



Financing Reductions in Oil and Gas Methane Emissions

A World Energy Outlook Special Report
on the Oil and Gas Industry and COP28

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Energy Agency



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Abstract

The oil and gas industry has some of the best and most cost-effective opportunities to reduce methane emissions. The potential to do so is clear. Some countries and companies have already demonstrated that achieving near-zero emissions from oil and gas operations is technically and economically possible. There are a growing number of initiatives, policies and regulations aiming to reduce emissions globally, and many reductions can be realised while saving money. However, overall progress has been much too slow, despite the record profits that the oil and gas industry saw in 2022. This report looks in detail at the investment requirements to deliver a sharp reduction in oil and gas methane emissions to 2030, and how these could be financed. The analysis is intended to inform discussions in the runup to COP28 and help prompt the necessary actions to accelerate the pace of change.

Executive summary

Tackling methane emissions from oil and gas operations is one of the most important measures to limit near-term global warming. In the IEA's [Net Zero Emissions by 2050 \(NZE\) Scenario](#), energy-related methane emissions fall by around 75% to 2030 – two-thirds of which comes from reducing emissions from oil and gas operations – and this contributes more than 15% of total energy-related greenhouse gas (GHG) emissions reductions to 2030.

Just over USD 75 billion in cumulative spending is required to 2030 to achieve these reductions in emissions. The required spending varies widely by geography, operator, and part of the value chain: around USD 55 billion is needed in upstream oil and gas facilities and just over USD 20 billion in downstream operations.

Methane abatement in the oil and gas industry is one of the cheapest options to reduce GHG emissions anywhere in the economy. Abatement measures would generate revenues of around USD 45 billion from the sale of captured methane. This means the average cost of methane reductions to 2030 is less than USD 5/tonne CO₂-equivalent. Even if there was no value to the captured gas, almost all available abatement measures would be cost effective in the presence of an emissions price of about USD 20/tonne CO₂-equivalent.

Oil and gas companies carry primary responsibility for abatement. The spending required to cut methane emissions in the NZE Scenario is less than 2% of the net income received by the industry in 2022. Private sources of finance can provide capital where internal financing options are limited. Regulations and policies on methane abatement are essential to drive down methane emissions. These can be paired with public financing, either directly from governments or through multilateral development banks, to help catalyse private investments and fill gaps where private sources of finance may not be willing or able to invest at the levels needed.

Of the total spending, we estimate that about USD 15-20 billion needs particular attention to ensure that adequate sources of finance are available. This includes the spending required to cut emissions in low- and middle-income countries, especially those without strong methane reduction policies and regulations, at facilities owned and operated by national oil companies and smaller independent companies, and for measures that do not generate meaningful return over their lifetimes. This is an appropriate area for focused international action.

There have been several notable efforts in the past to finance methane abatement. These include international emissions pricing schemes, regional emissions trading markets, sustainability-linked financing, and direct public funding. Financing initiatives should be tailored to fit targeted projects and reduction goals and be paired with clear accountability frameworks.

