drainage systems. In surface mines, emissions tend to come from drainage operations, exposed coal seams and other disturbed areas. Additional releases occur during coal handling, processing, storage and transport, as methane continues to escape from the coal itself.

Methane emissions from fossil fuel operations, 2025



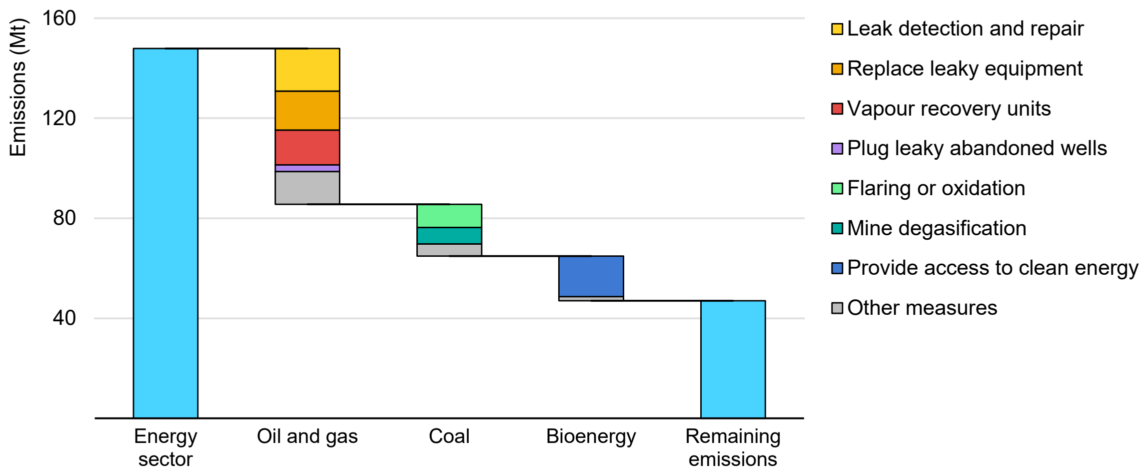
Note: Mt = million tonnes. LNG = liquefied natural gas. Other includes emissions from post-mining operations.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

Cutting fossil fuel emissions offers some of the fastest, largest, and cheapest ways to reduce methane

Well-established solutions exist to cut methane emissions from fossil fuel operations and deploying them does not require new technological breakthroughs. Some producers already achieve very low methane intensities by restricting routine flaring and venting, enforcing leak detection and repair (LDAR) requirements, and adopting clear technology standards. Norway shows what is possible: long-standing policies – including a ban on non-emergency flaring and a tax of venting and flaring – have driven emissions from its oil and gas operations to the lowest in the world. If all countries matched Norway's emissions intensity, global methane emissions from oil and gas operations would fall by more than 90%.

Applying currently available methane abatement technologies today would lower total energy sector emissions by almost 70% (100 Mt). More than 60% of these reductions would come from oil and gas, with coal and bioenergy each accounting for around 20%. Based on 2025 energy prices, our analysis indicates that around 30% of potential reductions in fossil fuel emissions could be achieved at no net cost. The share of such opportunities is higher in oil and gas than in coal, as many mitigation measures effectively pay for themselves: the cost of implementation is lower than the market value of the methane that can be recovered and sold.

Opportunities to reduce methane emissions from energy, 2025



Note: Mt = million tonnes. Other measures includes associated gas utilisation and specific equipment upgrades.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

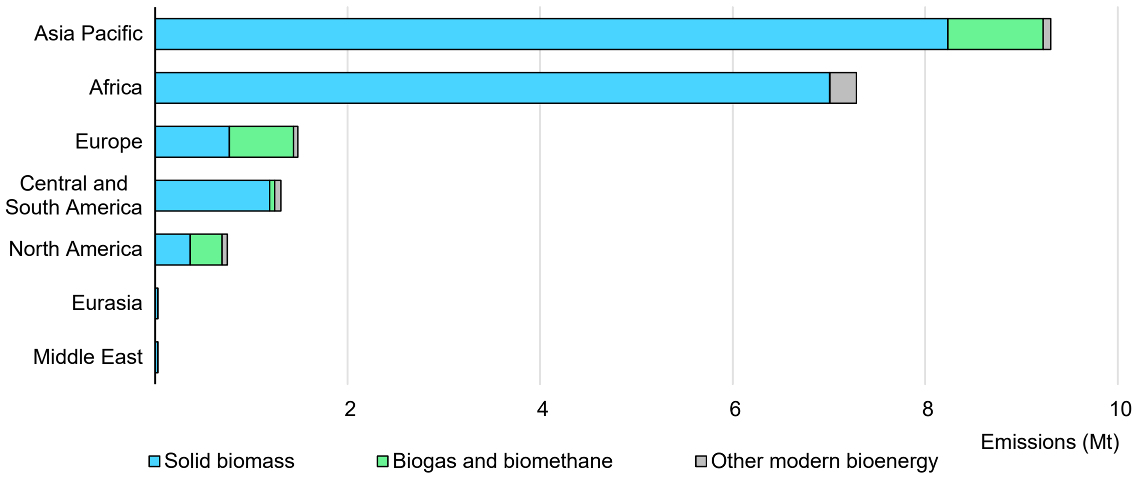
In oil and gas, most abatement potential lies in upstream activities, with the lowest-cost mitigation options typically found at oil and gas sites with significant leakage and access to gas markets. For coal, recent studies underline the importance of coal mine methane utilisation in shaping overall emissions trends, particularly in China. Despite continued growth in coal production, coal mine methane emissions have grown more slowly since 2016, largely due to a shift toward lower-emitting mines in northern provinces and greater use of captured methane. Satellite observations corroborate this structural change, pointing to similar shifts in the drivers of China's evolving methane emissions profile.

Improving access to clean cooking delivers health and economic gains while lowering emissions

Most methane emissions linked to bioenergy stem from the inefficient burning of solid biomass in households for cooking and heating. Traditional fuels such as wood, charcoal, agricultural residues and animal dung release significant amounts of methane when burned in simple stoves or open fires. In 2025, this incomplete combustion accounted for around 18 Mt of global methane emissions, largely in developing economies where clean cooking remains inaccessible or unaffordable.

A smaller share – around 2 Mt – comes from modern bioenergy supply chains, including facilities that produce biogas or biomethane. Anaerobic digestion units, landfill gas capture systems and wastewater treatment plants can all experience fugitive methane losses during feedstock handling, digestion, upgrading or storage. Some feedstocks, such as manure or organic wastes, also emit methane as they decompose before entering the digestion process, while others, such as dedicated energy crops, do not generate such pre-processing emissions.

Methane emissions from bioenergy, 2025



Notes: Mt = million tonnes. Estimates from end-uses are for 2023 based on IEA data (2025). Estimates from biogas and biomethane are for 2024 based on IEA modelling.

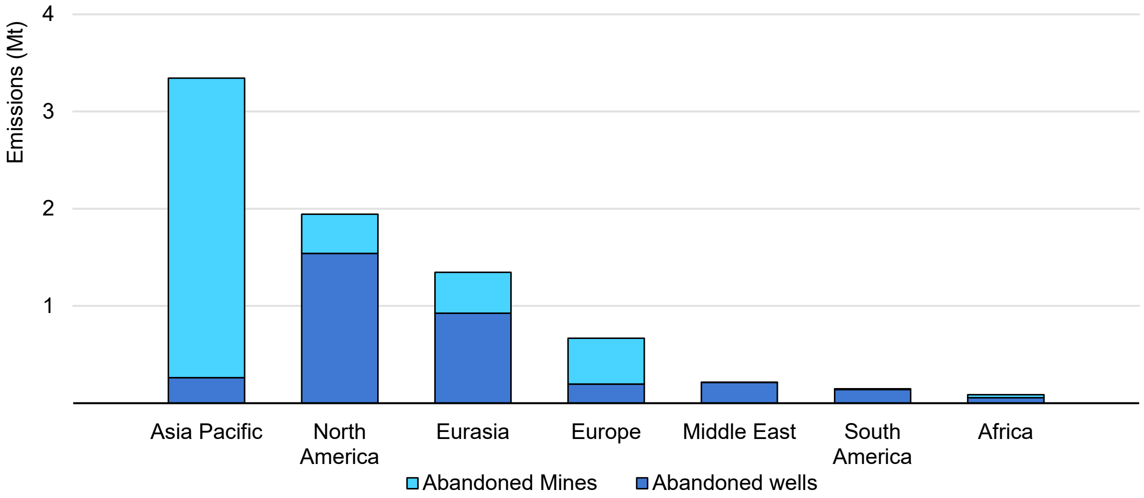
Across traditional and modern bioenergy systems, improvements in combustion efficiency, equipment design and operational best practices can substantially reduce methane emissions. Deploying best available technologies and strengthening LDAR programmes are especially important for modern facilities. Recent direct measurements of gas cooking stoves in Latin America underscore this: methane emissions were found to be six to 19 times higher than Intergovernmental Panel on Climate Change (IPCC) default factors used in national inventories, with continuous leaks and ignition pulses accounting for a significant share of the total.

Expanding access to clean cooking solutions – including liquefied petroleum gas (LPG), electricity, improved biomass stoves and clean biofuels – offers further scope to cut methane emissions while delivering substantial health, gender and economic benefits in communities most affected by traditional biomass use.

Abandoned mines and wells emitted around 8 Mt of methane in 2025

Our estimate of methane emissions from abandoned wells draws on historical production records, available measurement campaigns and databases tracking closed or inactive facilities (see the *Global Methane Tracker* documentation for methodological details). Although data coverage remains incomplete, current estimates suggest there are around 8 million abandoned onshore oil and gas wells globally, along with a substantial number of closed coal mines. In the United States alone, there are thought to be almost 4 million abandoned wells and more than 250 000 abandoned coal mines. Emissions from abandoned coal mines amounted to around 4.5 Mt, with China accounting for 60% of the total. Methane released from abandoned oil and gas wells contributed around 3.5 Mt, 40% of which came from the United States.

Methane emissions from abandoned facilities worldwide, 2025



Notes: Mt = million tonnes.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

Emissions vary widely across abandoned sites. Properly sealed wells and fully flooded mines tend to release little to no methane. By contrast, facilities that were not decommissioned to modern standards can leak for decades or longer. For example, one Romanian well drilled in 1909 was still leaking methane alongside natural seepage more than a century later. Direct measurement studies suggest abandoned sites are often underestimated in inventories, particularly because of high emissions from unplugged wells. Older closures also tend to emit less than more recently abandoned ones, especially in the coal sector.

Marginal wells – oil and gas wells that produce very small volumes – are a potentially significant but poorly quantified source of emissions. While individually they tend to emit small quantities of methane, their emissions are occasionally high relative to production. In many regions, marginal wells are more numerous than high-producing wells: in the United States, for example, marginal wells (producing less than 15 barrels of oil equivalent per day) represent around 80% of the total active number of wells, but they provide less than 10% of total oil and gas production. Their large number means their collective emissions can be significant. For example, in the United States, marginal wells are estimated to emit between 1-4 Mt of methane, i.e. up to one-third of the IEA's estimate for total upstream onshore oil and gas emissions in the country. Scientific studies also suggest that a small number of marginal wells are responsible for a disproportionate amount of emissions. In one study, no emissions were detected at around 55-60% of visited oil and gas production sites and the top 10% of emitting sources contributed approximately 90% of the total methane emissions observed, highlighting that action on a few sites could deliver substantial reductions.

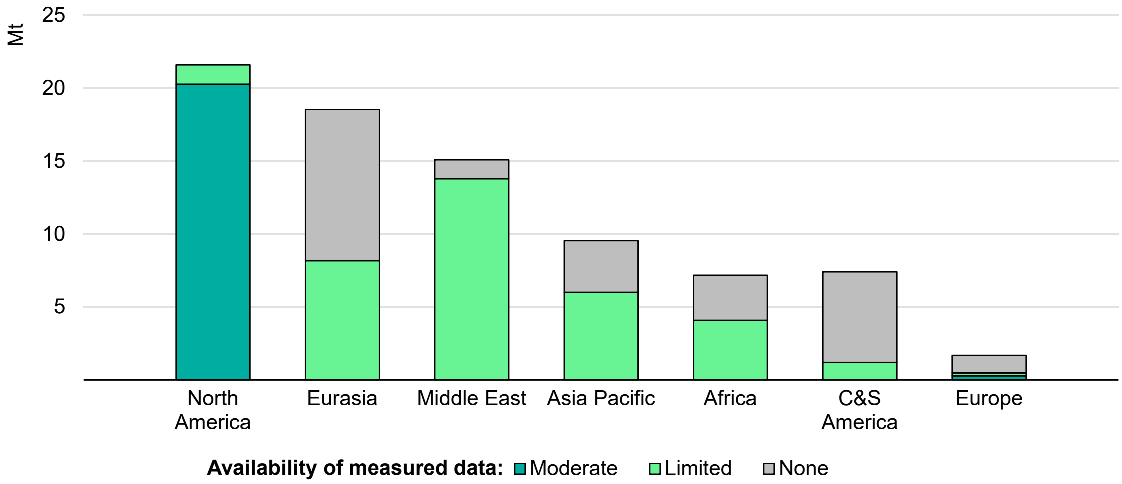
Global Methane Tracker offers comprehensive and coherent energy sector methane estimates based on the latest and best available evidence

The IEA develops and publishes country-level estimates of energy-related methane emissions and mitigation opportunities as part of its Global Methane Tracker. To provide a comprehensive view of anthropogenic methane, the Tracker includes emissions estimates from non-energy sectors such as agriculture and waste, using publicly available data. It also assesses how different policy measures could reduce emissions and compares national and regional commitments and strategies.

Our estimates are updated regularly using the best available evidence, including data on fossil fuel operations, country- and production-specific emissions intensities and scientific studies and measurement campaigns, as well as large emission events detected by satellites. They evolve over time as new measurements emerge and as factors such as infrastructure age, flaring patterns, operator practices and satellite detection capabilities improve, alongside governance frameworks and methane regulations.

There has been a large increase in the availability and reporting of methane emissions data in recent years, but estimates are still subject to a high degree of uncertainty and are often inconsistent across data sources. For areas where measured data is available, there can be large level of uncertainty given intrinsic limitations in measurement techniques (see Recent insights from methane emissions studies). Significant data gaps also remain, especially in parts of the world where satellites struggle to gather useful data, including, for example, in Venezuela, where cloud cover hinders observations, and in many parts of Russia, where snow and ice make it challenging to observe methane leaks. For these regions, uncertainty is even higher: our approach to generate estimates is to derive specific country and production type emission intensities using proxies from areas with measured data, which are then applied to production and consumption data on a country-by-country basis (see Global Methane Tracker documentation 2026 for further details).

Estimates of oil and gas methane emissions and related availability of measured data at a country level



Notes: Mt = million tonnes. C&S America = Central and South America.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

The IEA works closely with the United Nations Environment Programme (UNEP)'s International Methane Emissions Observatory (IMEO) and other partners to ensure our assessments incorporate the latest measurement-based and peer-reviewed research. Alongside the Global Methane Budget, recent (2025) studies continue to show a clear gap between bottom-up inventories and top-down atmospheric observations, underscoring the need for measurement-informed national reporting. They also highlight the role of intermittency and super-emitters, pointing to a need for monitoring approaches that go beyond infrequent surveys. Meanwhile, advances in satellite constellations, high-resolution remote sensing and machine-learning are improving coverage, detection and quantification.

In China, Zhang et al. (2025) developed a mine-specific emission-factor database using national coal mine registry data and estimated coal-sector methane emissions at 21.4 Mt in 2025, while satellite-based analysis by East et al. (2025) put the national total at around 14 Mt (the IEA's latest estimate is 22 Mt and the value reported to the United Nations Framework Convention on Climate Change [UNFCCC] is with 21 Mt). This highlights the persistent uncertainty in reconciling measurement-based and inventory-based approaches.

New measurement campaigns are also expanding geographical coverage. Fiehn et al. (2025) carried out the first airborne survey of Angola's offshore oil and gas operations, estimating emissions at roughly 150 kt from their 2022 campaign, and identifying differences between top-down and bottom-up estimates which can be further explored. He et al. (2025) documented an 8% annual increase in super-emitter activity on Turkmenistan's west coast from 2020-2023, a trend that is not captured in current inventories. IEA analysis similarly points to rising emissions from super-emitter events across Turkmenistan, with satellite data showing average annual growth exceeding 15% over the same period.

The IEA's Global Methane Tracker includes methane released during the end use of coal, oil products and natural gas, drawing on emissions factors from the Intergovernmental Panel on Climate Change (IPCC). However, some measurement campaigns suggest that actual emissions in industrial facilities, urban areas and households may exceed these factors, making end-use sources an ongoing source of uncertainty. Estimates will continue to be revised as more robust evidence becomes available.

Bioenergy-related methane emissions are another category with high uncertainty. For solid bioenergy, the Tracker uses emission factors from IPCC 2006 and applies these to our detailed analysis of the levels and types of traditional biomass used for cooking and heating. We also generate our own estimates of methane from biogas systems, covering emissions from biodigesters, upgrading facilities and digestate storage.

Methane emissions from abandoned coal mines and oil and gas wells are estimated by applying country- and production-type emissions intensities to the available data on abandoned wells and mine capacity. The assessment assumes that older facilities emit less methane than more recently closed ones. Measurement data for these sources remain sparse, and key facility information, including closure dates and site conditions, is lacking in many countries. This results in substantial uncertainty. Lei et al. (2025) estimate that 0.4 Mt of methane was emitted from 4.5 million abandoned oil and gas wells in 2022, well below the IEA's estimate of around 3 Mt.

Methane from hydropower facilities can also be significant, with some studies putting emissions at around 14 Mt annually. Sources include degassing at turbines and diffusive or ebullitive release from reservoirs. Due to limited global data on these processes, hydropower-related emissions are not yet included in the Global Methane Tracker, though they may be important in some contexts.

The IEA's Methane Abatement Model provides a tool for estimating methane reduction potential in oil and gas, along with associated abatement costs by country, segment and technology. Together with the Methane Tracker Data Explorer, it offers a consistent set of country-level estimates assembled from the best available evidence. Further methodological details are provided in the Global Methane Tracker documentation. We welcome additional measurement data along with scientifically robust information that can help refine these estimates over time.

Relevant reports, scientific studies or information can be shared with IEA analysts by email at methanetracker@iea.org.

Incorporating satellite data into the Global Methane Tracker

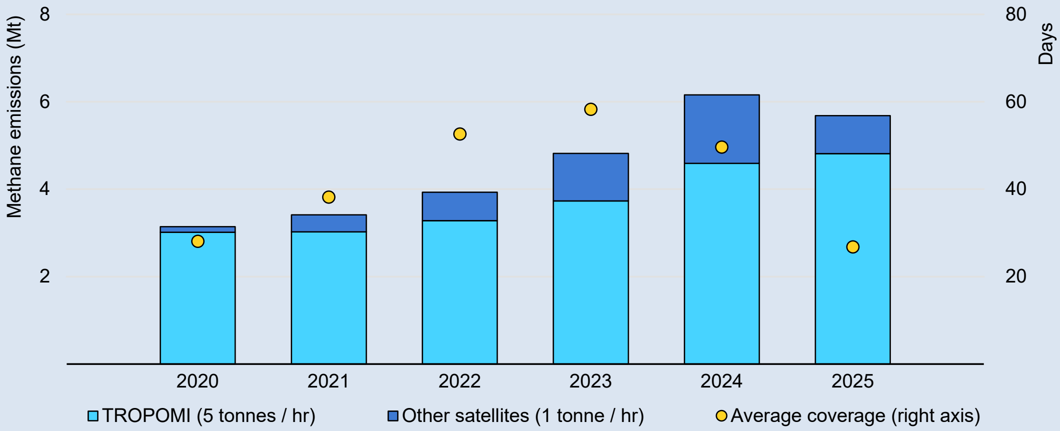
The Global Methane Tracker integrates results from all publicly-reported, credible sources of data. This includes emissions detected by satellites. Satellite inversion data from credible sources is used in one of two ways: to calibrate country-level emissions estimates and to generate a separate reported item for large emissions events at the global and country level.

A good example of satellite data used for calibration comes from MethaneSAT, which provided emissions and intensity data from 23 basins across 16 countries from its year in operation (March 2024 to June 2025). For ten of these countries, the covered basins represent at least 25% of national oil and gas output. In these cases, the IEA's emissions-intensity estimates fall within MethaneSAT's uncertainty bounds. The IEA's estimates from the Global Methane Tracker 2025 were already aligned for Egypt, Iran, Mexico and the United States, and emissions intensities for the remaining countries (Algeria, Argentina, China, the United Arab Emirates, and Uzbekistan) have been modified in this year's edition of the Global Methane Tracker based on these new data.

The satellite readings reported directly cover very large emissions sources. This includes emissions events that emit more than 5 tonnes per hour, based on TROPOMI data, and – for the first time in 2026 – data from a group of higher resolution set satellite instruments (EMIT, EnMAP, PRISMA, Sentinel-2, and Landsat 8/9) that can detect flow rates greater than 1 tonne per hour. In both cases, these data are provided by the data analytics firm Kayrros. This addition allows us to include estimates of satellite-detected large emissions events for 11 new countries. The emissions events that are directly observed are scaled up to provide an annual estimate of emissions based on a conservative reading of the number of days within the year when observations could be made.

The ever-increasing availability of satellite data and information continues to improve global understanding of methane emission levels and the opportunities to reduce them. However, satellites have some limitations: they often struggle to provide measurements over equatorial regions, high-latitude areas, mountainous terrain, and snow- or ice-covered regions, and most cannot provide continuous temporal observations. Cloud cover and other adverse weather conditions can also prohibit daily satellite observations. Coverage tends to be best in the Middle East, Australia and parts of North America and Central Asia. Emissions estimates often rely on auxiliary data (such as wind speeds) which are themselves subject to a high degree of uncertainty, as is the process of converting temporal and spatial snapshots into annual emission estimates.

Satellite-detected large emissions, 2020-2025



Note: Mean coverage refers to a spatially averaged observation frequency over a region, computed from the number of usable scenes (% days with valid observations) for each basin or grid cell. Emissions estimates are based on a conservative scaling up of emission events directly detected to account for the number of days within the year when observations could be made.