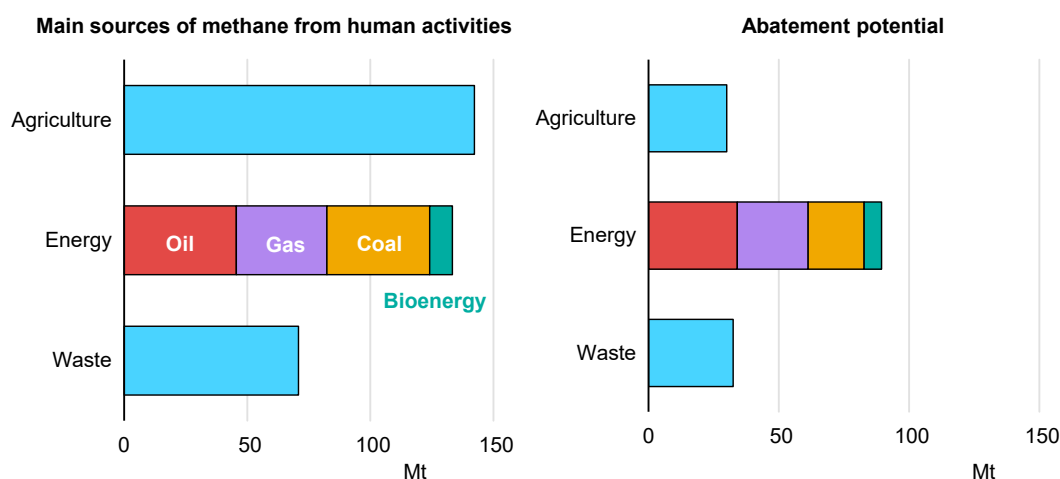
Recommendations

- **The oil and gas industry must lead efforts to tackle methane emissions by adopting a zero-tolerance approach.** Reducing oil and gas methane emissions is one of the cheapest options to reduce GHG emissions anywhere in the economy. The COP28 Climate Change Conference in Dubai this year is a unique opportunity for the oil and gas industry to show it is serious about tackling its methane emissions. It is time for bold and ambitious commitments, focused on delivery by 2030.
- **Policy makers should implement and enforce effective methane policies and regulations to incentivise early company actions.** Many options are available, including the adoption of technology and equipment standards, enforcing bans on non-emergency flaring and venting, and offering targeted financial incentives. Measures should be paired with a robust measurement and reporting regime.
- **Investors and insurers should incorporate methane abatement into their engagement with the oil and gas industry** with the aim to promote strict performance standards, verifiable methane reductions, and transparent and comparable disclosures on measured emissions.
- **A new international effort is needed from governments, industry and philanthropy to fill the financing gaps identified in this report, notably the USD 15-20 billion of spending required in low- and middle-income countries.** Public and philanthropic actors can play a catalysing role, supporting project identification and capacity building and unlocking additional private sources of finance. Leading companies need to step up to support higher performance across the entire industry.
- **Financing efforts should ensure rapid delivery of the most cost-effective mitigation opportunities.** More than 40% of the emissions reductions to 2030 in the NZE Scenario can be achieved with measures that would result in overall savings given the value of the captured gas. Alongside mechanisms to detect and immediately tackle large leaks, these options include replacing pneumatics and pumps, installing recovery systems, and implementing leak detection and repair programmes. These measures require just over 10% of the total spending on methane abatement and can produce results quickly, laying the groundwork for further reductions.
- **Investing in institutional capacity for abatement, especially in low- and middle-income countries, is a vital part of the solution.** Regulatory structures and frameworks for methane abatement should be created or further developed by increasing dedicated staff, building technical knowledge, and developing more robust monitoring and reporting systems.

Introduction

Methane is responsible for around [30% of the rise in global temperatures](#) since the Industrial Revolution, and rapid and sustained reduction in methane emissions are key to limiting near-term global warming. The energy sector accounts for nearly 40% of total methane emissions from human activity, and it has the largest potential for abatement in the near-term. Oil and gas operations are responsible for 80 million tonnes (Mt) of methane emissions and tackling these is one of the most important measures to limit near-term global warming.

Main sources of methane emissions and abatement potential based on current technologies



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Notes: Methane emissions and abatement potential for oil, gas, and coal is based on the IEA’s [Global Methane Tracker](#); abatement potential for bioenergy is consistent with achieving universal clean cooking; agriculture and waste is based on the [Global Methane Assessment](#). Emissions from biomass burning, which total [around 10 Mt of methane](#) per year, are not shown.

The IEA’s Net Zero Emissions by 2050 (NZE) Scenario maps out a complete and rapid transformation of the energy sector to achieve net zero energy-related CO₂ emissions by 2050. The scenario also encompasses rapid reductions in energy-related methane emissions, consistent with the overall goal of limiting the temperature increase to 1.5 °C. Energy-related methane emissions fall by nearly 100 Mt or 3 billion tonnes CO₂-equivalent (Gt CO₂-eq) to 2030 in the NZE Scenario, two-thirds of which comes from reducing oil and gas methane emissions.¹ The total

¹ One tonne of methane is considered to be equivalent to 30 tonnes CO₂ based on the 100-year global warming potential ([IPCC, 2021](#)).

reduction in methane emissions accounts for more than 15% of all energy-related GHG emissions reductions in the NZE Scenario to 2030.

We estimate that just over [USD 75 billion](#) in cumulative capital and operating expenditure is required globally over the period to 2030 to achieve this reduction in oil and gas methane emissions. Tackling methane emissions is one of the most cost-effective ways of reducing GHG emissions, not least because the abatement measures deployed would generate revenues of around USD 45 billion from the sale of captured methane. Yet there are challenges to mobilising this level of investment, including a lack of awareness about emissions and the cost-effectiveness of abatement, the opportunity cost of investment in methane reduction, a lack of infrastructure, a shortage of funds in some cases, capacity gaps in implementation, and economic and institutional barriers.

Alongside a determined industry focus on this issue, increased policy and regulatory action is essential to mobilise this level of spending at the pace and scale needed. Norway's [methane tax](#) has long been a powerful catalyst for action and other governments are beginning to act, including through the [Inflation Reduction Act](#) in the United States and the [Emission Reduction Fund](#) in Canada.²

Engagement by international actors, including banks and investors, is also key. External funding and blended finance can remove or reduce barriers to action and de-risk abatement measures. There are several international initiatives and organisations in this area, including the World Bank's Global Flaring Reduction Partnership, the Global Methane Pledge Energy Pathway and the Global Methane Hub.

In this report, we examine how the spending on methane abatement in the NZE Scenario is split between regions, types of company, and segments of the oil and gas supply chain. We provide an overview of the different financing mechanisms that could be used to mobilise this level of spending. Finally, we examine a number of case studies to highlight examples of how methane emissions reductions can be financed, showcase best practices and successful examples, and draw out lessons for future efforts.

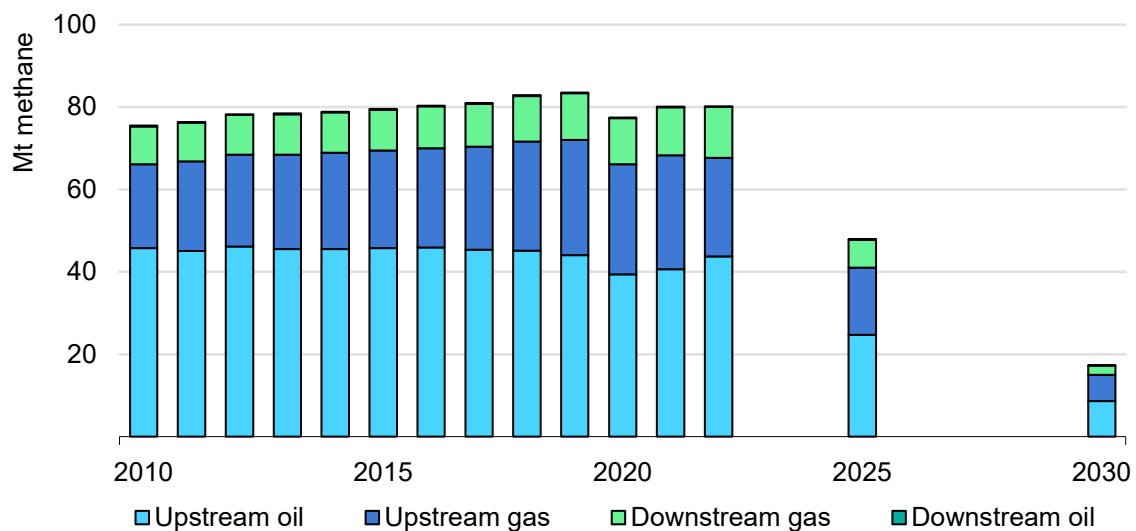
² Canada's Emissions Reduction Fund made around USD 610 million available to finance methane abatement projects. The United States Inflation Reduction Act created a USD 1,550 million Methane Emissions Reduction Program for methane abatement in the oil and gas sector.