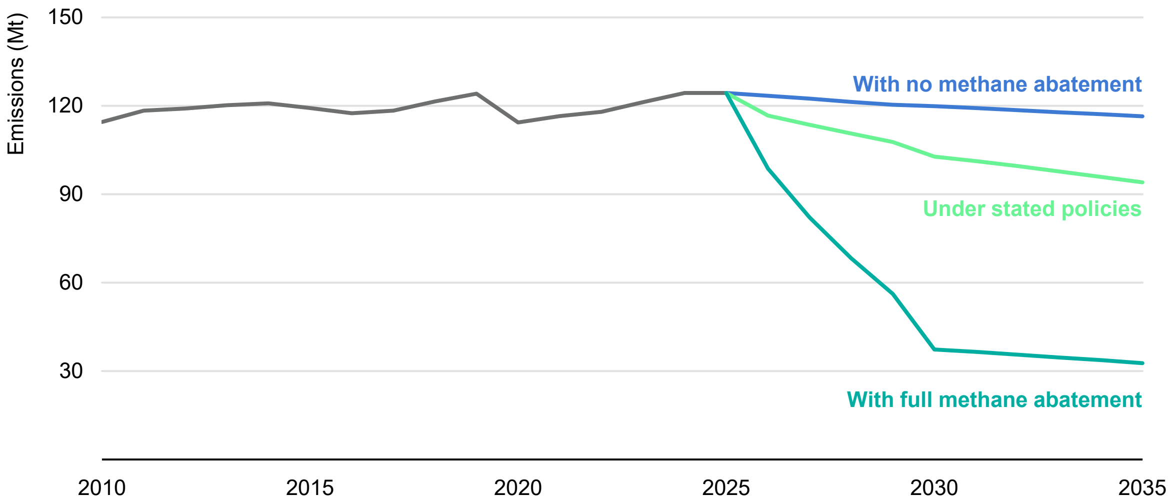
Source: IEA analysis based on data processed by Kayrros. Other satellites include EMIT, EnMAP, PRISMA, Sentinel-2 and Landsat 8/9.

Policy trends

Existing policies and regulations would cut energy sector emissions by 25% by 2035 – far short of high-level goals

National ambitions to lower emissions have grown significantly in recent years, with many new countries signing onto methane commitments. High-level methane pledges now cover around 80% of global fossil fuel production, up from around 50% in 2021. This includes the Global Methane Pledge (GMP), which today includes more than 150 countries and covers more than 50% of emissions from human activity worldwide. Launched in 2021 at the 26th United Nations Climate Change Conference (COP26), the GMP commits participating countries to collectively reduce anthropogenic methane emissions – from all sources, not just energy – by at least 30% below 2020 levels by 2030.

Fossil fuel methane emissions reductions to 2035 under no-abatement, stated policies and full technical abatement scenarios



Note: Mt = million tonnes.

Most GMP signatories are yet to take concrete action to introduce policies or to reduce emissions. The detailed policies and regulations in place today would cut oil and gas emissions by only around 20% by 2030 and 26% by 2035, well short of the GMP's economy-wide reduction target of a 30% cut by 2030. In the coal sector, ambition is even more limited, and the implementation gap is larger. Current policies and regulations would reduce coal-related methane emissions by 12% by 2030 and 22% by 2035.

Turning high-level commitments into results requires moving from promises to action. A reduction target is a first step, but it needs to be backed by specific policies, regulations, resources and implementation plans. Countries seeking to develop such frameworks can draw on existing support, including the International Energy Agency (IEA)'s regulatory roadmaps for cutting methane emissions in the oil and gas and coal sectors.

Recent changes in methane policies and regulations

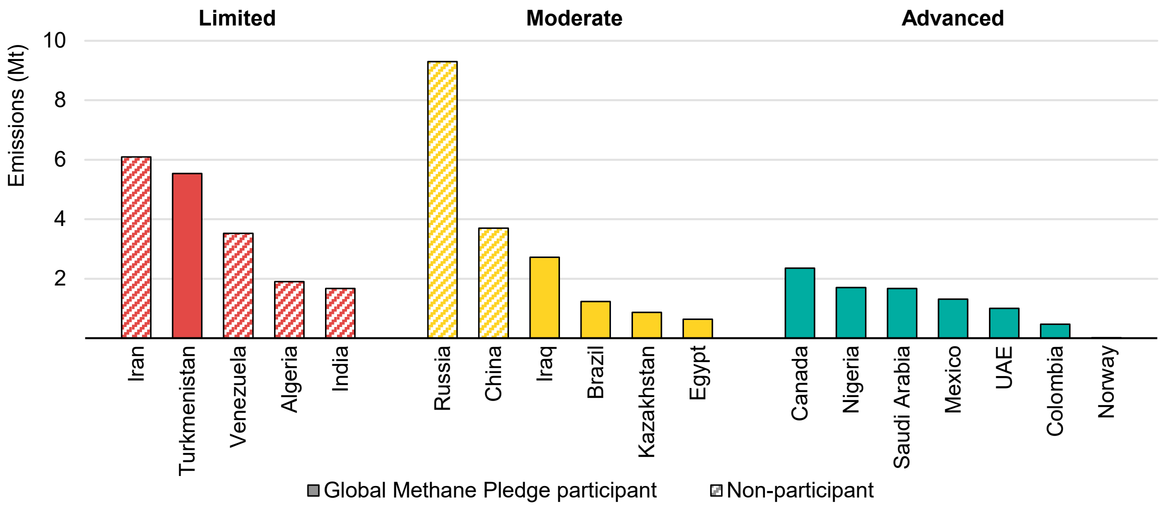
Several countries introduced or strengthened mandatory policies and regulations targeting methane emissions in 2025:

- **Canada** amended federal regulations on emissions from upstream oil and gas facilities. The revised rules tighten standards for leak detection and repair (LDAR), strengthen the management of fugitive emissions, and prohibit venting except in narrowly defined circumstances. The changes also introduce an alternative compliance pathway, allowing facilities that meet a prescribed methane intensity threshold to devise their own abatement strategies. Under Canada's federal architecture, oil and gas producing provinces can receive an exemption from the federal regulations, provided the province enacts regulations that are as strict and ambitious as the federal ones. Through these enhanced regulations, Canada seeks to reduce oil and gas emissions by 72% by 2030 (compared to 2012 levels), though this will depend on the strength of provincial regulations.
- The **European Union's** Methane Regulation began to take partial effect, introducing requirements for LDAR, source-level emissions quantification, and a ban on venting from coal mine drainage systems. The bloc's import standard also came into force in May 2025, requiring importers to provide information on product origin and routes, as well as on methane-control measures such as LDAR and monitoring, reporting and verification (MRV). EU energy ministers endorsed certification and "trace-and-claim" as workable solutions for demonstrating compliance with forthcoming import rules, and issued guidance to support both EU importers and non-EU producers.
- **Ghana** is developing guidelines setting out a comprehensive framework for managing methane emissions, including mandatory LDAR, repair obligations, limits on venting and flaring, and equipment standards.
- **Kazakhstan** is developing regulations to curb methane emissions from the fossil fuel sector, including by eliminating non-emergency venting, requiring LDAR, and establishing a measurement, monitoring, reporting and verification (MMRV) framework.
- **Nigeria** introduced a tax law offering fiscal incentives for the use of associated gas and tax deductions for reinjecting natural gas that would otherwise be flared.

- **Senegal** is developing methane abatement regulations in accordance with Decree 2025-227, which mandates an interministerial order to limit the pollutant content of atmospheric releases, set conditions for the discharge of combustion products, and specify requirements for emissions measurement and control devices.
- The **United Kingdom** released a methane action plan setting out measures developed as part of the Carbon Budget and Growth Delivery Plan. These include reducing emissions from flaring and venting and addressing methane leaks. The plan also outlines international efforts to cut global emissions, including diplomatic engagement and work to assess emissions linked to imported fossil fuels.
- In the **United States**, compliance deadlines for various regulatory requirements relating to methane emissions from the oil and gas sector have been extended until January 2027. Congress also delayed the entry into force of the "Waste Emissions Charge" mandated by the 2022 Inflation Reduction Act until 2034.

Nearly 100 other countries have either completed or are developing national methane action plans. This includes 38 countries that are being supported by the CCAC's Methane Roadmap Action Programme.

Selected top emitters and their regulatory scores, 2025



Notes: Mt = million tonnes. UAE = United Arab Emirates. Regulatory scores are based on regulations that are legally in force and for which compliance is mandatory. Scores are based on "on-the-books" laws and regulations, and do not reflect enforcement in practice. Regulations that have been enacted but are not yet in force are excluded from the scores, as are those adopted by subnational authorities. As a result, scores may not fully capture regulatory stringency in practice.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

The IEA's Policies Database catalogues more than 650 existing and announced policies and regulations related to methane emissions across 80 countries. Using this dataset, we assessed the regulatory performance of the largest emitters of energy-related methane, including on regulations addressing MRV, LDAR, flaring and venting rules, equipment and facility standards, and economic policies. The results show wide variations in regulatory maturity.

Integrating marginal wells into national abatement plans and frameworks

Marginal wells – low-producing wells that are past peak production and in decline – can account for a significant share of total domestic emissions (potentially up to 50% of total national emissions) and typically have higher emission intensities than non-marginal wells.

In many jurisdictions, once a well becomes marginal, large oil and gas companies often sell them to smaller operators, who may lack the resources to upgrade aging equipment. Some operators also leave wells at minimal production volumes for long stretches of time to delay formal abandonment and avoid decommissioning obligations. As a result, many marginal wells fall into disrepair and are poorly maintained, prolonging emissions with little contribution to energy supply.

Despite their significant contribution to national emissions, marginal wells are often overlooked in current policy and regulatory frameworks. Integrating them into methane-abatement strategies and regulations could deliver substantial emission cuts with limited impact on energy security.

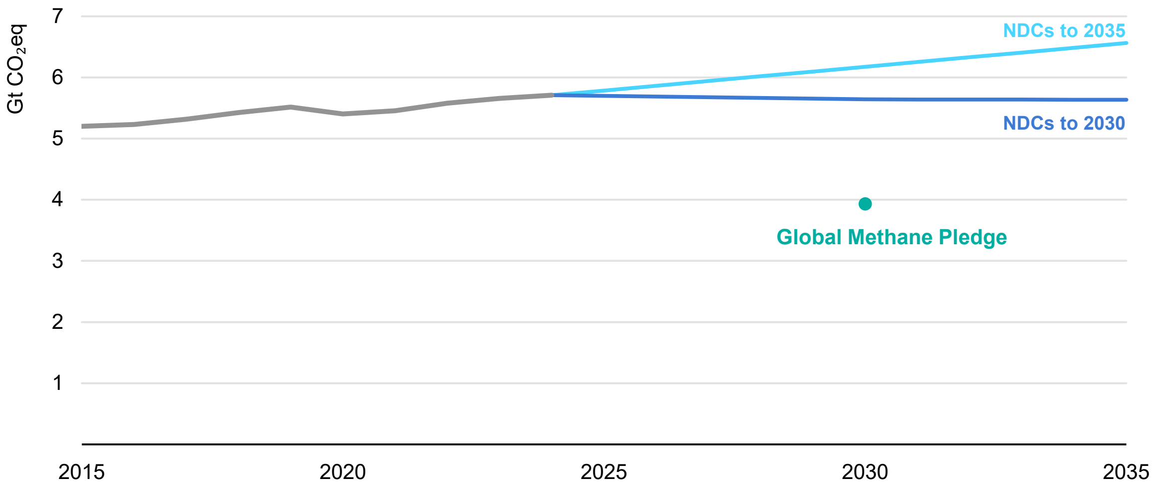
Several policy options exist to tackle emissions from marginal wells. Governments can launch data-collection programmes to inventory marginal wells and quantify their methane emissions, allowing abatement efforts to focus on high-emitting sites. Tried-and-tested policies (see "Key findings" above) can be applied to marginal as well as high-producing wells. Measures can also be introduced that discourage operators from keeping wells on minimal output to delay decommissioning, for example through penalties on operators that postpone plugging. In addition, funding schemes can be used to support abatement at marginal wells (including well plugging), as the United States did in 2024. Carbon credit mechanisms can also be used to finance plugging of marginal wells.

Countries have included methane in their updated NDCs, but these still lag the GMP target

As of April 2026, 141 countries had submitted updates to their Nationally Determined Contributions (NDCs) under the Paris Agreement for the period to 2035. Methane is included in the scope of all of them, but only around 20 set out specific measures to cut emissions from fossil fuel operations, and just five include quantitative targets for these reductions. Some countries, including Norway, have adopted methane reduction targets and outlined sectoral measures in national action plans that are not included in their NDCs.

IEA analysis suggests that for Global Methane Pledge signatories, achieving a 30% cut in domestic methane emissions (i.e. implementing the GMP target domestically) would deliver a much greater reduction in emissions than is currently implied by their NDCs. Under current NDCs, economy-wide methane emissions in GMP countries would rise in aggregate by around 15% between 2020 and 2030, and by 20% by 2035. This increase is partly due to the widespread use of "business as usual" baselines in NDC targets. By contrast, if these same countries were to achieve a 30% reduction in domestic methane emissions through national policies and regulations, this would cut methane emissions by about 2 gigatonnes of CO_2-equivalent (CO_2-eq) relative to the levels implied under current NDCs.

Changes in methane emissions for GMP countries under their NDCs and domestic implementation scenarios, 2015-2035



Notes: $MtCO_2eq$ = million tonnes of carbon-dioxide equivalent. Projections use conditional targets where they exist. When the target year is before 2035, we assume that no additional reductions are made past the target year. Where targets are based on reductions against a business-as-usual (BAU) scenario, we use total BAU 2030 greenhouse gas emissions estimates provided by countries in their NDCs and estimate the distribution of methane emissions across sectors by applying the distribution observed in 2020. The 100-year global warming potential of methane is used (GWP100 = 30).

Sources: NDC economy-wide and sectoral targets may be found in the UNFCCC NDC Registry. Historical energy-sector methane emissions are based on IEA modelling while non-energy methane emissions come from EDGAR.

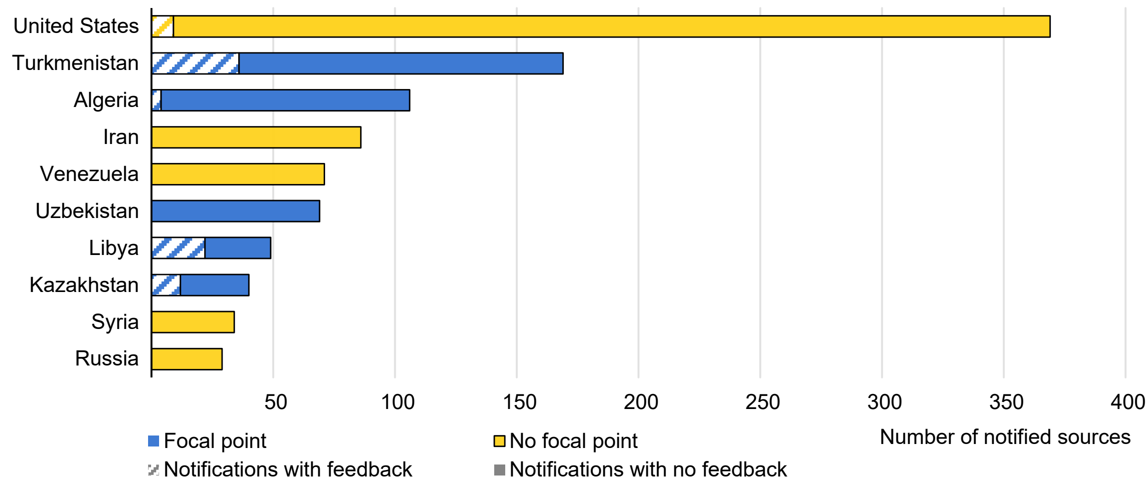
Satellite technology can detect large emission events, but policy and corporate action need to improve

Advances in monitoring technologies – notably satellites – have enabled the detection of large emission events. While satellite technology is not perfect, with performance reduced offshore and in mountainous, snowy, icy, overcast and high-latitude regions, satellite systems and data-processing techniques can now detect and quantify emission events ranging from major releases over large areas to smaller facility-level leaks. In 2025, satellites detected more than 5 million tonnes (Mt) of methane from very large emission events in oil and gas operations worldwide.

Several organisations now alert governments and companies to large emission events. Carbon Mapper hosts free and publicly available plume and source data on its data portal, while GHGSat has been notifying governments and industry of large emission events since the launch of its first satellite in 2016. The Oil and Gas Climate Initiative (OGCI) launched a Satellite Monitoring Campaign in 2021 and has since published guidance for responding to satellite notifications. The United Nations Environment Programme (UNEP)'s International Methane Emissions Observatory (IMEO) introduced the Methane Alert and Response System (MARS) in 2023, which provides free satellite-based alerts.

MARS uses more than 35 satellite instruments, combined with scientific expertise and artificial intelligence, to notify countries of actionable emission events occurring within their territory. As of early 2026, 24 countries and nine subnational governments had designated a point of contact, or "focal point" (typically within a relevant ministry or agency or national oil company), to receive direct notifications from IMEO. Where no focal point is designated, notifications are shared with the country's UNEP Permanent Representative. Although prompt responses to MARS notifications have led to successful mitigation in several countries, overall engagement remains low: globally, only around 12% of MARS notifications received a response in 2025.[2] Preventing and swiftly addressing major leaks or releases remains a key lever for reducing emissions, and there is substantial scope to improve the speed and effectiveness of action.

Top 10 countries by actionable MARS notifications from oil and gas operations, 2025



Notes: Includes countries with the most actionable notifications from the Methane Alert and Response System (MARS). "Actionable" refers to plumes that: have been validated by IMEO experts; have been detected within the last 15 days; and can be attributed to a specific facility or operator. Sources shown are based on emission events verified by MARS and do not reflect the distribution of emissions over regions; emission events can be observed more easily in some regions than others (see Documentation).

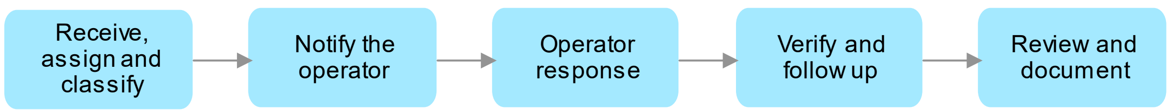
Source: IEA analysis based on IMEO data as of February 2026. Note that in some cases, even where the country had not designated a focal point, it still provided a response to UNEP's IMEO concerning the notification.

[2] Under IMEO procedures, a notification is considered to have been "answered" when the focal point responds with information on the detected event. A response does not necessarily mean mitigation action was taken.

Designating MARS focal points could significantly improve response rates. In countries that have nominated a focal point, nearly a third of emissions sources receive a response, and several countries – including Argentina, Brazil, Mexico and Yemen – have response rates close to 100%. This contrasts with a 2% response rate across the 14 countries that have received MARS notifications but have no focal point, nine of which have a 0% response rate.

In addition to nominating focal points, governments can also develop response plans to improve engagement with MARS notifications. The IEA, in collaboration with IMEO, has prepared a five-step sequential framework to help countries strengthen their response processes. The IEA and IMEO can provide technical support to governments and national oil companies (NOCs) interested in adapting this framework to their legal, operational and financial contexts.

A five-step framework for responding to MARS notifications



IEA. CC BY 4.0.

Beyond MARS, governments can embed super-emitter response programmes into their regulatory frameworks. Kazakhstan is developing such a programme as part of its new methane abatement rules, drawing on multiple data sources (including Carbon Mapper and MARS) and requiring operators to respond to satellite-detected events. In Nigeria, the National Oil Spill Detection and Response Agency has launched the Nigerian Gas Flare Tracker, which uses satellite technology to monitor and estimate flared gas volumes. In the United States, the California Air Resources Board, in collaboration with Carbon Mapper, has launched the California Satellite Methane Project to support efforts to reduce or eliminate methane leaks. Key elements to consider when designing super-emitter programmes include accreditation criteria for third-party satellite operators, procedures for operator notification, timelines for identifying and mitigating sources, mechanisms for operator feedback, and safeguards for data confidentiality.

Consistent implementation and enforcement of methane regulations

The number of countries with enforceable methane and flaring regulations has grown in recent years, including Nigeria, Indonesia and China. Once a regulation is in place, meaningful and lasting emission reductions depend on effective enforcement. Yet in practice, implementation can be hampered by limited access to verification technology, insufficient resources and staff, limited training on methane detection, outdated systems for collecting company data, and the need to coordinate with other agencies with competing priorities.

Building on its 2021 Regulatory Roadmap and Toolkit, the IEA is preparing guidance on the implementation and enforcement of methane policies and regulations in the oil and gas sector.

A range of tools and strategies can help address enforcement challenges. Digital compliance platforms can be set up to collect reports from operators. Risk-based enforcement plans can be adopted, prioritising the largest sources first. Penalties for non-compliance can be introduced, with tiered structures to reflect differences between operators. Satellite technology can be leveraged to detect non-compliant activity and target facilities for verification (though this is generally more effective for large, intermittent emission events than for diffuse low-rate emissions). Regulatory agencies can also coordinate to support a whole-of-government approach to methane abatement, while periodic regulatory reviews can incorporate operator feedback and reflect technological developments.

Effective implementation also requires building out the appropriate regulatory architecture for data collection, verification and enforcement. Agencies responsible for methane reduction need sufficient resources and staff, as well as training to build expertise in methane detection and abatement.

Supporting regulatory action in emerging market and developing economies

Emerging market and developing economies (EMDEs) often face additional barriers to implementing and enforcing methane regulations, including limited institutional capacity, lack of access to measurement and detection technologies, and financing constraints for abatement projects. Advanced economies can help address many of these challenges. Signatories to the COP30 Statement on Drastically Reducing Methane Emissions in the Global Fossil Fuel Sector have pledged to support low- and middle-income producer countries in achieving near-zero methane intensity. International partnerships, joint work programmes and other forms of collaboration can play a role. For example, in 2024, the European Commission launched the Methane Abatement Partnership Roadmap, which calls for cooperation frameworks between exporting and importing countries.

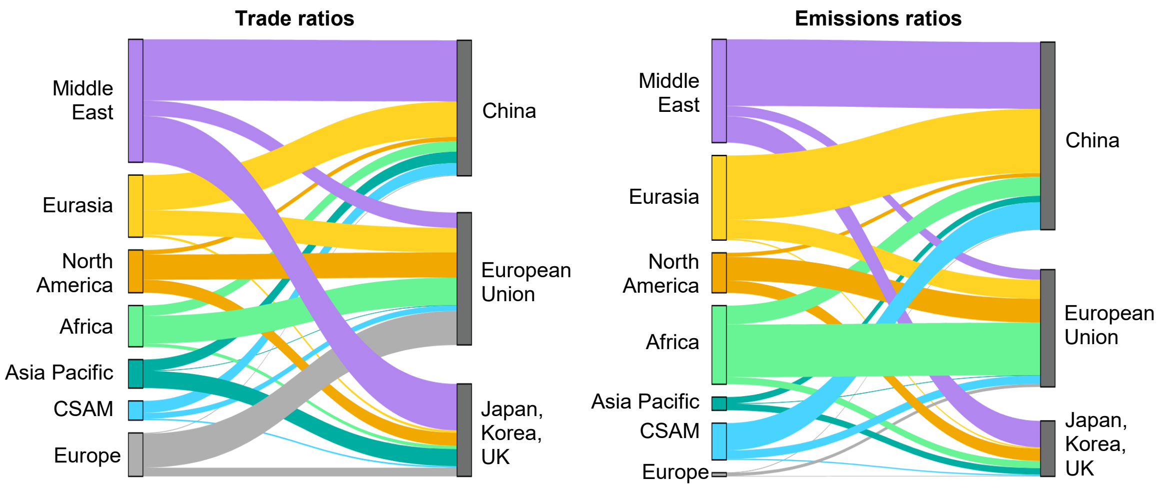
Advanced economies can also provide bilateral technical and institutional support for implementing methane policies, regulations and technologies in EMDEs. For example, the US Trade and Development Agency is working with the Egyptian General Petroleum Corporation to develop a roadmap for methane emissions reduction in Egypt, identifying major emissions sources in the oil and gas industry, setting reduction targets with clear timelines, and drafting proposed abatement legislation. Support can also be channelled through multilateral and regional initiatives, such as the Fossil Fuel Regulatory Programme, the World Bank's Global Flaring and Methane Reduction (GFMR) Partnership, the IEA's regional roundtables, and the IEA-CCAC Methane Regulator-to-Regulator Network.

Addressing methane in the marketplace

Near-zero methane standards from key importers could cut upstream oil and gas emissions by 20%

There is increasing interest in many countries in reducing the greenhouse gas (GHG) emissions linked to their fossil fuel imports. For some of the largest oil and gas importers – the European Union, the United Kingdom, Japan, Korea and China – such emissions (15 million tonnes in 2024) far exceed those from domestic oil and gas operations and infrastructure (5 million tonnes in 2024).

Oil and gas trade flows and associated methane emissions for selected importers, 2024



Notes: Europe excludes European Union Member States and the United Kingdom. Asia Pacific excludes China, Japan and Korea. UK = United Kingdom. CSAM = Central and South America.

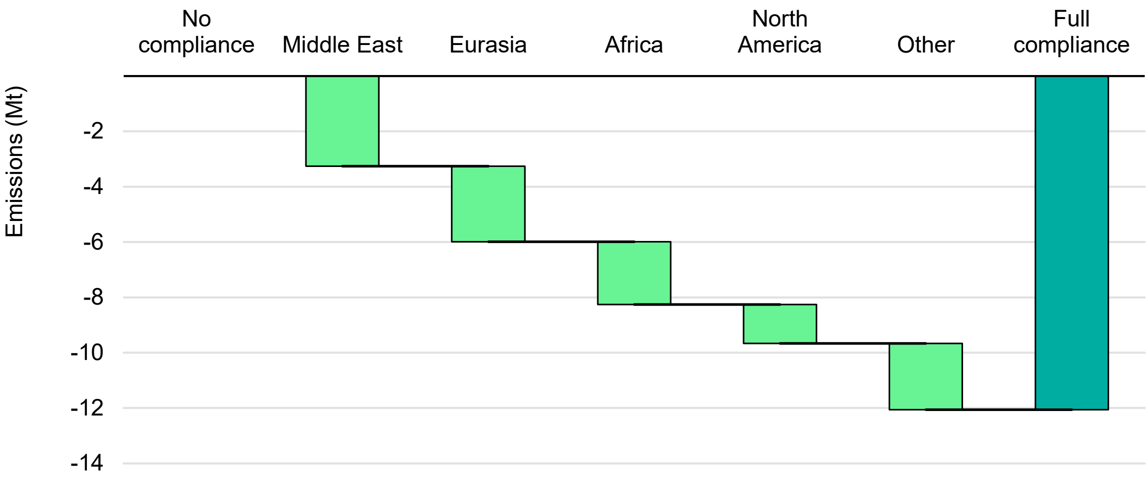
Sources: Oil and natural gas trade flows from 2024 are based on IEA data from 2025. IEA emissions estimates based on measured, satellite, and inferred data (see Documentation for further information).

Upstream methane emissions intensities associated with oil and gas imports differ across countries. According to International Energy Agency (IEA) estimates, average intensities are around 1% for the European Union and United Kingdom, 0.6% for Japan and Korea, and 1.3% for China.[3] By reducing these intensities to 0.2% – a level that could be achieved worldwide using all currently available

[3] Methane intensities are calculated here in energy terms as total methane emissions from upstream operations divided by marketed oil and gas production. This metric differs from the OGCI definition, which is calculated as the ratio of methane emissions from operated upstream assets to marketed gas volumes.

technologies – global methane emissions would fall by more than 12 million tonnes (Mt), or around 20% of total upstream oil and gas methane emissions.

Estimated potential emissions reductions with an import standard in the European Union, China and other advanced importing economies by region, 2024



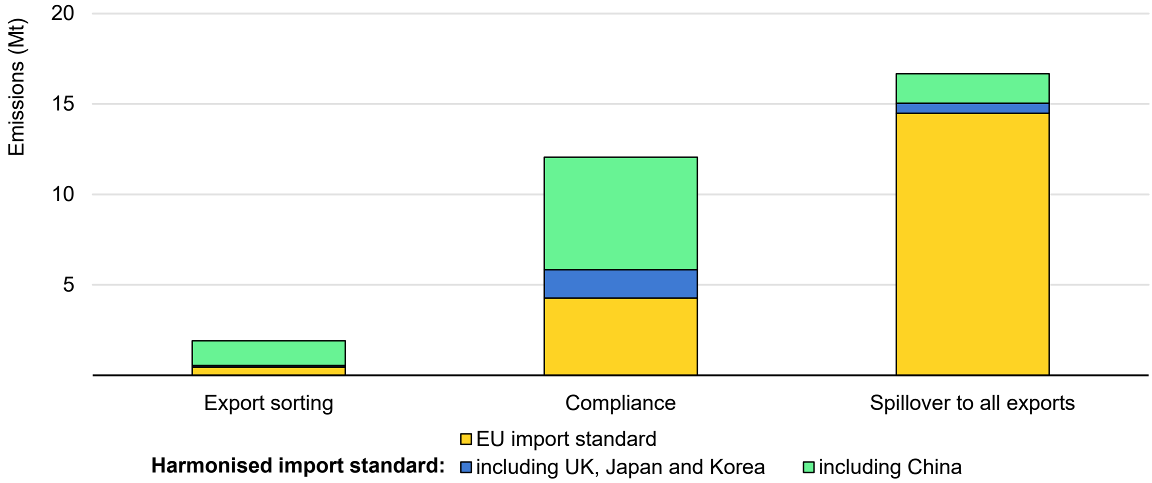
Notes: Mt = million tonnes. Reductions assume that exporters to the European Union, United Kingdom, Japan, Korea and China reduce the basin-level emissions intensity of exported volumes to 0.2%. Other includes non-EU Europe, Central and South America and other Asia Pacific regions, each of which has lower levels of trade with the importing countries in the analysis. Potential emissions reductions are estimated based on 2024 trade and emissions intensity data.

The real-world impact of a methane import standard would depend heavily on its design, enforcement and compliance. If import penalties are low relative to abatement costs, exporters and importers may choose not to comply. Alternatively, exporters could adjust trade flows (physically or via tradeable certificates) so that fuel with low-emissions intensity is directed to countries with an import standard, while higher-emission fuels are either consumed domestically or exported to unregulated markets. In this case, emissions may fall somewhat where exports still require improvements to meet the standard, but the overall impact would be significantly weakened.

Conversely, an import standard could drive deeper methane cuts in exporting countries if companies extended abatement beyond the volumes destined for regulated markets. Such spillovers could arise if the countries or companies affected by the standard reduced the emissions intensity of a greater share of their oil and gas production. For example, if exporters to the European Union, United Kingdom, Japan, Korea and China achieved a 0.2% upstream intensity across all exports, regardless of the destination, global methane emissions would fall by 17 Mt.

A coordinated emissions import standard can strengthen energy security for importing countries. If countries that currently export fuel to the European Union, Japan, Korea or the United Kingdom were to cut flaring and methane emissions across all their exports, this could make more than 25 billion cubic metres (bcm) of additional gas available to importers. Reducing methane emissions and flaring can thus deliver a double dividend: improved energy security alongside progress toward climate goals.

Estimated potential reductions in methane emissions from imported oil and gas with an import standard under different scenarios, 2024



Notes: Mt = million tonnes. UK = United Kingdom. Export sorting assumes exporters allocate production with an upstream methane emissions intensity of 0.2% for exports to the European Union, United Kingdom, Japan, Korea and China, and reduce emissions only where existing low-intensity production is insufficient to meet export demand. Compliance assumes exporters to the European Union, United Kingdom, Japan, Korea and China reduce the upstream emissions intensity of exports to these countries to 0.2%. Spillover to all exports assumes exporters to the European Union, United Kingdom, Japan, Korea and China reduce the upstream emissions intensity of all exports, regardless of destination, to 0.2%. Potential emissions reductions are estimated based on 2024 trade and emissions intensity data.

Designing import standards to maximise emissions reductions

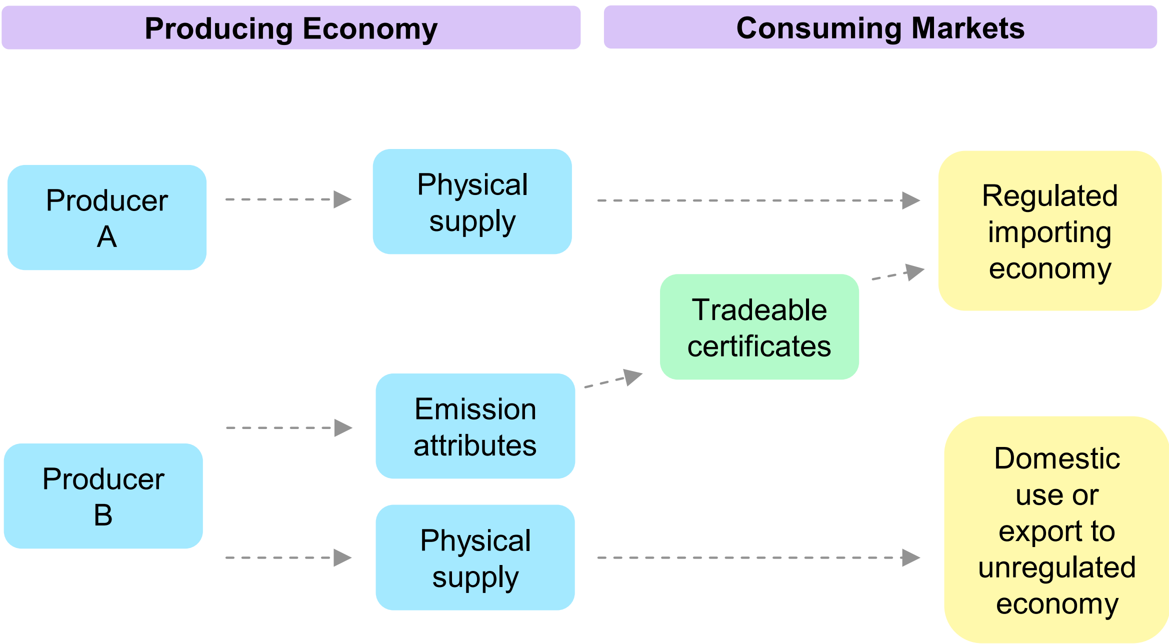
Regulators considering methane-related import standards can pursue several strategies to avoid pitfalls and maximise impact. Effective design begins with clear timelines for compliance. Import requirements can be phased in gradually to give producers, exporters and importers time to adjust. Clear guidance is also needed on whether the standard applies to existing contracts or only to those signed after a specified date.

Designing an effective import standard also requires clear and consistent implementation rules. Regulators need to specify how importers need to measure and report the methane intensity of imported fuels. Once reliable data is available, regulators will need to determine whether imported fuels are to be subject to a maximum methane intensity threshold, and if so, how fuels exceeding that threshold will be handled. Several approaches exist for reporting upstream methane intensities and complying with a performance threshold, and countries need to decide which methods and certification schemes will be accepted as proof of compliance.

In a "book-and-claim" model, physical supply is decoupled from its emissions profile through tradeable certificates. These can operate at a national level, with importers sourcing certificates from any producer within a given country, or at the basin or regional level, with certificates tied to the basin or region of origin of the imported fuel.

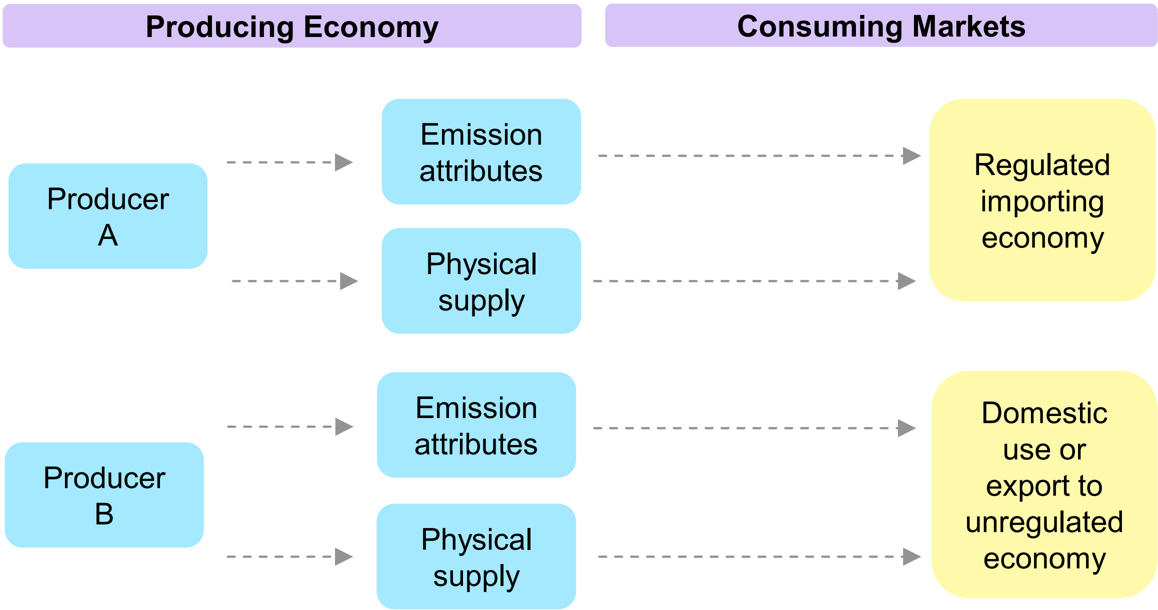
Book-and-claim models tend to be relatively low-cost and simple for industry but could potentially weaken the impact of an import standard. This is because these systems would allow importers to purchase certificates from low-intensity producers that do not directly export physical supply to them. As a result, some high-intensity exporters may not be incentivised to implement abatement measures, resulting in a lower level of overall emission reductions. For example, if a producer with a high emissions intensity (Producer A in the figure below) exports to an economy with an import standard, the importer could buy a certificate from a producer that already has a low emissions intensity (Producer B), resulting in no overall emissions reduction (similar to the export sorting scenario described above).

National book-and-claim model



In a "trace-and-claim" model, importers trace the imported fuel back to its production asset, rather than purchase certificates. This model is more likely to deliver real emission reductions but may prove relatively more costly and onerous to implement in some oil and gas supply chains, particularly more complex ones.

Trace-and-claim model



IEA. CC BY 4.0

Countries or regions seeking to introduce an import standard may wish to adopt a phased approach, starting with a book-and-claim approach at the basin level. Under this arrangement, regulated importers would comply by purchasing tradeable certificates, but only those issued within the same basin or region as the physical origin of the imported fuel. To enforce this geographic constraint, information on origin could be attached to certificates at the point of issuance and embedded within digital trading platforms through which importers acquire them. As data reporting, verification and traceability improve over time, regulators could then transition to a trace-and-claim system, which is likely to deliver greater emission reductions in producing countries.

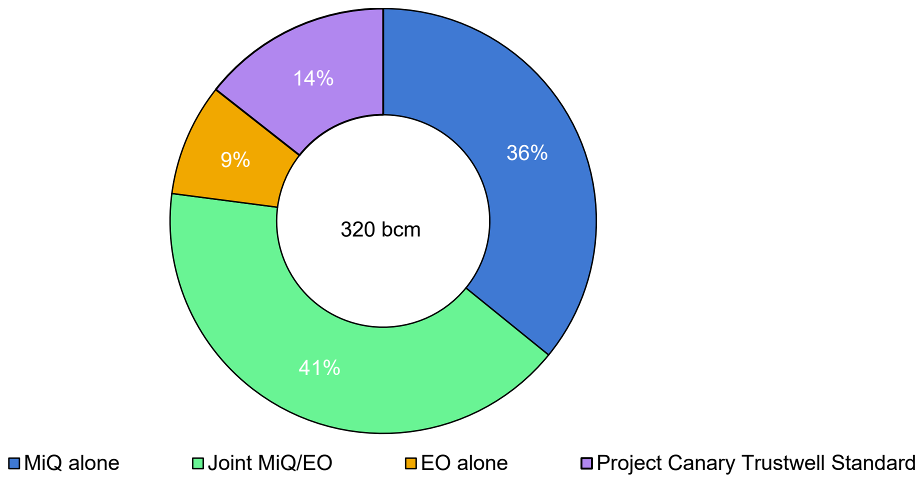
To unlock meaningful emission reductions, the enforcement mechanisms of import standards need to be sufficiently robust to encourage exporting countries or companies to adopt methane abatement measures. Importing countries can pair the introduction of such standards with technical assistance and financial support for exporting countries, helping to facilitate compliance with the new requirements. Regulators could further enhance effectiveness by coordinating with other jurisdictions that have already implemented similar standards, working together to harmonise import requirements and streamline compliance for both producers and buyers.

Harmonised measurement, reporting and verification can spur the formation of a global differentiated market for fuels with near-zero methane intensity

Several voluntary initiatives have emerged in recent years to improve transparency on methane emissions in the fossil fuel sector. These come in different forms, ranging from reporting frameworks – such as the Oil and Gas Methane Partnership (OGMP) 2.0, which underpins other transparency initiatives including the Coalition for LNG Emission Abatement towards Net-zero (CLEAN) – to supply-chain protocols, including the Groupe International des Importateurs de Gaz Naturel Liquéfié (GIIGNL)'s MRV and GHG Neutral LNG Framework and Context Labs' digital platform. Other initiatives focus on certification, including programmes run by MiQ, Equitable Origin and TrustWell.

Voluntary initiatives can allow high-performing operators to differentiate their products from higher-emissions alternatives. This can allow operators to attract new customers seeking fuels with lower emissions intensities – for example technology firms, data centres, or industrial companies that use natural gas as a feedstock and that have voluntary climate commitments in place. Over time, such differentiation could also support price premiums for lower-intensity fuels, strengthening incentives for producers to curb emissions.

Share of certified natural gas by emissions-certification programme, 2024



Notes: bcm = billion cubic metres. MiQ = Methane IQ. EO = Equitable Origin. Based on certifications awarded in 2024. Project Canary stopped certifying new customers in 2024, following a shift in focus toward its software and data business. Certificates issued prior to this date remain valid.

Voluntary initiatives face several challenges, slowing the emergence of a differentiated market for low-intensity fuels. The current landscape is fragmented, with schemes differing in scope, methodology, definitions and grading. This can confuse buyers and weaken their ability to compare fuel sources by emissions performance. Among voluntary initiatives, only some certification schemes require third-party verification of emissions, potentially affecting the reliability of emissions reported under other initiatives. Most initiatives also focus on oil and gas supply chains, with comparatively little attention paid to coal.

Although certification typically involves independent third-party verification of emissions (enhancing buyers' trust in reported emissions), it also faces its own unique challenges. Measurement-based quantification is not always required, raising the risk that methane emissions could be underestimated. Although volumes of certified natural gas reached 320 bcm in 2024 (roughly 7.5% of global output), certification remains concentrated in the North American upstream natural gas sector, with limited uptake outside this segment. Questions have also been raised about the integrity and transparency of some schemes, casting doubt on the reliability of emissions reported under them.

To address these challenges, countries can work together to harmonise voluntary initiatives and set common standards for measuring, reporting and verifying methane emissions across the oil and gas value chain, including common interoperability standards and consistent approaches for recording emissions performance on digital registries. Countries can build on initiatives that are already under way, such as OGMP 2.0 and CLEAN.