Abatement opportunities and spending needs

A 75% reduction in oil and gas methane emissions is achieved by 2030 in our NZE Scenario

In the IEA's Net Zero Emissions by 2050 (NZE) Scenario methane emissions from oil and gas operations fall from 80 Mt in 2022 to 17 Mt in 2030. This results mostly from the rapid deployment of emission-reduction measures and technologies, including a stop to all non-emergency flaring and venting and universal adoption of regular leak detection and repair (LDAR) programmes. By 2030, all oil and gas producers in the NZE Scenario have an emissions intensity similar to the world's best operators today.

Oil and gas methane emissions in the NZE Scenario, 2010-2030



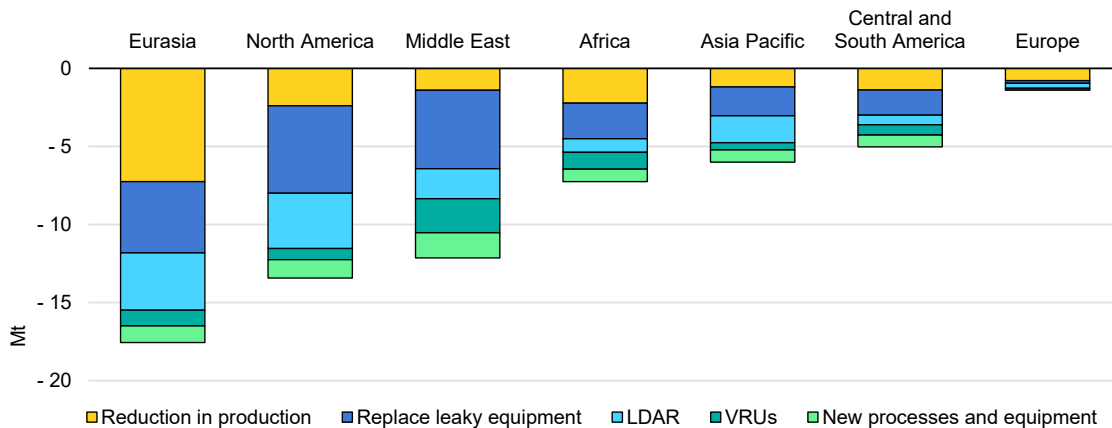
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The NZE Scenario sees a major ramp up in clean energy investment which results in a near-25% decline in oil and gas demand between 2022 and 2030. This results in around one-quarter (17 Mt) of the overall decline in oil and gas methane emissions to 2030.

The remaining reduction (46 Mt to 2030) stems from deliberate efforts by the oil and gas industry to reduce the emissions intensity of its operations. Around 21 Mt of methane is avoided by replacing pumps, controllers, compressors and other equipment with low- or zero-emissions alternatives, such as instrument air systems

and electric pumps. Another 13 Mt is avoided through regular or continuous LDAR programmes that ensure that fugitive leaks are addressed rapidly and prevent large emissions events by identifying malfunctioning parts or processes before they fail. Around 6 Mt is avoided using vapour recovery units, which direct waste flows of methane to productive uses, enabling the end of routine venting and flaring. The final 6 Mt is avoided through additional processes and measures such as blowdown capture, reduced emissions completion, and routing tank vents to recovery systems.