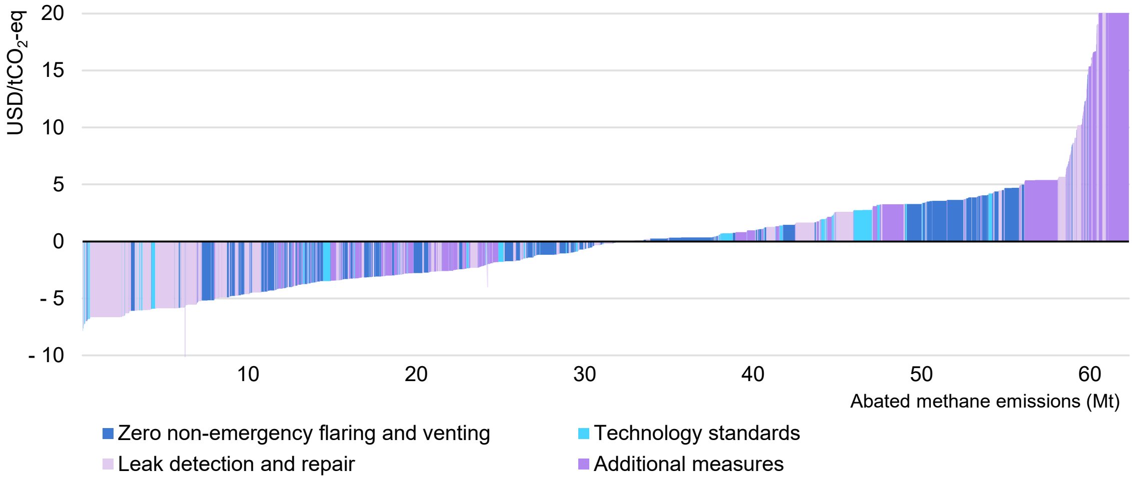
A globally accepted measurement, monitoring, reporting and verification (MMRV) framework could reduce the burden on companies of complying with multiple schemes and help market participants trade fuels on the basis of methane intensity. This could also spur the development of a globally differentiated market for near-zero methane intensity fuels, particularly if coupled with targeted incentive mechanisms. Such a market could, in turn, support price premiums for low-methane fuels, enabling operators to recoup investments in abatement technologies.

Strategies to speed action

Making a business case for methane abatement

Tackling methane emissions from fossil-fuel operations is one of the quickest and cheapest ways to curb global greenhouse gas emissions. Most of the methane abatement measures available today in the oil and gas sector would be cost-effective at a carbon price of about USD 20 per tonne of carbon dioxide equivalent (tCO_2-eq).

Marginal cost curve for oil and gas methane abatement by policy type



Notes: tCO_2-eq = tonnes of carbon dioxide equivalent.
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

Methane abatement has not caught on as widely as it could, for several reasons. Companies may underestimate of the scale of the problem or be unaware of the available solutions. Capital is often steered toward higher-profile projects, while corporate leaders may overstate the costs of cutting methane. Incentives can also be misaligned: equipment owners do not always benefit from fixing methane leaks, contracts may blunt the impact of savings on revenues, and those who own the gas may not recognise its full value. Upfront investment can be hard to secure, especially in developing economies. Companies may lack the needed staff or specialised services to tackle the problem. And in some cases, they have yet to find a workable way – or a convincing business case – to put captured gas to productive use.

Overcoming these barriers will require co-operation between governments, industry, financiers, international organisations and civil society. Governments can mandate disclosure of methane-related metrics. Investors and lenders can help by factoring methane into their decisions, working with companies to set targets and ensure accountability. Public and philanthropic actors can act as catalysts, supporting project development, building capacity and unlocking additional private finance.

Prioritising coal mine methane abatement

At over 40 million tonnes (Mt), methane emissions from coal are similar to oil. Although capturing and using methane is sometimes economically viable, in most cases the revenue earned would not justify the costs from a purely economic perspective. Even so, cutting these emissions remains a priority – especially for coking coal, which is harder to replace than steam coal and is often mined underground, where abatement is more feasible. Underground mines also have fewer potential point sources of emissions than surface mines or oil and gas operations. Monitoring equipment is already widely used in ventilation shafts for safety, making data easier to collect. That, in turn, can support mine-level plans to use or abate the gas.

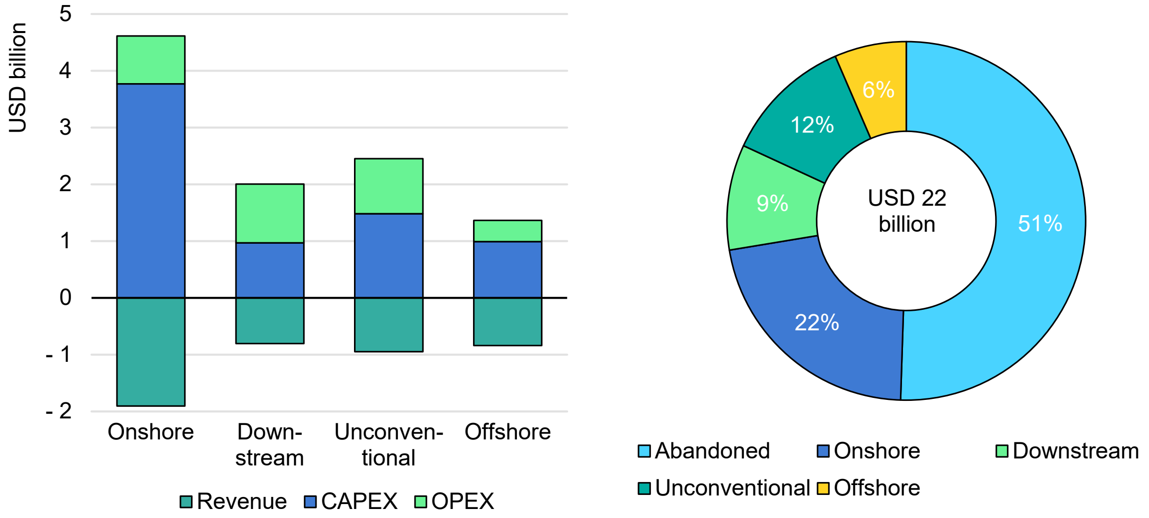
Most of the coal industry has yet to commit to tracking or reducing its methane emissions. Some companies take part in initiatives like the United Nations Economic Commission for Europe (UNECE) Group of Experts on Coal Mine Methane and Just Transition, or the Global Methane Initiative. Others address methane within broader climate or sustainability strategies. For example, the Australian group BHP has pledged to minimise fugitive methane “to the greatest extent technically and commercially viable,” using existing or emerging technologies. Anglo American reports investments in methane pre-drainage infrastructure at its underground coking coal operations. Producers who can credibly demonstrate lower methane emissions could gain a commercial edge: Steel producers, for instance, are increasingly looking for ways to lower the lifecycle emissions intensity of their products.

State-owned coal companies accounted for a significant share of global coal production in 2025 and will be central to the outlook for methane emissions from the mining sector. In Asia, state-owned enterprises dominate coal output, with Chinese and Indian state-owned groups collectively responsible for a substantial share of global production. These companies have a range of options to accelerate methane reductions. They can work with governments to strengthen policy on coal mine methane, including the development of national frameworks for capturing and using ventilation air methane. Methane management can also be built into mining operations – for example, by incorporating drainage systems into new mine plans or retrofitting degasification equipment in existing mines. Where capital constraints present a barrier, state-owned coal companies can draw on financing from multilateral development banks or concessional funding tied to methane-abatement outcomes.

Bridging the financing gap

We estimate that achieving a 75% reduction in methane emissions from fossil fuels would require around USD 28 billion in spending per year, on average, through 2035. Of this, close to USD 22 billion would be in oil and gas and USD 7 billion in coal. Around USD 21 billion would take the form of capital expenditure and USD 7 billion would be operating costs. In low- and middle-income countries, achieving these reductions would require about USD 28 billion in cumulative spending over the same period.

Average annual capital investment, operating costs, and revenues from full deployment of methane abatement measures in oil and gas operations



Notes: CAPEX = capital expenditure. OPEX = operating expenditure.

Companies, financial institutions and governments all have a role to play in unlocking new financing and closing the funding gap. To date, however, external financing aimed at reducing methane emissions in the fossil fuel industry has been very limited.

Fossil fuel companies carry primary responsibility for abating methane emissions, as the average annual spending required amounts to less than 2% of the industry's annual net income. Yet few companies currently disclose how much they invest in methane abatement across their operations.

Where retained earnings are insufficient to fund methane abatement projects and external support is needed, fossil fuel companies can tap into debt markets. Various instruments are available, ranging from conventional loans and bonds to newer structures like transition-linked, sustainability-linked, and use-of-proceeds bonds.

Voluntary guidance is now emerging to support this. In November 2025, the Methane Finance Working Group – launched at COP28 in 2023 – published guidance on issuing methane-related financial instruments, including use-of-proceeds bonds and key performance indicator (KPI) -linked debt. The aim is to steer capital towards methane abatement, particularly in emerging markets and national oil companies (NOCs).

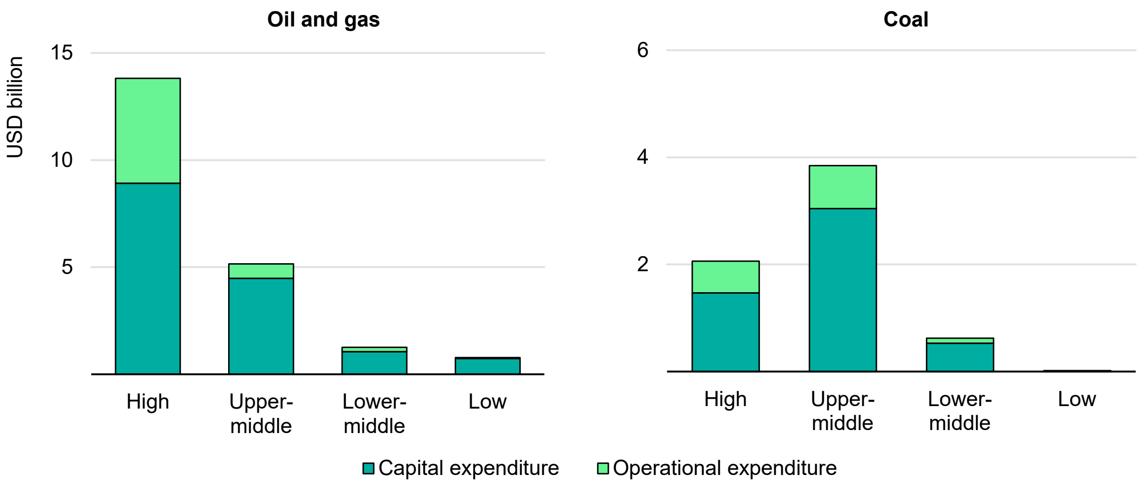
Financial tools for accelerating reduction of methane emissions

Financial mechanism	Description	Key players
Corporate profits investment	Using corporate profits derived from regular business activities to invest in methane abatement projects	Oil and gas companies
Methane-related revenue reinvestment	Using profits or cost savings derived from existing methane abatement projects (e.g. captured methane or operational efficiencies) to fund new methane abatement projects	Oil and gas companies
Methane-linked bonds and loans	Bonds and loans that tie financial outcomes to achieving methane targets (e.g. by offering lower interest rates or penalties based on performance)	Oil and gas companies, institutional investors, commercial banks, multilateral development banks
Methane "use-of-proceeds" bonds and loans	Bonds or loans under which capital raised is exclusively earmarked for specified methane abatement projects	Oil and gas companies, institutional investors, commercial banks, multilateral development banks
Vanilla bonds and loans	Conventional bonds or loans that are not specifically tied to methane emissions reduction, but are used to finance abatement projects based on traditional financial analysis	Oil and gas companies, institutional investors, commercial banks, multilateral development banks
Grants and subsidies	Non-repayable funding provided for methane abatement projects	Governments, climate funds, philanthropic foundations, multilateral development banks
Insurance and underwriting	Policies and financial products that require methane-specific criteria as a condition of coverage	Insurance companies, export-import banks

Financial sector actors (including investors, banks and insurance companies) can integrate methane abatement criteria into investment, lending and underwriting decisions. This can include setting minimum methane-intensity thresholds, requiring transparent and comparable disclosure of emissions, and pushing for verifiable reductions. Loans to oil and gas companies (both conventional and sustainability-linked) can be tied to progress on methane abatement. Insurers can likewise design policies and financial products that reward methane abatement. Some major banks have already begun to reflect methane in their engagement with the fossil fuel industry: JPMorgan Chase, HSBC and Barclays have published methane-management guidelines for their oil and gas clients.

Governments can provide funding for methane abatement projects, particularly where abatement options have net positive costs and access to capital is limited. This can include grants or loans conditional on the deployment of measures to capture and commercialise methane. Natural gas captured from flaring and venting can also be integrated into joint purchasing schemes, such as the European Union's AggregateEU platform. Funding can likewise be pooled across countries or channelled through multilateral and regional institutions, such as the World Bank's Global Flaring and Methane Reduction Partnership trust fund, which provides grants and technical assistance to governments and state-owned operators to support flaring and methane-reduction projects in the oil and gas sector.

Average annual spending to fully deploy methane abatement measures in the oil and gas and coal sectors, by income category, to 2035



One critical area where funding can be directed is access to technology in emerging market and developing economies (EMDEs). Technology access often represents a significant barrier for governments and companies in EMDEs. Public support can help finance the purchase of methane-detection equipment and low-emissions technologies, such as optical gas imaging (OGI) cameras. For some abatement measures, including leak detection and repair (LDAR), both upfront and operating costs are often lower than commonly assumed.

While governments, companies and financial institutions have a range of tools at their disposal to accelerate methane abatement, relatively few projects have so far attracted support. To scale-up financing, governments, companies, financial institutions and international organisations could work together to develop a pipeline of bankable projects, including by funding early-stage development costs for pre-feasibility studies, financial modelling and project structuring.

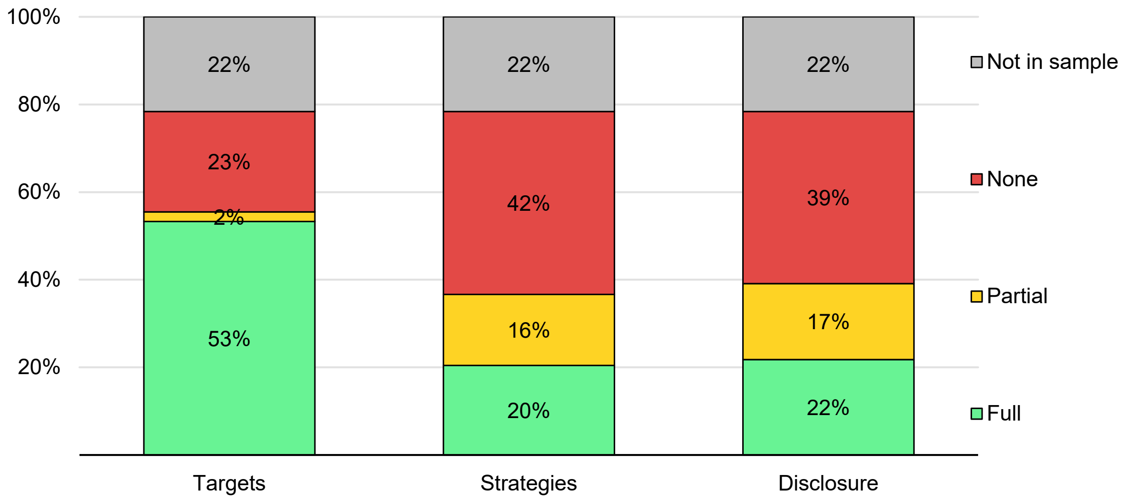
Successful implementation of a few pilot projects could help to demonstrate the viability of the concept, paving the way for wider deployment.

Increasing transparency

Accurate data is not a prerequisite for tackling methane emissions, but it is extremely valuable. It allows a governments and companies to establish a baseline – an inventory of current emissions – against which progress can be measured. Such data also helps identify the most effective abatement opportunities, along with their costs and potential savings, and also makes it possible to track progress over time.

Pledges to Progress 2025, a joint report by the International Energy Agency (IEA), the International Methane Emissions Observatory (IMEO) and the Environmental Defense Fund (EDF), assessed 116 of the largest oil and gas companies against 25 metrics tracking efforts to meet the goals of the Oil and Gas Decarbonization Charter (OGDC). It found that half of global production in 2023 came from companies with targets aligned with the charter. Yet only a third was produced by firms that have laid out strategies to meet them, and just a third was covered by disclosures sufficient to gauge progress. In short, transparency and reporting on abatement plans still lag the industry's stated ambitions.

Share of global oil and gas production covered by targets, implementation strategies and metrics for disclosure and reporting

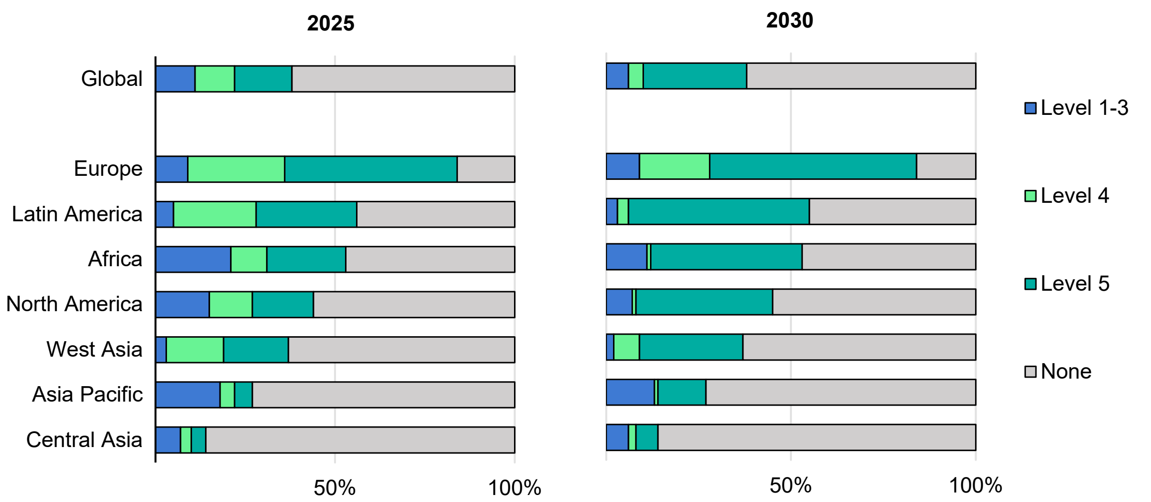


Notes: Analysis of 116 companies included in the Pledges to Progress 2025 report, including all members of the Oil and Gas Decarbonisation Charter and the 100 biggest oil and gas producers.

In 2025, about 70% of global oil and gas production was owned by operating companies; the rest was held by joint ventures and other shared holdings. For international oil companies (IOCs), roughly half of production came from such non-operated stakes. Yet most IOCs exclude these from their climate, methane and flaring targets, and few disclose Scope 1 and 2 greenhouse gas emissions separately for operated and non-operated assets. Greater company-to-company collaboration on methane and flaring will be critical for spreading best practice across the industry; joint ventures offer an important route to broader and deeper emissions cuts.

A key transparency initiative is the Oil and Gas Methane Partnership (OGMP) 2.0, the flagship reporting and mitigation initiative of the United Nations Environment Programme (UNEP). Around 40% of global oil and gas production is now covered by OGMP 2.0's five reporting levels, which range from emissions-factor estimates (Level 1) to rigorous, measurement-based reporting (Level 5). Based on current membership and implementation plans, Level 5 reporting would rise from 16% of production in 2025 to around 30% by 2030 – and higher if more companies join.

OGMP 2.0 coverage of oil and gas production, 2025 and 2030 (estimated)



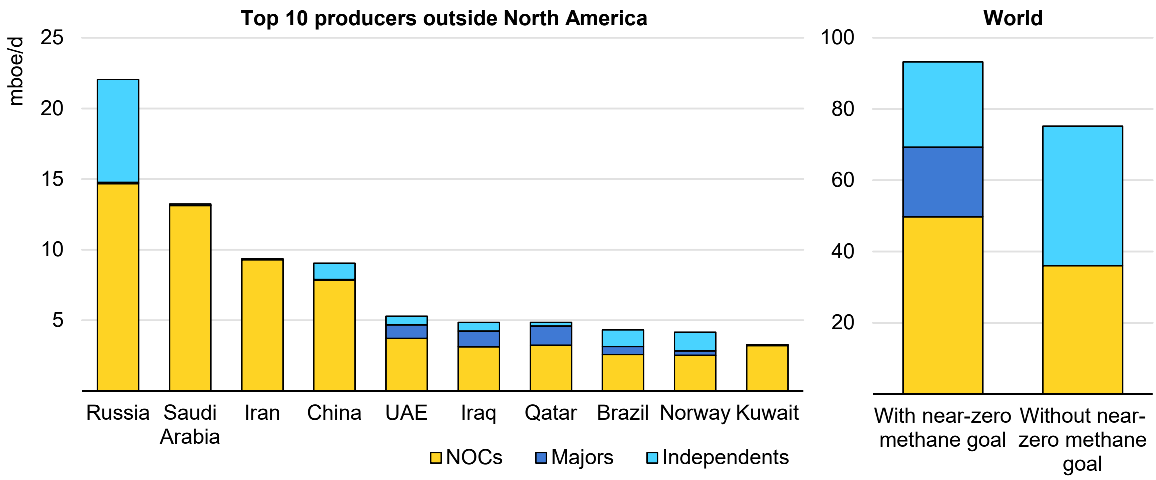
Source: Data provided by the International Methane Emissions Observatory, based on current membership and implementation plans.

Governments can strengthen transparency by incorporating detailed methane metrics into mandatory corporate disclosure regimes for both fuel producers and buyers. A standardised disclosure framework would enable better comparisons between operators and help investors and other stakeholders encourage fuel buyers to source lower-emissions fuels.

Advancing methane reductions in national oil companies

National oil companies (NOCs) accounted for half of global oil and gas production in 2025, and they have a key role to play in shaping the outlook for methane emissions. In the Middle East, NOCs produce around 80% of all oil and natural gas, led by Saudi Arabia's Aramco and the National Iranian Oil Company. These two companies produce roughly as much oil and gas as all the majors (BP, ConocoPhillips, Chevron, Eni, ExxonMobil, Shell, and TotalEnergies) combined.

Oil and gas production in selected countries and covered by methane goals, 2025



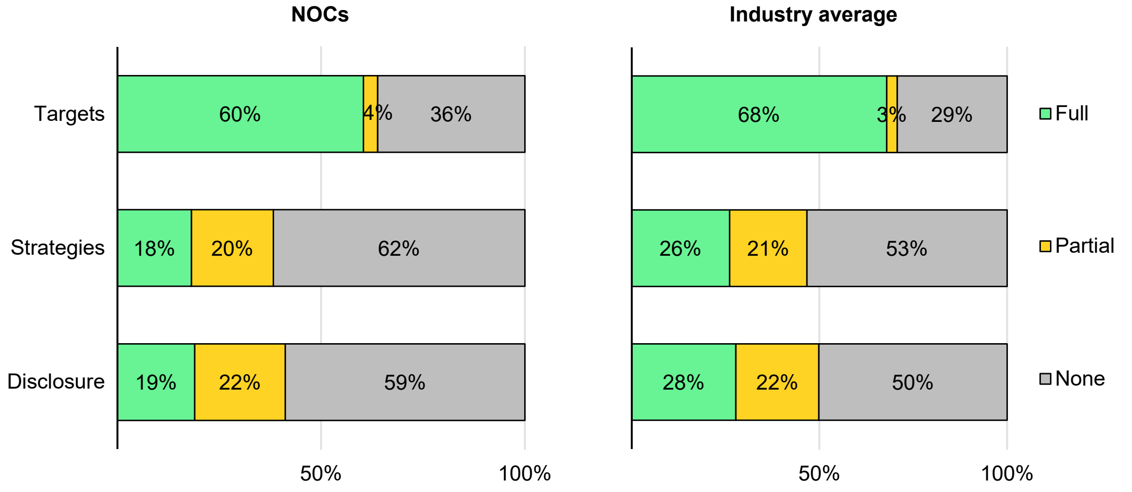
Notes: mboe/d = million barrels of oil equivalent per day. UAE = United Arab Emirates.

More than half of the oil and gas produced by NOCs comes from companies that have signed the OGDC or are members of OGMP 2.0. If these companies were to meet their near-zero methane targets, global emissions would fall by roughly 10 Mt; if all NOCs were to achieve near-zero upstream methane intensity, reductions would reach nearly 30 Mt.

In the Pledges to Progress report, NOCs were found to perform slightly below the industry average on targets, abatement strategies and disclosure. Performance on methane and flaring, however, varies widely: if all NOCs matched Saudi Aramco, for example, flaring volumes would fall by around 60 billion cubic metres (bcm), or about 90%.

NOCs have a range of options to accelerate methane emissions reductions. They can work with host governments to align priorities – coordinating major investment decisions or advocating for stricter regulatory standards. Methane management can also be embedded in operations, for example by integrating equipment upgrades into plans to revitalise aging infrastructure or by developing in-house LDAR programmes.

NOC performance on emission targets, strategies, and disclosure vs. industry average



Note: NOC = national oil company. Chart reflects analysis of 116 companies under the Pledges to Progress framework.

NOCs can also turn to industry peers and initiatives for technology sharing and support on technical, operational, and regulatory matters. For example, the Japan Organisation for Metals and Energy Security (JOGMEC) has signed arrangements with PETRONAS and Pertamina to advance collaboration on methane measurement and reduction, while TotalEnergies is partnering with Petrobras, Sonangol and SOCAR to share its drone-based detection technology. The OGDC has launched the Collaborate & Share Program to encourage peer-to-peer exchanges, foster collaboration and encourage best practices. Where access to capital is constrained, NOCs can also tap into financing opportunities such as multilateral development bank funding or sustainability-linked debt instruments.

Recent insights from methane emissions studies

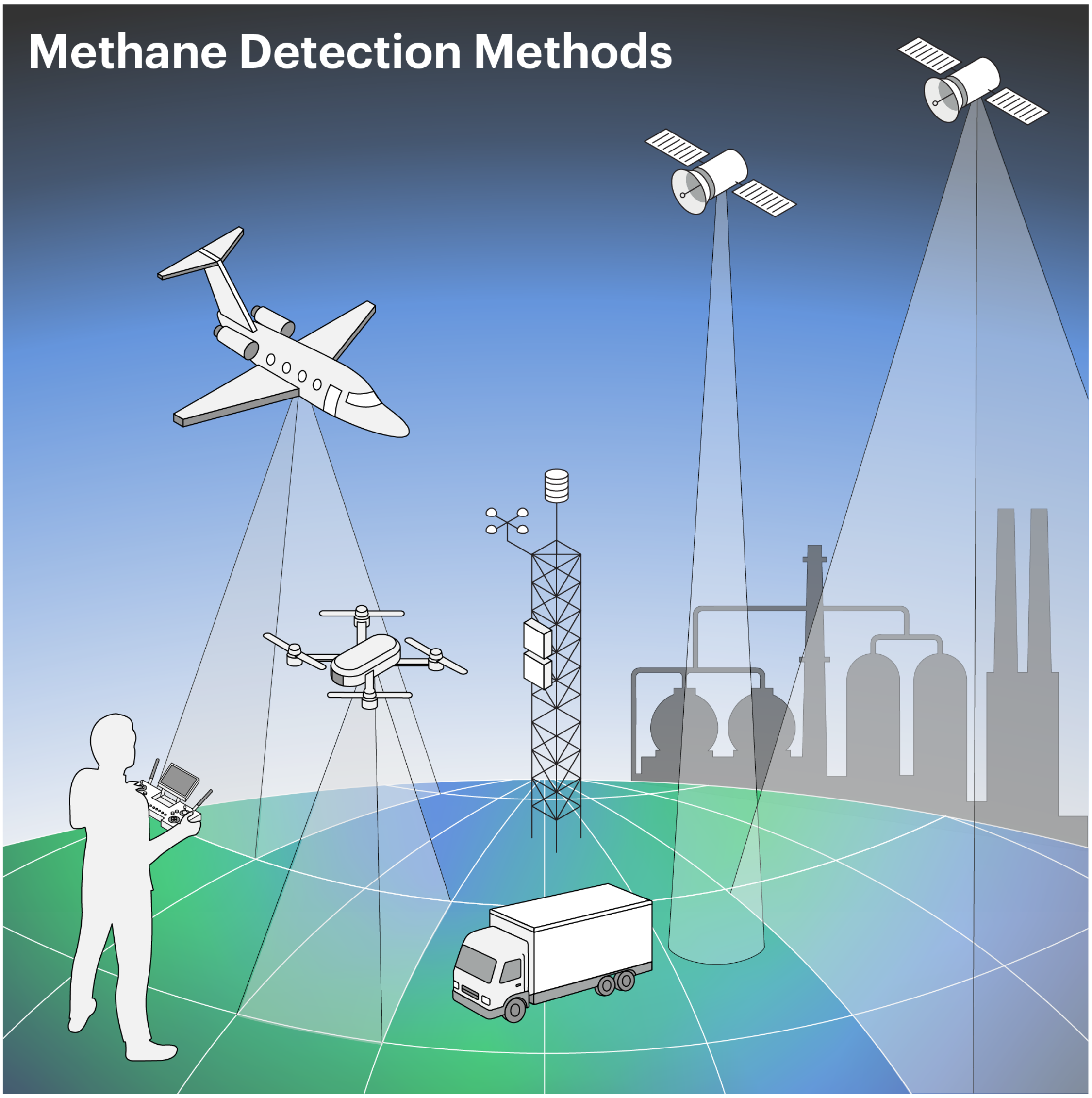
Advances in measurement and data processing

Methane detection has improved markedly in recent years by making better use of existing satellite arrays and launching new devices, improving airborne instrumentation and calibration, and deploying tower, stationary and handheld detectors more widely. Overall, detection limits have been optimised, coverage has broadened and observation times have increased. Meanwhile, advances in data processing have enhanced both the speed and the quality of analysis.

These advances yield better coverage and sharper insights into the sources and scale of methane emissions. They also confirm that effective methane management requires multi-scale measurement frameworks that combine space-based, airborne and ground-based data, explicitly account for "super-emitters" and rely on dynamic inventories that can be updated as new observations emerge. This section offers selected examples of recent progress in the field that illustrate how these approaches can be applied in different settings. Further technical details and practical applications can be pursued in consultation with practitioners.

In terms of satellite coverage, instruments such as GOSAT/GOSAT-2, Sentinel-2, and Sentinel-5P (TROPOMI) provide wide-area observations. Their coarse spatial resolution means they are best-suited to detecting elevated methane levels over broad regions. Sentinel-5P offers daily global coverage, while GOSAT/GOSAT-2 provide sampling every few days. Together, they help identify emissions hotspots on a regional scale. Sentinel-2 can detect very large concentrated plumes at finer spatial resolution. Other land-imaging satellites – notably Landsat 8/9 and WorldView-3 – and sensors such as PRISMA can contribute to methane monitoring as part of multi-purpose observation systems. Other satellite-based detection systems offer finer spatial resolution and with varying detection limits. Higher-resolution, targeted or regional-scale observations can complement coarser mappers, enabling basin-scale surveys and facility-level attribution of methane emissions. Detection methods and thresholds, quantification and processing methods, and observation times are all constantly improving.

Airborne monitoring systems offer higher spatial resolution and lower detection thresholds than satellites, enabling targeted surveys of fields and facilities. Aircraft-based mass-balance methods and imaging spectroscopy can measure and map methane emissions across areas spanning several kilometres, while operating with flexible flight plans and across a wider range of meteorological conditions. Ground-based detection technologies provide the highest sensitivity and temporal resolution for methane monitoring.



Technology family	**Typical scale covered**	**Purpose**	**Key limitations**
Global satellites	Regional	Flagging hot spot basins, long term trends, inventory checks	Miss most individual leaks; attribution is coarse only
Targeted imaging satellites	Basin to facility	Finding large super emitters at named facilities	Limited small leak sensitivity; tasking capacity finite
Aircraft mounted sensors	Basin to facility	Measuring total emissions from clusters, validating satellites	Costly and episodic; needs planning and aviation access
UAV/drones	Facility	Checking priority sites, verifying fixes, mapping plumes	Weather, airspace rules, battery limits
Ground-based tower	Field to facility	Quantify methane fluxes and high temporal precision	Placement constraints; overlapping sources
Mobile labs (vehicles)	Facility	Estimating source strengths along roads, checking networks	Limited off road reach; depends on road access and traffic
Handheld and on site instruments	Components	Pinpointing leaks, confirming repair, compliance checks	Very local; needs trained staff on the ground

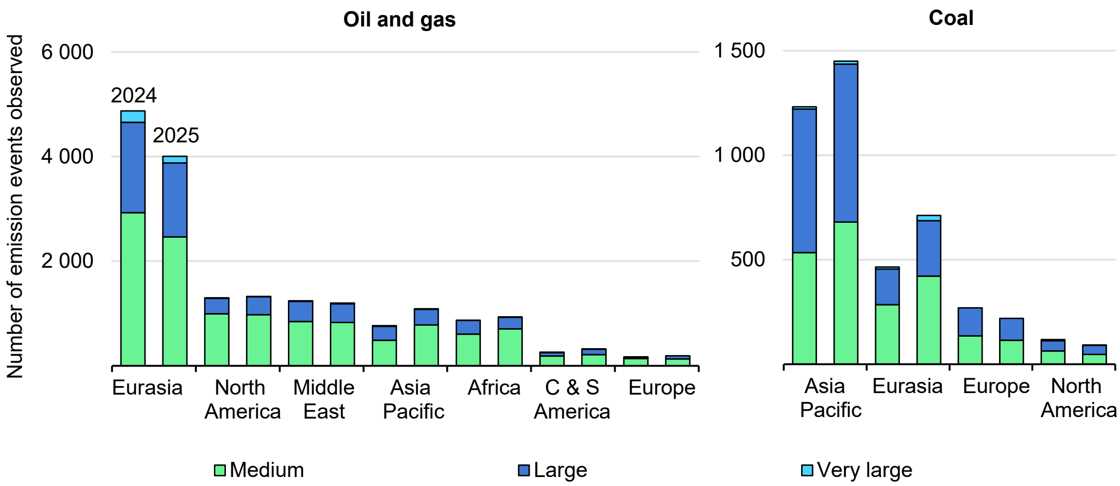
Satellite-derived estimates are providing an ever more detailed picture of methane emissions

MethaneSAT data continues to yield insights as survey results are processed and released, despite the satellite's failure about a year after launch. The system measures methane concentrations and uses these observations to estimate annual emission rates.

MethaneSAT provided readings used to estimate emissions from around 23 basins across 16 countries during its year of operation, covering roughly a third of global oil and gas production. The data reveal a wide range in emissions intensity both between and within countries. The highest emissions intensities were observed in the South Caspian basin, while operations in the Widyan basin (Kuwait and Saudi Arabia) were among the least emissions-intensive.

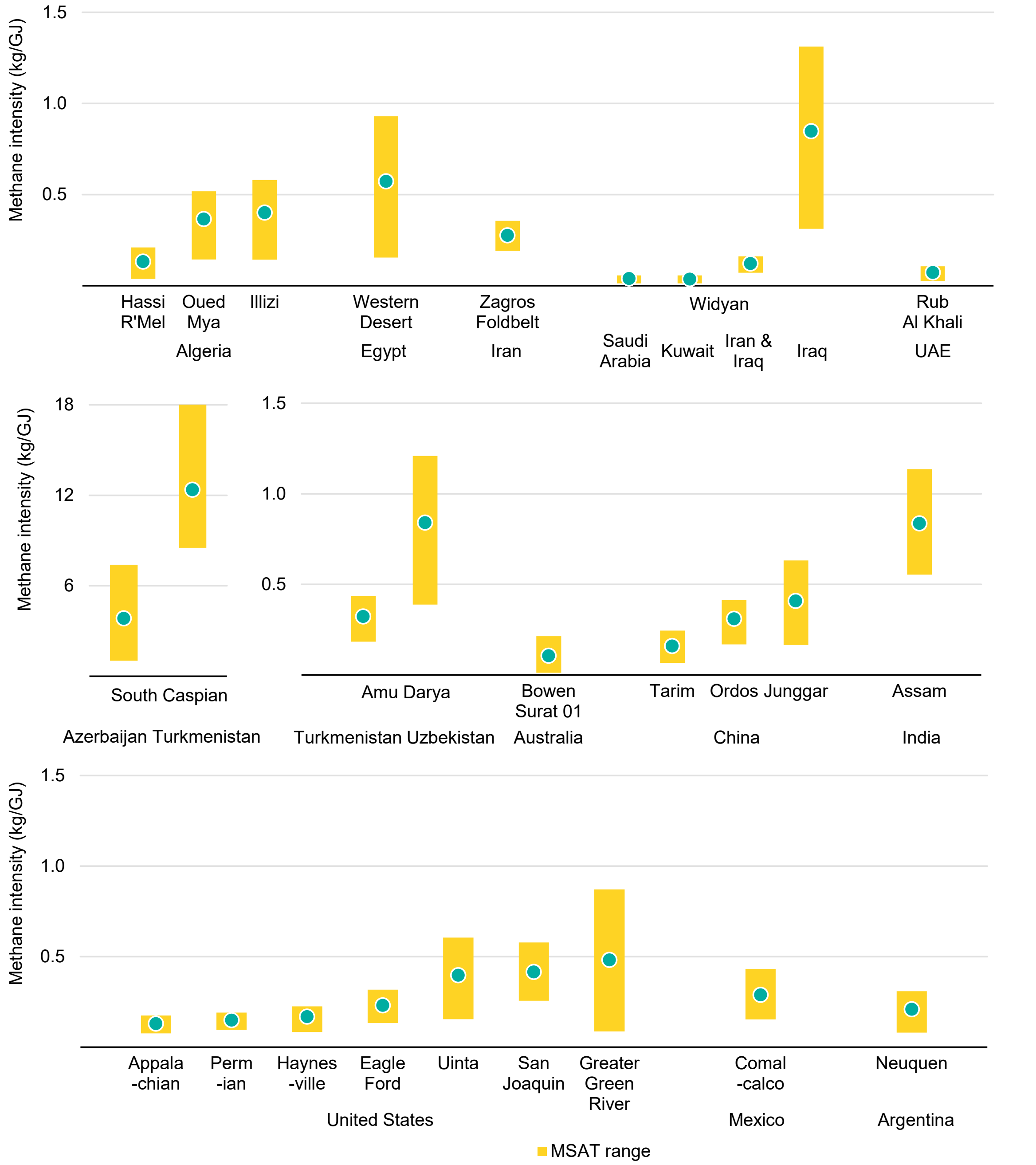
The GHGSat constellation – now comprising 14 satellites that are specifically tasked to observe a given location – has attributed 8.3 million tonnes (Mt) of methane emissions globally to more than 3 000 oil, gas and coal sites. In one study, coal sites were found to be emitting 47% of the time, compared with about 15% for oil and gas sites. This suggests that emissions from coal sites tend to be more persistent and therefore more predictable, whereas those from oil and gas facilities are more intermittent.

Emissions events detected by the GHGSat constellation, 2024 and 2025



Notes: Medium = 0.1-1 tonnes/hr; Large = 1-10 tonnes/hr; Very large = >10 tonnes/hr.

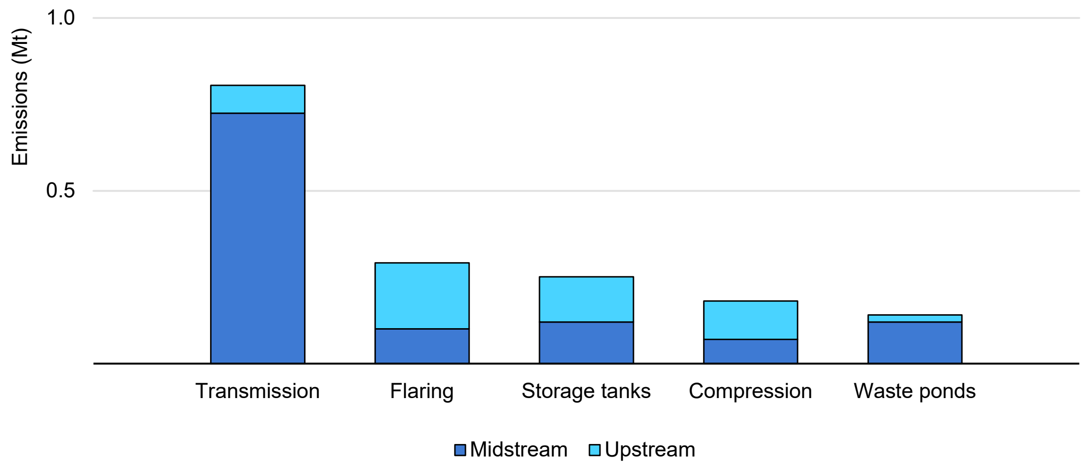
Methane emissions intensities by basin, 2025



Notes: kg/GJ = kilogrammes per gigajoule. UAE = United Arab Emirates. Iran & Iraq = measurements attributable to both countries across this area of the basin.
Source: IEA analysis of MethaneSAT data.

Satellite observations from the Tanager-1 satellite, launched in 2024, and attribution analysis by Carbon Mapper have also provided new insights into persistent sources of emissions. Tanager-1 has a 90% probability of detecting emissions above about 100 kilograms kg/hr depending on conditions, and between August 2024 and January 2026, it identified around 200 highly persistent upstream and midstream oil and gas sources across 56 areas in 18 countries. Pipeline leaks accounted for almost 40% of these persistent emissions, followed by flaring and leaks from storage tanks in both upstream and midstream facilities.

Upstream and midstream emissions inferred from Tanager-1 plume observations, 2025



Notes: Mt = million tonnes. Upstream includes wellsite, well and field pads, and gas processing plants. Midstream includes pipelines not associated with a facility (typically gathering or flow lines), compressor stations and oil storage facilities.
Source: Carbon Mapper.

Satellite data is increasingly being used to improve monitoring of country-specific emissions trends and inventories. For example, the Integrated Methane Inversion (IMI) system uses processed data from the Tropospheric Monitoring Instrument (TROPOMI) to estimate total emissions in 25 x 25 km grid cells. In China, TROPOMI observations have been used to build a complete top-down dataset of methane emissions, identifying the locations of energy-related super-emitters and capturing reductions linked to improved coal mine methane management. In Turkmenistan, observations from Italy's PRISMA mission and China's GF-5B, ZY-1E, ZY-1F satellites – supported by independent confirmation from Sentinel-2 and Landsat – suggest that methane emissions rose by around 7% a year between 2020 and 2023, broadly in line with growth in natural gas production. This implies little change in the emissions intensity of production over the period. However, incorporating tools capable of detecting smaller emissions than those captured in this analysis would provide a more complete picture of overall emissions and how they evolve over time.

Integrating maturing airborne tools with ground-based measurements is central to effective MMRV

No single technology can reliably detect the full range of emissions from oil and gas operations. As with the different types of satellites described above, airborne and ground-based systems capture different parts of the methane emissions spectrum. Recent advances in imaging spectroscopy, mass-flux quantification and autonomous platforms now allow for more accurate estimation of emissions and better identification of their sources.

MethaneAIR is an aircraft-based methane monitoring system that uses the same instrument technology as MethaneSAT but mounted on planes rather than a satellite, allowing observations at different spatial scales. It measures emissions from both dispersed and point sources and provides estimates of regional methane flux. Data from more than 30 flights conducted between June and October 2023 across 12 oil and gas basins – covering about 70% of onshore oil and gas production in the United States (excluding Alaska) – were used to estimate basin-level methane emissions. The results suggest that these regions emitted close to 8 Mt of methane, providing a baseline for future mitigation efforts.

Another airborne instrument that has provided important observations is the Global Airborne Observatory, which is equipped with an Airborne Taxonomic Mapping System (AToMS) that includes integrated spectrometers, as well as Light Detection and Ranging (LiDAR) and digital imaging instruments. One recent study of the Permian Basin in the US state of New Mexico detected more than 500 methane super-emission events from around 300 repeatedly observed sources over multiple days. These events released between six and 15 kilotonnes (kt) of methane, with super-emitters estimated to account for roughly 50% of total basin emissions (with a range of 37% to 73%).

Unmanned aerial vehicles (UAVs), including Autonomous Uncrewed Small Unmanned Aircraft (AUSUA) class drones, can also provide complementary data to satellite and crewed aircraft. A number of field studies have shown that small UAV platforms can be deployed rapidly and flown at lower altitudes over emissions sources. For example, when equipped with different spectroscopy tools, AUSUA systems can provide monitoring and plume characterisation. Recent field validations have quickly improved the use of these tools, including deploying swarms of UAVs to reconstruct methane plumes in three-dimensions (3D). They are also being used alongside open-path systems to test optimal methods and account for background emissions.