Methane emissions reductions between 2022 and 2030 in the NZE Scenario



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Notes: LDAR = Leak Detection and Repair. VRUs = Vapour Recovery Units. Replace leaky equipment includes instrument air systems, electric pumps, and other measures that involve replacing existing equipment. New processes and equipment includes blowdown capture, routing vents to recovery systems, and related measures.

Just over USD 75 billion in spending is required to 2030 to achieve the needed reductions in methane emissions

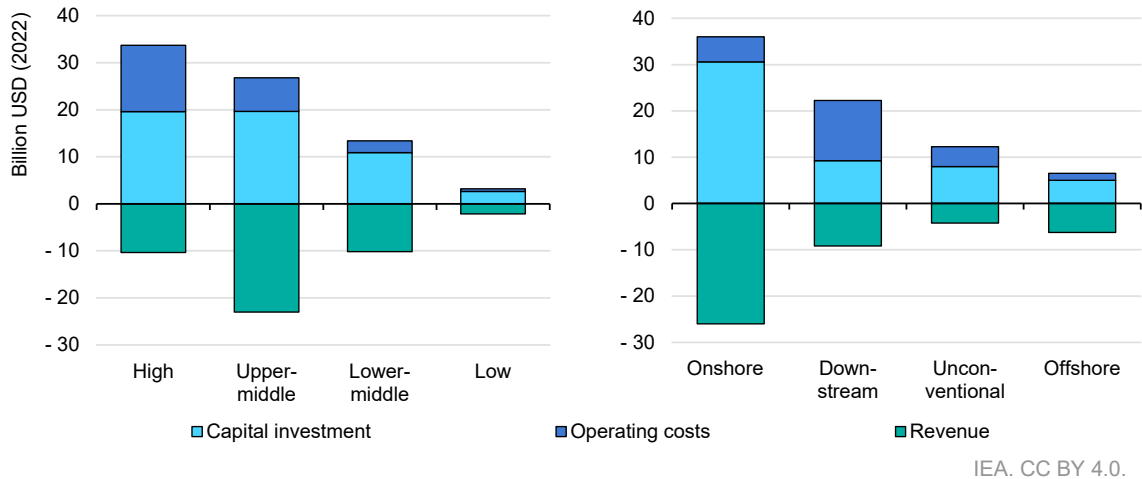
Roughly 70% of this is capital expenditure on new equipment and 30% is operating costs, the latter mainly related to LDAR programmes. These estimates are based on oil and gas supply and prices in the NZE Scenario, our estimates of methane emissions as described in the [Global Methane Tracker](#), and our detailed modelling of 45 methane abatement technologies and their country and region-specific costs.

Just under USD 34 billion spending is needed in high-income countries, USD 27 billion in upper-middle income countries, USD 13 billion in lower-middle income countries, and USD 3 billion in low-income countries.³ Despite higher capital costs, the cost of abatement is generally smaller in low- and middle-income countries because of much lower labour costs. Abatement measures would

³ Countries are grouped based on the 2022 categorisation provided by the [World Bank](#).