At facility and component level, static and handheld tools such as flux towers, optical gas imagers (OGI) and fixed sensors are increasingly being deployed, with detection limits ranging from 0.1 to 5 000 kg/hr. Handheld OGI cameras are particularly effective at locating specific leak points across complex well-pad topographies, and the industry is increasingly exploring integrated portable systems that combine spatial detection with direct measurement of emission rates. Open-path and other ground-based approaches, including the wider testing and deployment of handheld OGI cameras, have also become more common.

A 2025 single-blind controlled evaluation of 12 survey technologies confirmed that traditional OGI cameras can reliably identify and precisely locate small component-level emission sources. However, standard OGI systems produce qualitative visualisations rather than quantitative estimates of emission rates (kg/h). To address this, a recent study validated a human-portable mass flux method using a backpack-mounted trace gas analyser capable of quantifying very low controlled releases (below 6 kg/hr).

While routine surveys can help reduce small component leaks, they may miss larger combustion and venting sources. This measurement gap has led to growing interest in combining high-resolution handheld OGI with portable mass flux instruments or macro-scale aerial systems to produce more comprehensive site-level inventories.

Separately, a study using a fixed-point continuous monitoring system across 940 upstream oil and gas facilities in seven basins across the United States found that 80–90% of estimated methane mass is emitted at rates below 100 kg/hr, while super-emitter events account for only 10-20% of total emissions over the study period. This highlights the importance of combining different measurement approaches to fully capture and attribute cumulative emissions.

In a recent controlled release study, methane was emitted at known metered rates across five different sites. Satellite, airborne, drone, and ground-based technologies were then used to detect and quantify the releases, allowing direct comparison across methods. The results showed differences of up to an order of magnitude, highlighting how both operating conditions and sensor type can lead influence results. Another controlled release campaign similarly found significant variation in performance across detection systems under different conditions and emissions rates.

Together, these studies are helping to shape fit-for-purpose monitoring and mitigation strategies. Methane emissions vary widely across sites and scales, and only by comparing and combining measurements from multiple sources can we begin to identify broader patterns and build more reliable predictive tools. Integrating orbital, airborne and ground-based measurements – and controlled release studies – improve both geographic and temporal understanding, but emissions estimates remain incomplete, constrained by limited sampling and processing capacity. A key challenge is to determine the spatial and temporal observational resolution required to accurately characterise both all types of emissions.

Regional insights

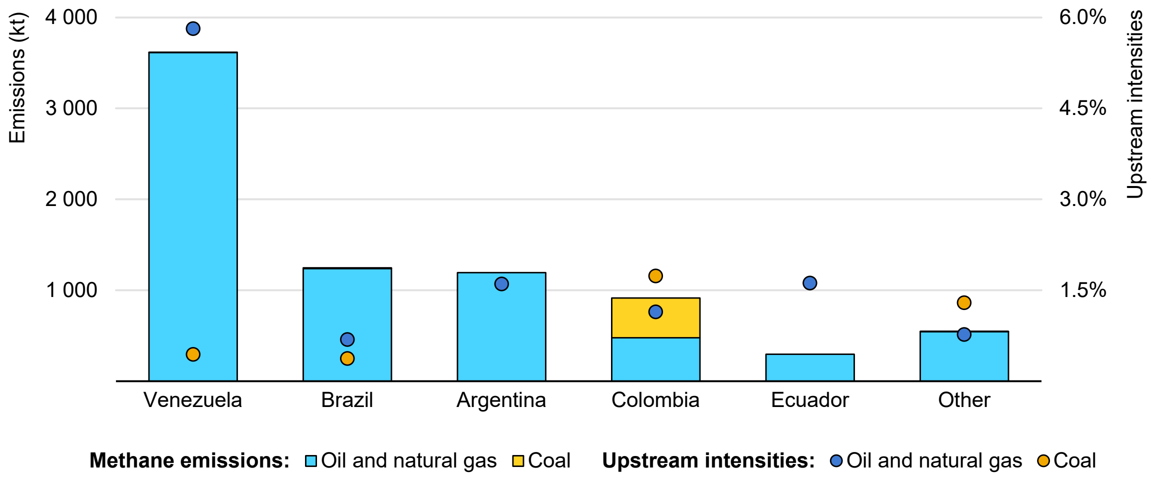
Central and South America

The fossil fuel sector in Central and South America emitted just under 8 million tonnes (Mt) of methane in 2025, around half of which was from oil and gas facilities in Venezuela. Oil and gas facilities are the main sources of methane emissions in Venezuela, Argentina and Brazil, whereas in Colombia emissions are split roughly evenly between coal mining and oil and gas activities. In Venezuela, the upstream methane emissions intensity of oil and gas operations is nearly six times the global average, and flaring intensity is around 12 times higher. The intensities of operations in Argentina and Ecuador are around twice the global average, while Colombia sits slightly above and Brazil performs slightly below.

Measurement data is limited across Central and South America, reflecting the fact that much of the region's oil and gas production is located offshore or in areas with persistent cloud cover, where satellite monitoring is challenging. Several recent initiatives aim to address these gaps. Direct measurements of gas cooking stoves have revealed emissions far above the default level set by the Intergovernmental Panel on Climate Change (IPCC). Meanwhile, work integrating satellite observations with Colombia's national methane inventory has identified underreporting in the energy sector and offers a model for improving national inventories. The United Nations Environment Programme's International Methane Emissions Observatory (IMEO) is currently conducting a study on the sources of methane emissions in Colombia and the Climate and Clean Air Coalition (CCAC) is supporting efforts to strengthen monitoring, reporting and verification in that country's mining sector.

All of the region's major energy producers have signed the Global Methane Pledge, except for Venezuela. Colombia is the only country with an explicit strategy for reducing methane emissions as well as regulations to limit emissions from oil and gas operations. These include explicit technology standards and restrictions on flaring and venting, as well as a requirement for biannual leak detection and repair (LDAR). Brazil is developing regulations to reduce methane emissions from the oil and gas sector, expected by 2026. In its updated Nationally Determined Contribution (NDC), Chile has set a target to reduce methane emissions by 10% by 2035, relative to an expected peak in 2025. At the subnational level in Argentina, the province of Chubut prohibits methane venting and has established monitoring, measurement, reporting and verification (MMRV) and LDAR requirements. The province of Neuquén has also established a greenhouse gas (GHG) monitoring and mitigation programme for the hydrocarbon sector that mandates emissions reporting, with a view to developing future regulations. Argentina, Brazil and Colombia have also designated points of contact to receive notifications from the IMEO's Methane Alert and Response System (MARS), including seven subnational contact points in Argentina. All the region's major producers also participate in the Latin American and Caribbean Methane Emissions Observatory (OEMLAC), which promotes a coordinated approach to reducing methane emissions.

Methane emissions from fossil fuel operations in Central and South America, 2025



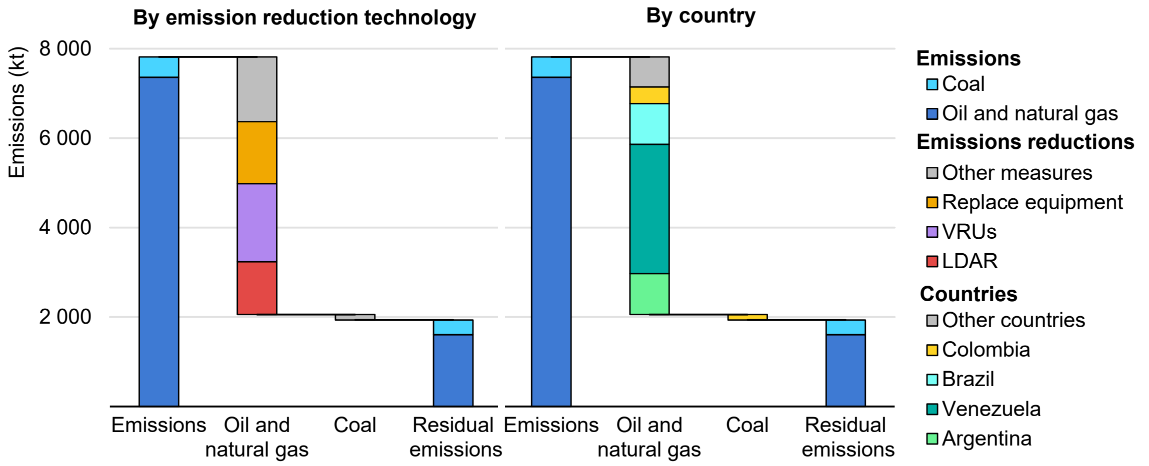
Notes: kt = kilotonnes. Other includes Bolivia, Chile, Cuba, Guyana, Paraguay, Peru, Trinidad and Tobago, Uruguay and Caribbean Island States. Methane intensity is calculated in energy terms as emissions from upstream operations divided by marketed fuel production volume, assuming methane has an energy density of 55 megajoules per kilogram (MJ/kg).
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

Many national oil companies (NOCs) in the region participate in the Oil and Gas Decarbonisation Charter (OGDC) or the Oil and Gas Methane Partnership (OGMP 2.0), including Petrobras (Brazil), ENAP (Chile), Ecopetrol (Colombia) and EP Petroecuador (Ecuador).

Argentina, Brazil and Ecuador have policies to restrict flaring, although these have had mixed success. From 2015 to 2025, flared volumes plateaued in Brazil, but they increased by 70% in Ecuador and more than tripled in Argentina. Stopping all non-emergency flaring and venting is the single-most effective policy measure for reducing methane emissions in the oil and gas sector. Many uses exist for gas that is currently flared, including: distribution to consumers via existing networks, or as compressed natural gas (CNG) or liquefied natural gas (LNG); power generation near oil and gas sites and/or fuel for on-site heating at plants; and reinjection to maintain reservoir pressure.

Under stated policies, methane emissions in Central and South America would decline by around 15% by 2030, and by more than 30% by 2035. Applying currently available methane abatement technologies today would lower emissions by 75%, with around half of these reductions coming from the oil and gas sector in Venezuela. Almost 70% of these emissions reductions could be achieved at no net cost to producers.

Methane emissions abatement potential in Central and South America, 2025



Notes: kt = kilotonnes. LDAR = leak detection and repair. VRU = vapour recovery unit. Other measures includes improved flaring, blowdown capture, associated gas utilisation, and monitoring and plugging of abandoned wells. Other countries include Bolivia, Chile, Cuba, Ecuador, Guyana, Paraguay, Peru, Trinidad and Tobago, Uruguay and Caribbean Island States.

China

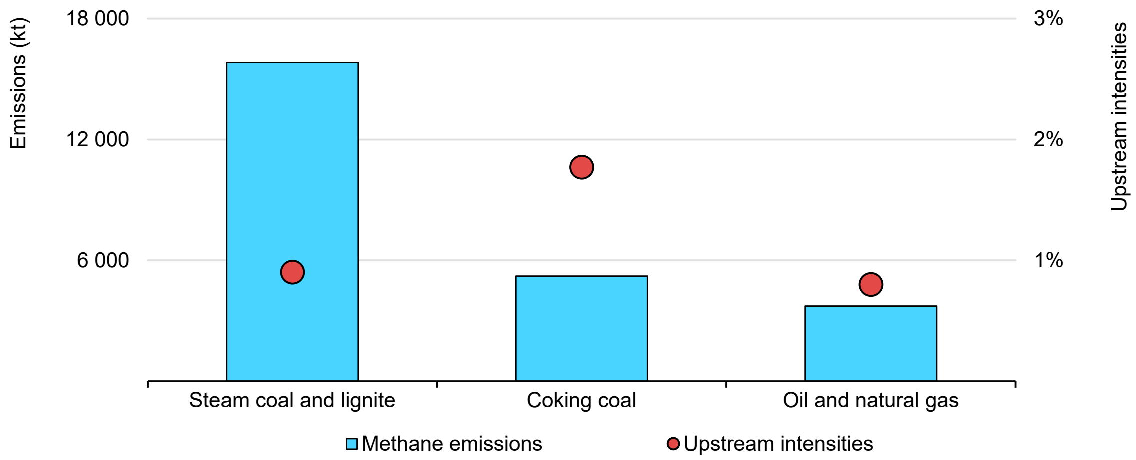
China is the world's largest emitter of methane, with coal mines accounting for most energy-sector emissions. China produces and consumes around half the global supply of coal. While energy demand and fossil fuel production have risen in tandem, methane emissions have risen at a slower pace and even decreased slightly from 2024 to 2025. In 2025, the fossil fuel sector in China emitted just over 25 million tonnes (Mt) of methane, of which almost 22 Mt came from coal mines (including abandoned underground mines that can continue emitting methane for years after closure).

Oil and gas operations in China have a lower upstream methane intensity than the global average, and its coal mines also perform better than average. Deep mines that produce coking coal are linked to higher intensities and present key opportunities for abatement.

China is also the world's largest individual importer of oil, gas and coal, with annual methane emissions from these imports estimated to be around 11 Mt. Of these, 40% are linked to imports of crude oil from Russia, Venezuela and the Middle East.

China does not participate in the Global Methane Pledge, but it has an action plan to cut methane emissions. This includes a target of 6 billion cubic metres (bcm) of coal mine gas use annually and prioritises methane recovery in the oil and gas sector through measures such as leak detection and repair requirements (LDAR), and limits on flaring. China's action plan also emphasises methane monitoring, reporting and verification systems. China's latest Nationally Determined Contribution (NDC) identifies improved coal mine gas utilisation as a measure to support its economy-wide target of reducing net greenhouse gas emissions 7-10% below peak levels by 2035.

Methane emissions from the fossil fuel sector in China, 2025



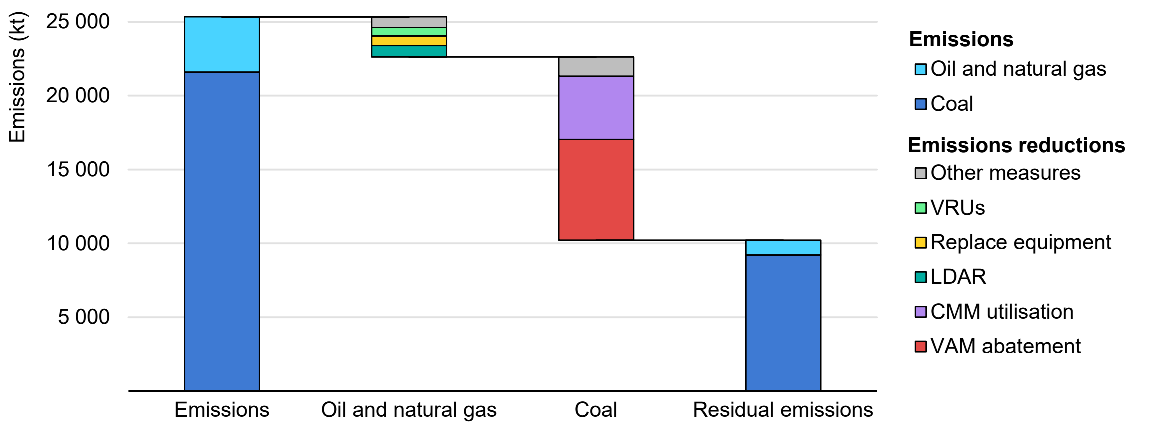
Notes: kt = kilotonnes. Methane intensity is calculated in energy terms as emissions from upstream operations divided by marketed fuel production volume, assuming methane has an energy density of 55 megajoules per kilogram (MJ/kg).
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

China has introduced several policies and regulations for controlling methane emissions from fossil fuels. The Ministry of Ecology and Environment has strengthened the coal mine methane emissions standard, requiring utilisation of gas with methane concentrations of 8% or more (down from 30% previously) and extraction volumes above 10 cubic metres per minute. Oil and gas operators are subject to limits on flaring and venting.

PetroChina participates in the Oil and Gas Decarbonization Charter (OGDC), and China Gas Holdings Limited is a member of the Oil and Gas Methane Partnership (OGMP) 2.0. Several Chinese oil and gas companies have also set up a Methane Control Alliance to promote the sharing of technology and expertise to reduce emissions.

Under stated policies, methane emissions in China would fall by 10% by 2030, and by more than 20% by 2035. Applying currently available methane abatement technologies today would lower emissions by more than 50%, mainly from the coal sector. More than 90% of the emissions reductions in the oil and gas sector could be achieved at no net cost to producers, compared with about 30% in the coal sector.

Methane emissions abatement potential in China, 2025



Notes: kt = kilotonnes. LDAR = leak detection and repair. VRU = vapour recovery unit. CMM = coal mine methane. VAM = ventilation air methane. Other measures includes improved flaring, blowdown capture, associated gas utilisation, and monitoring and plugging of abandoned wells.

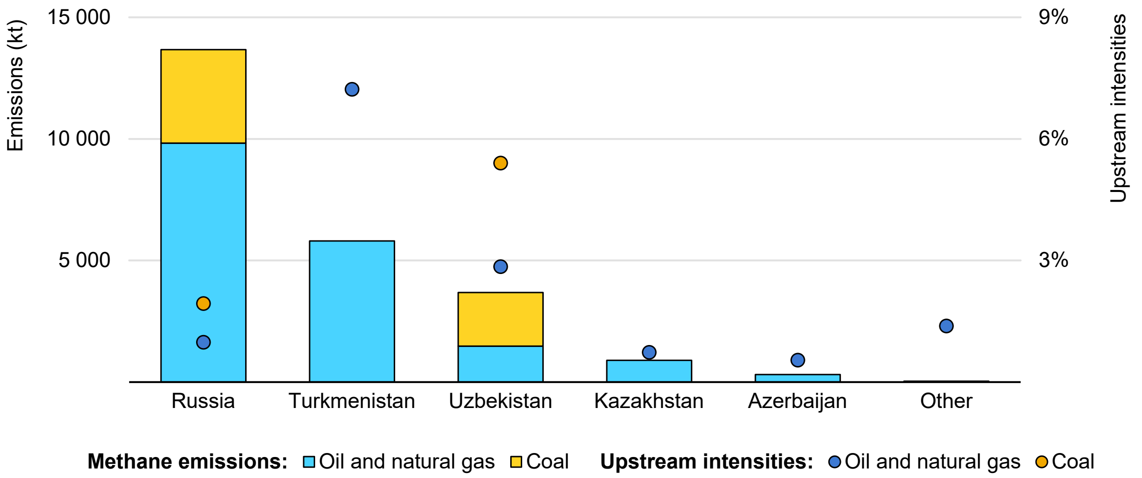
Eurasia

The fossil fuel sector in the Eurasian region was responsible for more than 24 million tonnes (Mt) of methane emissions in 2025. Around 60% of these emissions originated in Russia, where the oil and gas sector released just under 10 Mt and coal mines nearly 4 Mt of methane.

Upstream methane intensities for oil and gas are high in several countries, with Turkmenistan having one of the highest intensities in the world, on par with Venezuela. Methane intensity in Azerbaijan is near the global average, while Kazakhstan is the only producer in the region with below-average intensity. Emissions events large enough to be detected by satellites are common in Turkmenistan, representing more than a third of all oil- and gas-related observations from the Methane Alert and Response System (MARS). While satellite coverage of Russia is very limited – due to ice, snow and prolonged periods of limited daylight – 256 methane plumes were observed over its territory in 2025.

All major emitters in Eurasia participate in the Zero Routine Flaring by 2030 Initiative. Russia is the only producer that is not part of the Global Methane Pledge. In the latest Nationally Determined Contribution (NDC) submissions, Kazakhstan has set a target to reduce fugitive methane emissions from the energy and waste sector by 42% by 2035, while Uzbekistan has committed to reduce methane emissions by 30% by 2030. In addition, Russia, Kazakhstan, Uzbekistan, Azerbaijan and Armenia have identified at least some measures to mitigate methane emissions in their NDCs. Azerbaijan's NDC highlights the implementation of leak detection and repair (LDAR) and technological upgrades to reduce emissions. Kazakhstan's NDC also identifies LDAR programmes as well as a requirement for 98% flaring efficiency.

Methane emissions from the fossil fuel sector in Eurasia, 2025



Notes: kt = kilotonnes. Other includes Armenia, Georgia, Kyrgyzstan and Tajikistan. Methane intensity is calculated in energy terms as emissions from upstream operations divided by marketed fuel production volume, assuming methane has an energy density of 55 megajoules per kilogram (MJ/kg).
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

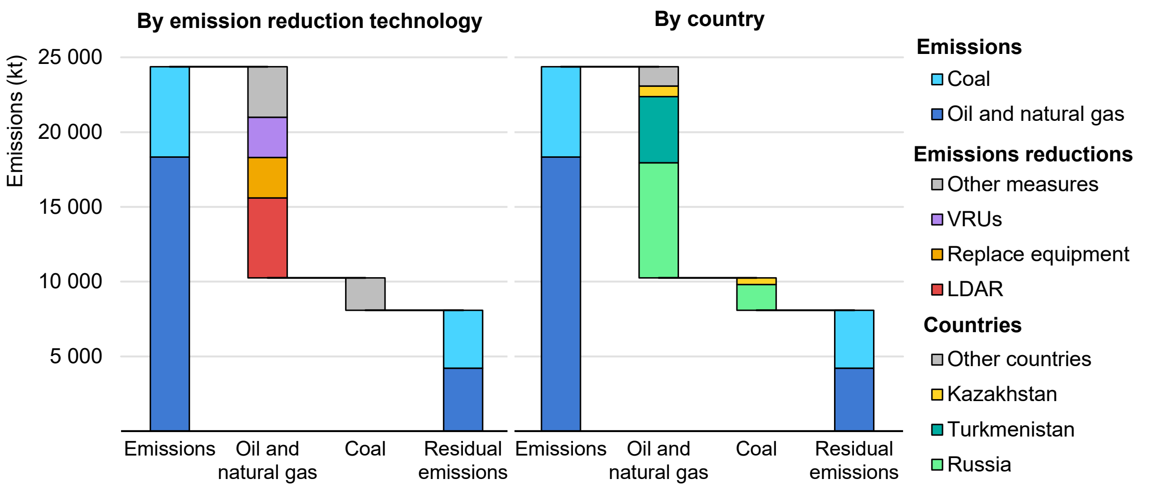
Few countries in Eurasia directly regulate methane emissions from the fossil fuel industry. Russia and Kazakhstan impose financial penalties on methane emitters, but these are quite low and exemptions apply. The Fossil Fuel Regulatory Programme (FFRP) is supporting Kazakhstan in the development of regulations that include LDAR, equipment standards and a framework for monitoring, reporting and verification (MRV).

Many national oil companies from the region participate in the Oil and Gas Decarbonisation Charter (OGDC) or the Oil and Gas Methane Partnership (OGMP) 2.0, including SOCAR (Azerbaijan), KazMunayGas (Kazakhstan) and Uzbekneftegaz (Uzbekistan).

Around 40% of Eurasia's methane emissions from oil and gas in 2025 could have been avoided through measures that would have ultimately paid for themselves. Leak detection and repair (LDAR) is the single-most effective measure for reducing fossil fuel methane in the region and it is highly cost-effective: 80% of the emissions savings from LDAR would have come at no net cost to operators. This includes abatement related to rapid-response systems for addressing large emissions events detected by satellite.

Under stated policies, methane emissions in Eurasia would fall by 15% by 2030, and by 20% by 2035. Applying currently available methane abatement technologies today would lower total emissions by almost 70%, mainly from the oil and gas sector in Russia, and almost half of those reductions could be achieved at no net cost to producers.

Methane emissions abatement potential in Eurasia, 2025



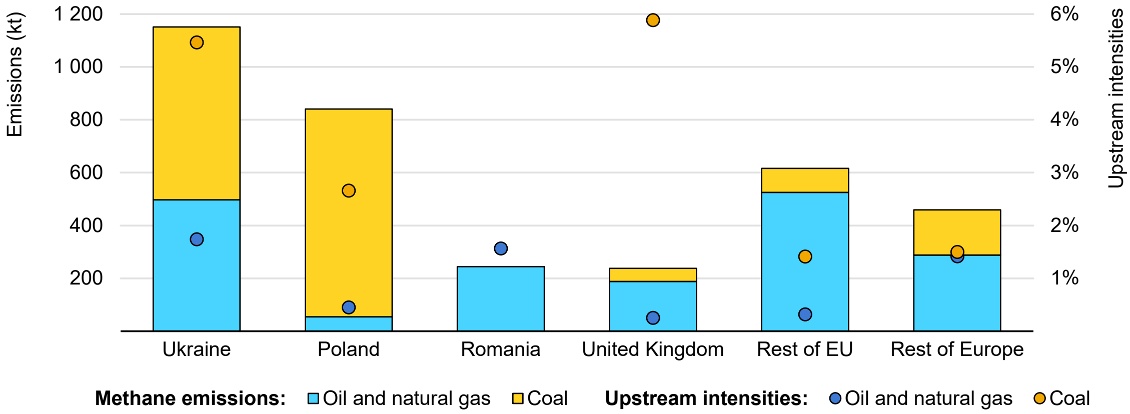
Notes: kt = kilotonnes. LDAR = leak detection and repair. VRU = vapour recovery unit. Other measures includes improved flaring, blowdown capture, associated gas utilisation, and monitoring and plugging of abandoned wells. Other countries includes Armenia, Azerbaijan, Georgia, Kyrgyzstan, Tajikistan and Uzbekistan.

Europe

Most of the methane emissions from fossil fuels used in Europe are tied to imports. In 2025, methane emissions from the supply chain for oil, gas and coal imports are estimated to be around 7 million tonnes (Mt), almost double those from Europe's domestic fossil fuel sector.

Around 50% of the fossil fuel methane emissions that occur within Europe come from the oil and gas sector, mostly from downstream operations, while the remainder originates from coal mines, primarily in Poland and Ukraine. Upstream oil and gas operations are the main source of emissions in the United Kingdom and Romania, while abandoned facilities account for almost a quarter of oil and gas emissions in Romania. Norway and the Netherlands have the lowest upstream intensities in the world, while most other countries in the region perform near the global average.

Methane emissions from the fossil fuel sector in Europe, 2025



Notes: kt = kilotonnes. Rest of EU includes Czechia, Denmark, Germany, Italy, The Netherlands and other European Union members. Rest of Europe includes Albania, Belarus, Bosnia and Herzegovina, Gibraltar, Greenland, Iceland, Israel[4], Kosovo, Montenegro, North Macedonia, Norway, Republic of Moldova, Serbia, Türkiye and the United Kingdom. Methane intensity is calculated in energy terms as emissions from upstream operations divided by marketed fuel production volume, assuming methane has an energy density of 55 megajoules per kilogram (MJ/kg).

Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

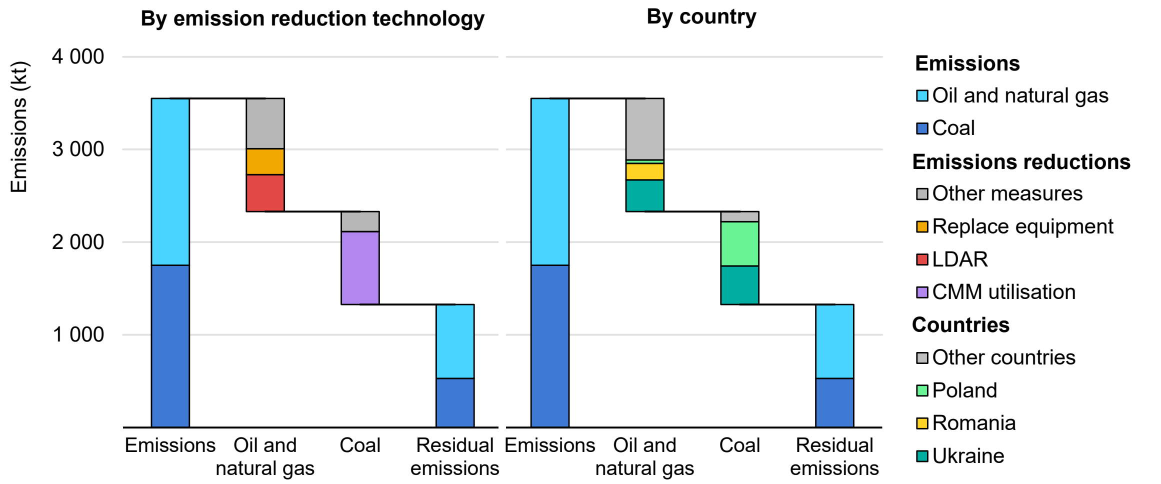
All major producers in Europe have signed the Global Methane Pledge. Starting in 2025, certain provisions of the European Union Methane Regulation began to take effect, including requirements pertaining to mandatory monitoring and reporting of source-level emissions, establishment of leak detection and repair (LDAR) programmes, and restrictions on venting and flaring. As of 5 August 2025, EU Member States are required to establish rules on penalties for non-compliance under the regulation. However, few Member States have set up penalty regimes to date. They are also required to publish an inventory of inactive, plugged and abandoned wells. As of May 2025, importers of oil, gas and coal into the European Union are also required to provide qualitative information on the origin and transport route of imported products, as well as on the application of monitoring, measurement, reporting and verification (MMRV), LDAR and other measures to control methane emissions. EU energy ministers have endorsed certification and trace-and-claim approaches as viable means of demonstrating compliance with upcoming import requirements. Guidance to support compliance by importers and producers in non-EU countries has also been published.

In 2024, the European Union also announced a Methane Abatement Partnership Roadmap, with a blueprint for cooperation between fossil fuel importing and exporting countries aimed at reducing methane emissions.

[4] The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Under stated policies, methane emissions in Europe would fall by 30% by 2030, and by more than 40% by 2035. Applying currently available methane abatement technologies today would lower emissions by more than 60%, of which around 40% could be achieved at no net cost to producers. Coal mine methane utilisation in Poland and Ukraine alone accounts for almost 35% of the potential reductions.

Methane emissions abatement potential in Europe, 2025



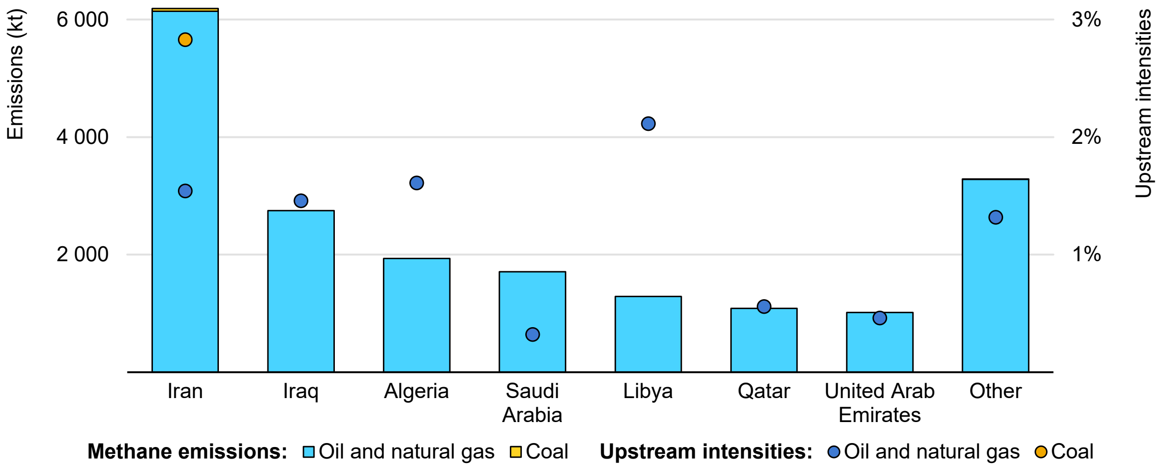
Notes: kt = kilotonnes. LDAR = leak detection and repair. VRU = vapour recovery unit. Other measures includes improved flaring, blowdown capture, associated gas utilisation, and monitoring and plugging of abandoned wells. Other countries include other European Union members, Albania, Belarus, Bosnia and Herzegovina, Gibraltar, Greenland, Iceland, Israel, Kosovo, Montenegro, North Macedonia, Norway, Republic of Moldova, Serbia, Türkiye and the United Kingdom.

Middle East and North Africa

Fossil fuel operations in the Middle East and North Africa emitted around 20 million tonnes (Mt) of methane in 2025, almost all of it from oil and gas activity. Flaring is a leading source of emissions, accounting for just under a quarter of the total. Performance varies widely: upstream methane intensities in Libya, Algeria and Iran are three to five times higher than Saudi Arabia, Qatar and the United Arab Emirates – all of which perform better than the global industry average.

Emissions events large enough to be detectable by satellite are common in the Middle East and North Africa, representing almost 40% of observations linked to oil and gas by the Methane Alert and Response System (MARS). The region's geography, with minimal cloud cover and open landscapes, ensures good satellite coverage. In 2025, satellites detected more than 730 emission events linked to oil and gas in Iran, around 630 in Algeria, and more than 80 in Egypt. A satellite campaign supported by the Oil and Gas Climate Initiative (OGCI) with data from GHGSat studied 12 facilities and found that incomplete combustion from burning pits was the main source of emissions in Algeria and Egypt, followed by gas lift system vents and equipment venting. A previous campaign in Iraq found flaring and direct venting as major sources.

Methane emissions from the oil and gas sector in the Middle East and North Africa, 2025



Notes: kt = kilotonnes. Other includes Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Tunisia, Syria, and Yemen. Methane intensity is calculated in energy terms as emissions from upstream operations divided by marketed fuel production volume, assuming methane has an energy density of 55 megajoules per kilogram (MJ/kg).
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

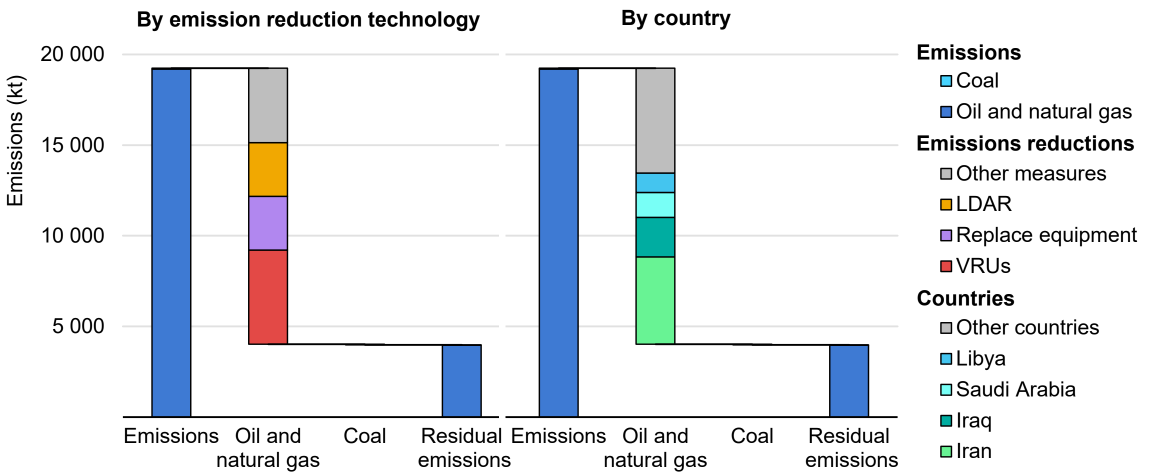
All countries in the region participate in the Global Methane Pledge except for Algeria, Iran and Syria. Many also take part in the Zero Routine Flaring by 2030 Initiative. However, fewer countries have developed regulations focused on limiting oil and gas methane emissions. In its latest Nationally Determined Contribution (NDC), Qatar has defined a target to achieve near-zero methane emissions across all assets in the oil and gas sector, including by mandating Oil and Gas Methane Partnership (OGMP) 2.0 reporting and leak detection and repair (LDAR) programmes. Qatar also has technology standards, as does Kuwait, which also requires LDAR in the upstream sector. The NDCs of Saudi Arabia and the United Arab Emirates also include measures on methane abatement. Egypt and Iraq have announced that they are currently working on developing new regulations. Egypt is also preparing a roadmap for reducing methane emissions. In 2025, Jordan and Libya also designated points of contact for receiving notifications of large emissions from the International Methane Emissions Observatory's MARS programme, joining Algeria, Bahrain, Iraq, Kuwait and Oman. The International Energy Agency (IEA) is working alongside the Clean Air Task Force (CATF) and Climate and Clean Air Coalition (CCAC) to support Iraq's efforts to mitigate oil and gas emissions.

Flaring and venting restrictions are common in most countries, but flared volumes have increased by around 20% since 2015. Many of the region's national oil companies have joined the Oil and Gas Decarbonisation Charter (OGDC) or the Oil and Gas Methane Partnership (OGMP) 2.0, including ADNOC (United Arab Emirates), the National Oil Corporation (NOC) of Libya, Saudi Aramco (Saudi Arabia), Bapco Energies (Bahrain) and Petroleum Development Oman.

Three countries – Iran, Iraq and Algeria – together produce around 10% of the world's oil but account for 40% of global flaring volumes and related methane emissions. Most flares in these countries operate on a continuous basis and many are located within 20 kilometres of existing gas pipelines.

Under stated policies, methane emissions in the Middle East and North Africa would fall by 25% by 2030, and by more than 30% by 2035. Deploying currently available methane abatement technologies today would lower emissions by 80%, with around 60% of these reductions achievable at no net cost to producers. In some countries, however, access to these technologies remains challenging – due to sanctions restricting Iran's access to key equipment, for example, and Iraq's lack of civil infrastructure to utilise captured methane.

Methane emissions abatement potential in the Middle East and North Africa, 2025



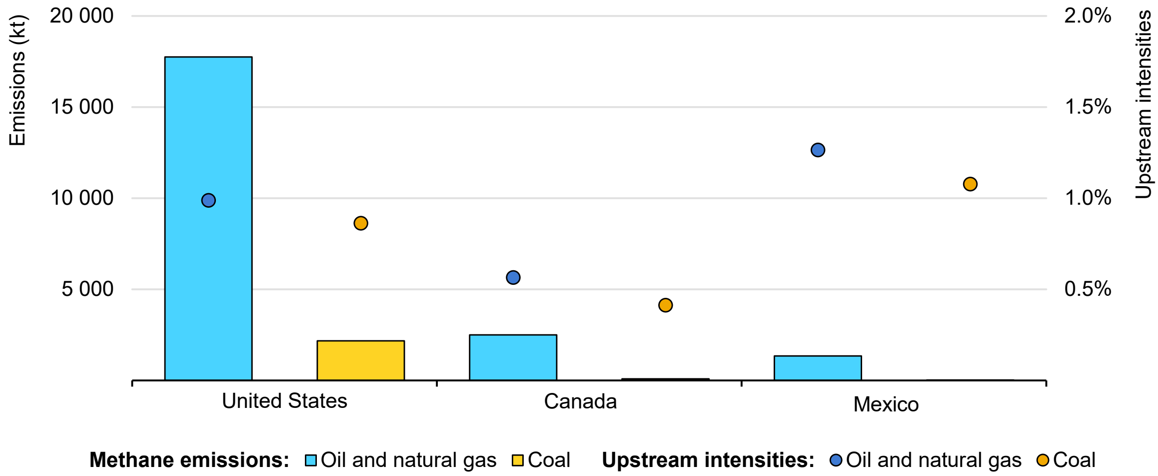
Notes: kt = kilotonnes. LDAR = leak detection and repair. VRU = vapour recovery unit. Other measures includes improved flaring, blowdown capture, associated gas utilisation, and monitoring and plugging of abandoned wells. Other countries include Algeria, Egypt, Morocco, Tunisia, Bahrain, Jordan, Kuwait, Lebanon, Oman, Qatar, Syria, United Arab Emirates and Yemen.

North America

North America's fossil fuel sector emitted almost 24 million tonnes (Mt) of methane in 2025, of which just under 85% came from the United States. North American unconventional oil and gas production accounted for 12 Mt, around half of the total. Major sources of emissions include tanks that vent to the atmosphere, leaks and natural gas-powered pneumatic devices that release methane during normal operations.

Canada has the lowest upstream methane intensity in the region, while the United States is close to the global average and Mexico sits above it. Airborne measurements indicate that intensities in the United States can vary by an order of magnitude between producing basins. Since 2022, the Methane Alert and Response System (MARS) has tracked 1 300 super-emitting oil and gas-related events in the United States – about 10% of the global total – with around 461 classified as "actionable," meaning the source was identified and considered still likely to be emitting.

Methane emissions from the fossil fuel sector in North America, 2025



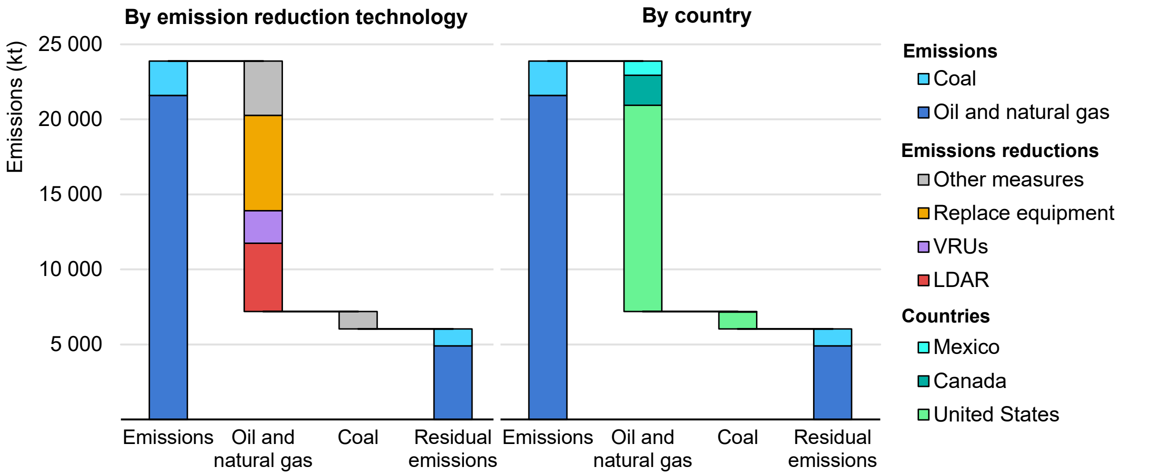
Note: kt = kilotonnes. Methane intensity is calculated in energy terms as emissions from upstream operations divided by marketed fuel production volume, assuming methane has an energy density of 55 megajoules per kilogram (MJ/kg).
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

Canada has recently amended its federal regulations on methane emissions from upstream oil and gas facilities. The amended regulations set higher standards for fugitive emissions management and repairs and prohibit venting apart from exceptional circumstances. The amendments also offer an alternative compliance pathway to facilities that meet a prescribed methane intensity threshold by permitting them to design their own abatement approach. Canada's latest Nationally Determined Contribution (NDC) restates its goal of reducing methane emissions from the oil and gas sector by 75% by 2030 compared to 2012. The United States has deferred the deadlines for compliance with various regulatory requirements under the Environmental Protection Agency (EPA)'s Final Rule for Oil and Natural Gas Operations until 22 January 2027. Congress also overturned an EPA rule implementing the "Waste Emissions Charge" mandated by the Inflation Reduction Act. However, policies and support for emissions reductions remain in place at state level, including measures such as flaring restrictions.

Mexico is now implementing its existing regulations on methane to meet its international commitments. Its latest NDC reaffirms Mexico's target to reduce methane emissions by 30% by 2030 compared to 2020 and eliminate routine gas flaring, in accordance with PEMEX's 2024 Sustainability Plan. It also sets out Mexico's commitment to reduce fugitive emissions in oil and gas production through best operating practices and detection and mitigation technologies.

Under stated policies, methane emissions in North America would fall by almost 20% by 2030, and plateau to 2035. Applying currently available methane abatement technologies today would lower emissions by 75%. However, less than 15% of these reductions could be achieved at no net cost to producers. This share is much lower than in other regions because relatively low natural gas prices in North America mean that the cost of abatement often exceeds the market value of the methane that can be recovered and sold.