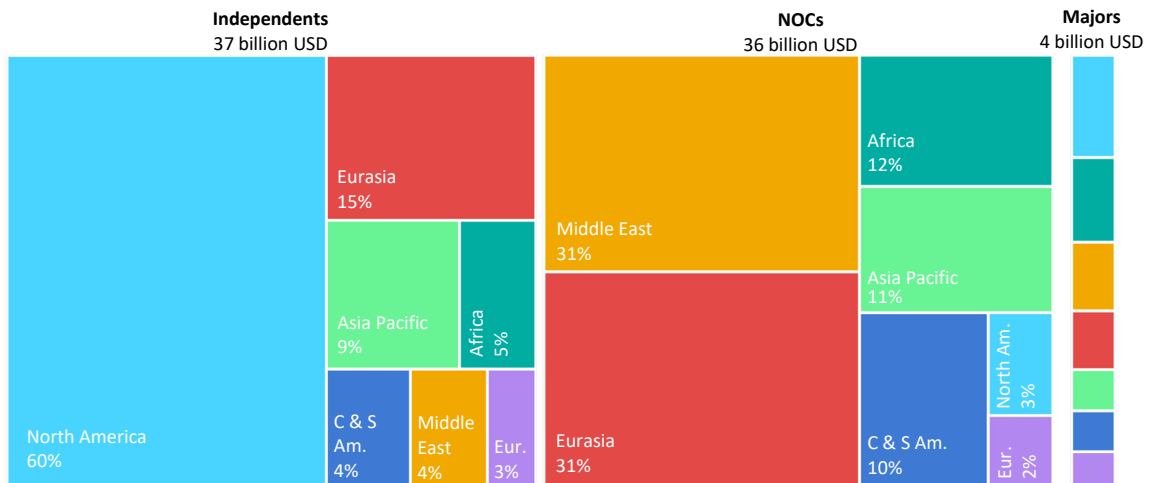
generate revenues of around USD 45 billion globally from the sale of captured methane.

Emissions reductions, spending, and related revenue to 2030 in the NZE Scenario by country income group and industry segment



Nearly USD 36 billion is needed to address methane emissions from National Oil Companies (NOCs), who are responsible for the majority of emissions in Eurasia and the Middle East. Around USD 12 billion of this spending is needed at facilities owned by NOCs in low- and lower-middle income countries.

Methane abatement spending to 2030 in the NZE Scenario by region and company type



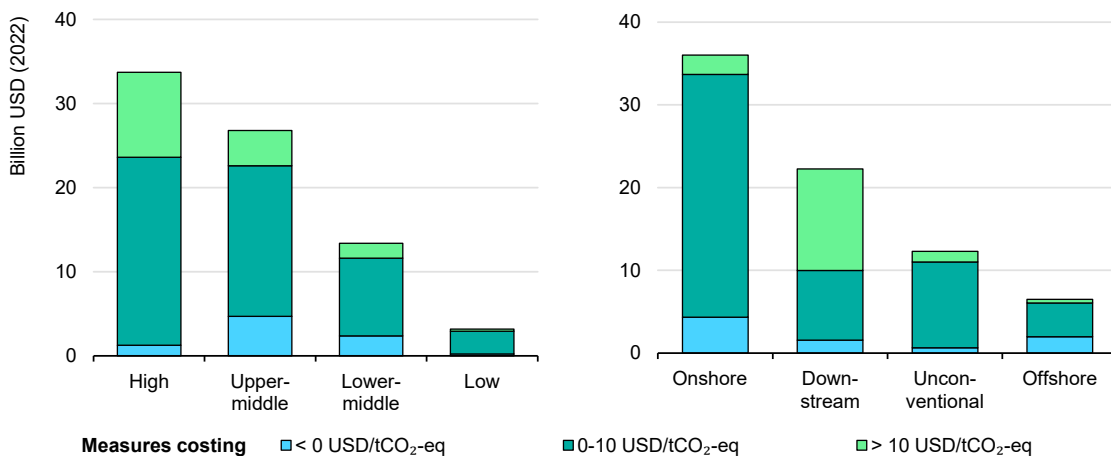
Notes: C & S Am. = Central and South America. Eur. = Europe. North Am. = North America. Eurasia = Caspian regional grouping and the Russian Federation (Russia). Investment requirements are allocated on the basis of the equity ownership of produced oil and gas rather than operator.

About USD 4 billion is needed to address methane emissions from the oil and gas owned by the Majors (including production from both operated and non-operated assets),⁴ of which USD 2 billion is needed in low- and middle-income countries. These companies are well placed to accelerate methane cuts in low- and lower-middle income countries where regulations often take longer to be established and enforced. They can also help bring methane abatement technologies to these countries and spread best practices.

Another USD 37 billion spending is needed to address emissions from independent operators.⁵ These emissions are heavily concentrated in the United States, where USD 22 billion spending is needed to 2030 in the NZE Scenario.