Methane emissions abatement potential in North America, 2025



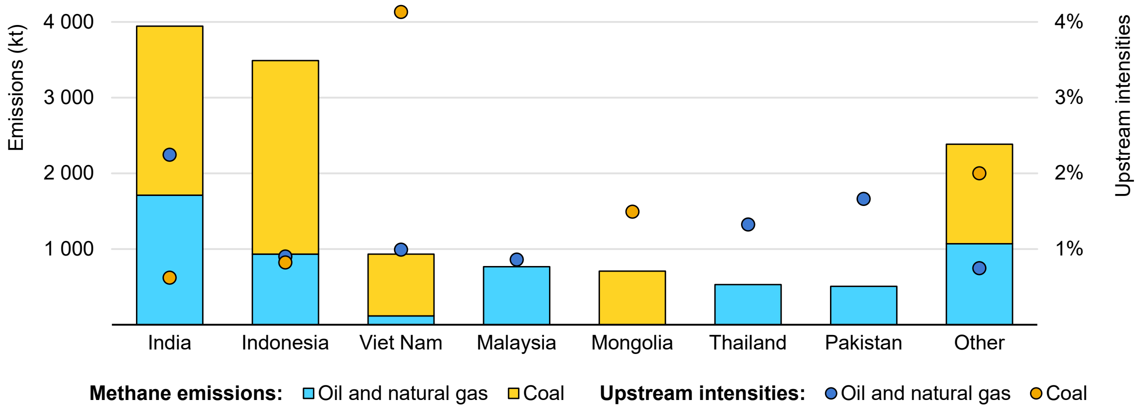
Notes: kt = kilotonnes. LDAR = leak detection and repair. VRU = vapour recovery unit. Other measures includes improved flaring, blowdown capture, associated gas utilisation, and monitoring and plugging of abandoned wells.

South and Southeast Asia

The fossil fuel sector in South and Southeast Asia emitted around 13 million tonnes (Mt) of methane emissions in 2025, with more than 60% originating from coal mines and the rest from oil and gas operations. India and Indonesia were the biggest emitters. Methane emissions in the region have risen in recent years, driven by rising energy demand and fossil fuel production. However, across the region, both fossil fuel production and associated methane emissions are expected to start declining in the coming years.

Upstream methane intensities for oil and gas in Southeast Asia are around the global average, with lower intensities in Malaysia and Brunei, where operations are largely offshore. In India and Pakistan, methane intensities are around twice the global industry average. Methane intensities from coal production are particularly high in Viet Nam – almost four times the global average – owing to the country's geology and limited coal mine methane capture. In India and Indonesia, intensities are below the global average, while in Mongolia, coal intensity is higher. Across the region, most emissions come from surface mines, where abatement options are more limited.

Methane emissions from fossil fuel operations in South and Southeast Asia, 2025



Notes: kt = kilotonnes. Other includes Afghanistan, Bangladesh, Bhutan, Brunei, Cambodia, Chinese Taipei, Cook Islands, Democratic People's Republic of Korea, Fiji, French Polynesia, Kiribati, Lao People's Democratic Republic, Maldives, Myanmar, Nepal, New Caledonia, Palau, Samoa, Singapore, Solomon Island, Sri Lanka, Tonga and the Philippines. Methane intensity is calculated in energy terms as emissions from upstream operations divided by marketed fuel production volume, assuming methane has an energy density of 55 megajoules per kilogram (MJ/kg).
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

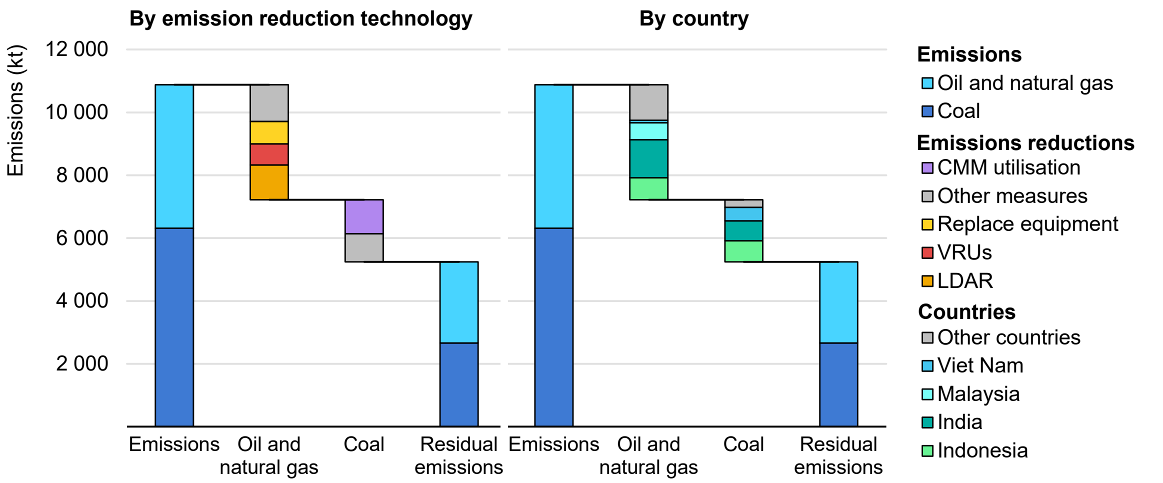
All major emitters in the region participate in the Global Methane Pledge except for India and Thailand – although Thailand has identified some opportunities for lowering methane emissions, such as minimising fugitive emissions from oil and gas activity. Thailand also granted in-principle approval to the Draft Climate Change Act that *inter alia* mandates measurement, reporting and verification (MRV) for regulated entities, including in the energy sector.

Bangladesh and Viet Nam have developed action plans to address methane emissions with quantified reduction targets. Viet Nam's plan encourages the collection of associated gas from oil operations, investment in leak detection and repair (LDAR), and methane drainage and recovery before and during underground coal mining. Viet Nam also has a policy that includes provisions on emissions monitoring and reporting. Bangladesh's methane emissions reduction plan refers to reducing leaks and recovering vented associated gas. In its updated Nationally Determined Contribution (NDC), Bangladesh has set a conditional target of 70% reduction in fugitive emissions from gas leakages in the energy sector by 2035. Indonesia has a rule to increase the utilisation of associated gas.

In addition, Indonesia's updated NDC recognises reduction in flaring and venting from the upstream oil and gas sector and reduction in fugitive emissions from coal mining as mitigation measures for the energy sector. The Philippines is developing policies for methane abatement with a focus on improving measurement of methane emissions and has also made efforts to develop a National Action Plan and Methane Roadmap.

Over the past year, the Association of Southeast Asian Nations (ASEAN) has launched a range of regional initiatives to address energy sector methane emissions. For instance, the ASEAN Centre of Energy (ACE) convened a high-level regional policy dialogue, jointly published a methane management roadmap for the oil and gas sector, and launched the Omega project with the Climate and Clean Air Coalition (CCAC) to identify gaps in addressing methane emissions in the region and enhance the capacity of national oil companies (NOCs) to achieve methane abatement.

Methane emissions abatement potential in South and Southeast Asia, 2025



Notes: kt = kilotonnes. LDAR = leak detection and repair. VRU = vapour recovery unit. Other measures includes improved flaring, blowdown capture, associated gas utilisation, and monitoring and plugging of abandoned wells. Other countries includes Afghanistan, Bangladesh, Bhutan, Brunei, Cambodia, Chinese Taipei, Cook Islands, Democratic People's Republic of Korea, Fiji, French Polynesia, Kiribati, Lao People's Democratic Republic, Maldives, Mongolia, Myanmar, Nepal, New Caledonia, Pakistan, Palau, Samoa, Singapore, Solomon Island, Sri Lanka, Thailand, Tonga and the Philippines.

Many NOCs from the region participate in the Oil and Gas Decarbonisation Charter (OGDC) or the Oil and Gas Methane Partnership (OGMP) 2.0, including ONGC (India), PETRONAS (Malaysia), Pertamina (Indonesia), PPL (Pakistan) and PTTEP (Thailand). PETRONAS, Pertamina, and PTTEP also spearhead the ASEAN Energy Sector Methane Leadership Programme (MLP) that is intended to enhance the capacity of NOCs to manage and reduce their methane emissions.

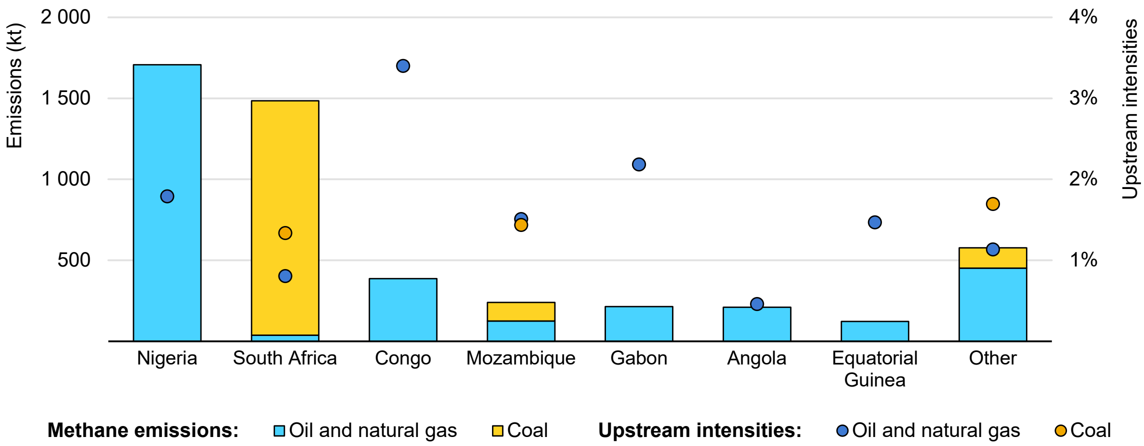
Under stated policies, methane emissions in South and Southeast Asia would fall by 10% by 2030, and by almost 20% by 2035. Applying currently available methane abatement technologies today would lower emissions by more than 50%, of which 60% of reductions could be achieved at no net cost to producers.

Sub-Saharan Africa

In 2025, fossil fuel operations within sub-Saharan African countries emitted around 5 million tonnes (Mt) of methane, of which around 70% came from oil and gas operations and the remainder from coal mines (mainly from South Africa). Methane emissions from fossil fuels in the region fell early in the decade but have since risen again, in line with fluctuations in oil and gas activity in Nigeria, the region's largest emitter. Emissions from the traditional use of biomass account for almost 50% of energy-related methane in sub-Saharan Africa.

Upstream methane intensity is high across many of the region's leading oil and gas producers. In Nigeria, Congo and Gabon, intensities are two- to three-times the global industry average. Several countries have the potential to increase their production significantly in the coming years, including Nigeria, Senegal and Uganda.

Methane emissions from the fossil fuel sector in sub-Saharan Africa, 2025



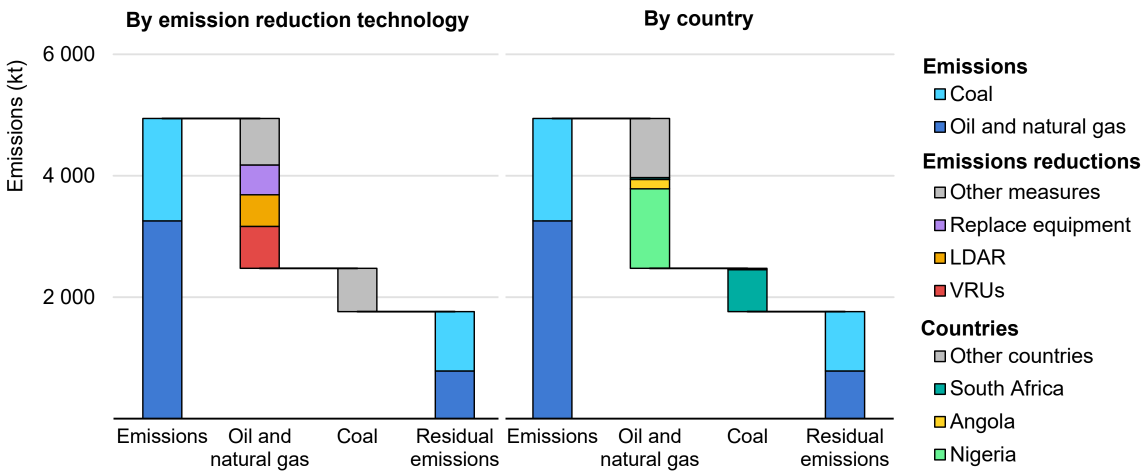
Notes: kt = kilotonnes. Other includes Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Eritrea, Eswatini, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Namibia, Niger, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia and Zimbabwe. Methane intensity is calculated in energy terms as emissions from upstream operations divided by marketed fuel production volume, assuming methane has an energy density of 55 megajoules per kilogram (MJ/kg).
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

Apart from South Africa, all major emitters in the region participate in the Global Methane Pledge. Many also take part in the Zero Routine Flaring by 2030

Initiative, including Angola, Nigeria, Congo and Gabon. Some countries have developed action plans to reduce methane emissions, including Côte d'Ivoire, Ghana and Nigeria, with Senegal developing its own. Côte d'Ivoire, Ghana and Nigeria have also established targets for methane emissions reduction. In its latest Nationally Determined Contribution (NDC), Côte d'Ivoire has communicated a target of 50% reduction in fugitive methane emissions from the energy sector by 2035. In 2025, Angola also designated a contact point for receiving notifications of large emissions from the International Methane Emissions Observatory (IMEO)'s Methane Alert and Response System (MARS), joining Nigeria, South Africa and Mozambique.

Nigeria has developed methane regulations specifically for the oil and gas sector. These include emissions and equipment standards, requirements for leak detection and repair (LDAR), fiscal incentives for the utilisation of associated gas and measurement and reporting obligations. In its latest NDC, Nigeria commits to achieving zero routine gas flaring by 2030 and a reduction in fugitive emissions (leaks and venting) from the oil and gas industry of 60% by 2035 and 95% by 2050. Nigeria is now implementing these regulations to meet those commitments. Ghana is developing guidelines and technical guidelines to curb oil and gas methane emissions. Senegal is also drafting rules that set standards for emissions measurement and control equipment, and that govern the release of combustion products into the atmosphere.

Methane emissions abatement potential in sub-Saharan Africa, 2025



Notes: kt = kilotonnes. LDAR = leak detection and repair. VRU = vapour recovery unit. Other measures for oil and gas include improved flaring, blowdown capture, associated gas utilisation, and monitoring and plugging of abandoned wells. Other measures for coal include coal mine methane utilisation, ventilation air methane abatement, flaring and enhanced combustion efficiency. Other countries includes Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia and Zimbabwe.

Several other countries in the region also limit flaring, including Gabon and Equatorial Guinea. Angola's NDC also commits to a reduction of 394 million standard cubic feet per day (MMSCF/day) in flaring at oil fields by 2035. Many national oil companies (NOCs) participate in the Oil and Gas Decarbonisation Charter (OGDC) or the Oil and Gas Methane Partnership (OGMP) 2.0, including Sonangol (Angola), NILEPET (South Sudan) and NAMCOR (Namibia). Nigeria LNG has achieved the OGMP 2.0 Gold Standard Reporting Level 5, while NNPC, the national oil company, is also a member of the scheme.

Under stated policies, methane emissions in Sub-Saharan Africa would fall by around 35% by 2030, and by 40% by 2035. Applying currently available methane abatement technologies today would lower emissions by 65%, of which nearly 70% could be achieved at no net cost to producers.

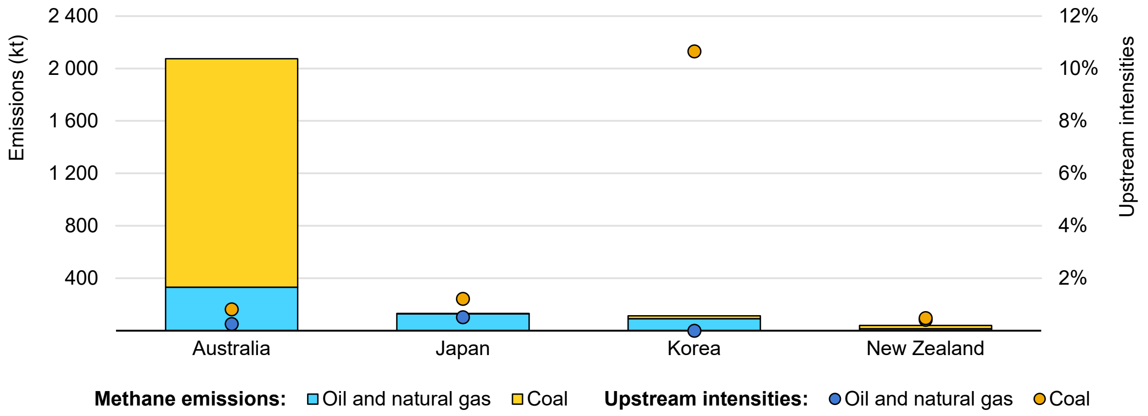
Other Asia Pacific

Fossil fuel operations in the Asia Pacific region (excluding China and South and Southeast Asia) released more than 2 million tonnes (Mt) of methane in 2025. Around 75% of those emissions came from coal production, with the remainder from the oil and gas sector. Australia's coal sector alone emitted 1.7 Mt of methane in 2025, particularly from underground and open-cut mines in Queensland and New South Wales. Most of the methane emissions in Japan and Korea are tied to imports since these countries have little domestic fossil fuel production. In 2025, upstream methane emissions associated with oil and gas imports are estimated at around 2 Mt, seven times those from Japan and Korea's domestic oil and gas sectors.

Australia is the fourth-largest coal producer in the world but has an emissions intensity that is roughly half the global average.

All major emitters in the region participate in the Global Methane Pledge. In 2025, Australia released an action plan to reduce emissions from its resources sector, including coal, oil and gas. The plan includes measures to cut methane emissions, such as reducing fugitive emissions, expanding pre-drainage in coal mines, abating ventilation air methane (VAM), and improving detection and measurement technologies. Korea's methane roadmap targets a 30% reduction in methane emissions by 2030 from 2020 levels through a fugitive emissions management plan, improved measurement, reporting and verification (MRV) systems, and support for methane abatement technologies, among other measures. Japan is also developing a roadmap to cut emissions from the liquefied natural gas (LNG) supply chain. In 2025, the Japan- and Korea-supported Coalition for LNG Emission Abatement towards Net-zero (CLEAN) released project-level data on the methane intensity and methane management practices at 22 projects that supply the two countries.

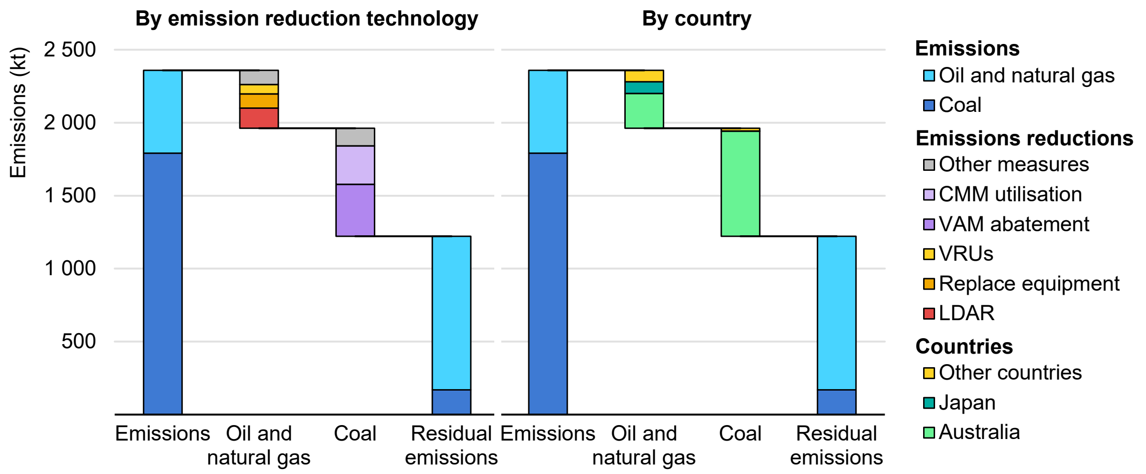
Methane emissions from the fossil fuel sector in Asia Pacific, 2025



Notes: kt = kilotonnes. Methane intensity is calculated in energy terms as emissions from upstream operations divided by marketed fuel production volume, assuming methane has an energy density of 55 megajoules per kilogram (MJ/kg).
Source: IEA estimates based on measured, satellite, and inferred data (see Documentation for further information).

Under stated policies, methane emissions in the Asia Pacific region would fall by more than 25% by 2030, and by more than 30% by 2035. Deploying currently available methane-abatement technologies today would lower emissions by 50%, largely from Australian fossil fuel operations, particularly coal mines. Around 75% of emissions cuts in the oil and gas sector can be achieved at no net cost to producers, compared with just under 10% in the coal sector.

Methane emissions abatement potential in Asia Pacific, 2025



Notes: kt = kilotonnes. CCM = coal mine methane. LDAR = leak detection and repair. VRUs = vapour recovery unit. Other measures includes improved flaring, blowdown capture, associated gas utilisation, and monitoring and plugging of abandoned wells. Other countries includes Korea and New Zealand.

Annex

Methodology

IEA estimates based on measured, satellite, and inferred data, see Documentation for further information.

Abbreviations

CCAC	Climate and Clean Air Coalition
CH_4	Methane
CLEAN	Coalition for LNG Emission Abatement toward Net Zero
CO_2	Carbon dioxide
EMDE	Emerging and developing economies
FFRP	Fossil Fuel Regulatory Programme
GMP	Global Methane Pledge
GWP	Global warming potential
IEA	International Energy Agency
IMEO	International Methane Emissions Observatory
IPCC	Intergovernmental Panel on Climate Change
LDAR	Leak detection and repair
LNG	Liquified natural gas
MARS	Methane Alert Response System
MMRV	Measurement, monitoring, reporting and verification
MRAP	Methane Roadmap Action Programme
NDC	Nationally Determined Contribution
NOC	National oil companies
OGCI	Oil and Gas Climate Initiative
OGDC	Oil and Gas Decarbonization Charter
OGMP 2.0	Oil and Gas Methane Partnership 2.0
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change

See the IEA glossary for a further explanation of many of the terms used in this report.

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Typeset in France by IEA - May 2026
Cover design: IEA
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