More than 40% of the emissions reductions to 2030 come from measures with no net cost (assuming an 8% rate of return over the lifetime of the measure).⁶ This is because the capital and operating costs of the abatement measures are less than the market value of the additional gas that is captured and can be sold. They include solutions such as replacing pneumatics and pumps, installing recovery systems, or implementing LDAR programmes across upstream operations. These no-net-cost measures have lower spending requirements: they provide 40% of the emissions reductions to 2030 with just over 10% of the total spending over this period. They also result in USD 25 billion of revenue in the NZE Scenario to 2030 from the gas that is captured and can be sold.

Spending on methane abatement measures to 2030 with negative and positive net costs in the NZE Scenario by income category and industry segment



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⁴ bp, Chevron, ExxonMobil, Shell, TotalEnergies, ConocoPhillips and Eni.

⁵ Independents are upstream operators or fully integrated companies that are smaller than the Majors. They encompass a wide range of companies: Lukoil, Repsol, many North American companies – including shale gas and tight oil players – such as Marathon Oil, Apache and Hess, and diversified conglomerates with upstream activities, such as Mitsubishi Corp.

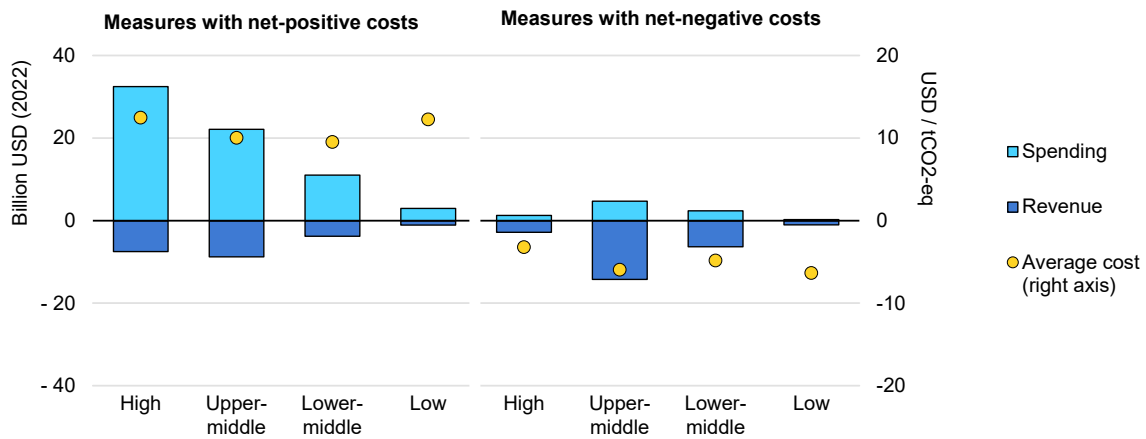
⁶ See Technical Annex for details on the cost and revenue calculations for these measures.

Some of the largest opportunities to deploy abatement options with no net cost are in middle income countries, especially in Eurasia, the Middle East and the Asia Pacific region. These are often associated with countries that have high levels of emissions, flaring, and satellite-detected large leaks. For example, around 1.4 Mt of methane could be reduced in 2030 in Turkmenistan with measures with no net cost; in Iraq, which flared nearly 18 billion cubic metres of natural gas in 2022 resulting in a large level of methane emissions, emissions in 2030 could be cut by more than 0.6 Mt at no net cost.

Reducing oil and gas methane is one of the most cost-effective measures to cut GHG emissions but new sources of financing are likely needed

Globally, abating 1 Mt of methane in conventional oil and gas production in 2030 requires just over USD 1 billion of spending although this varies substantially depending on site characteristics. In the downstream segment, abatement is more costly as operations span a wide area and it is often hard to access equipment: USD 22 billion spending is needed to reduce annual emissions in 2030 by 7 Mt. Unconventional operations also require more investment as these tend to have a higher component count: for every 1 Mt of methane avoided in 2030, nearly USD 2 billion spending is required.

Spending on oil and gas methane abatement to 2030 by country income group in the NZE Scenario



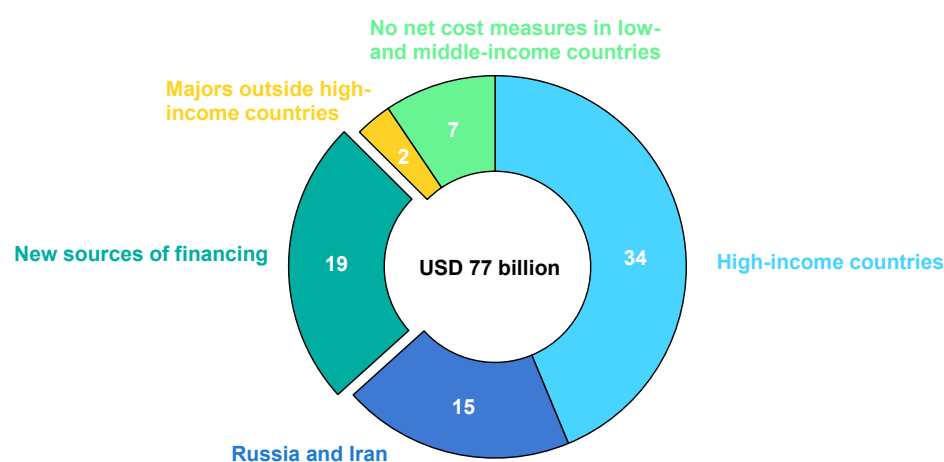
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Considering cumulative reductions in emissions between 2023 and 2030, around USD 315 spending is needed per tonne of methane reduced, equivalent to a global average cost of USD 11/tonne CO₂-eq. The captured methane that can be sold would generate around USD 45 billion revenue to 2030. Taking this into account, the average net cost of methane reductions to 2030 is less than

USD 5/tonne CO₂-eq. In low- and middle-income countries, the average cost is around USD 2/tonne CO₂-eq. Even if there was no value to the captured gas, almost all available abatement measures would be cost effective in the presence of an emissions price of about USD 20/tonne CO₂-eq, meaning that methane abatement in the oil and gas industry is one of the cheapest options to reduce GHG emissions anywhere in the economy.

Given the overall cost-effectiveness of methane abatement, the oil and gas industry should be in a position to finance many abatement measures from its own cashflows, especially if environmental and reputational issues are given due weight in producers' capital allocation. Nonetheless, new sources of finance will likely be required to mobilise all of the investment needed in the NZE Scenario.

Spending on oil and gas methane abatement to 2030 in the NZE Scenario



Note: Value for Russia and Iran includes net positive cost measures only.

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It will be most challenging to finance methane abatement in low- and middle-income countries, especially those without strong methane reduction policies and regulations, at facilities owned and operated by NOCs and smaller independent companies, and for measures that do not generate meaningful return over their lifetimes. In such a context, we estimate that new sources of finance could be required to mobilise around USD 15-20 billion of spending to drive methane reductions at the pace and scale seen in the NZE Scenario. This estimate does not include spending required for abatement measures in Russia and Iran.

Our estimates of emissions and costs do not include abandoned and orphaned oil and gas wells. These could represent a significant source of emissions but data outside the United States and Canada is too sparse to make a reliable estimate. Within the United States, the Environmental Protection Agency indicates they are responsible for close to 5% of US methane emissions linked to the energy sector.

It will also be necessary to ensure funding for project identification and regulatory development, as this will help to facilitate financing for abatement actions. Our estimates of costs do not include capacity building and technical support to develop and implement sound methane policies and regulations. As many countries do not yet have a regulatory structure in place for methane, it will be necessary to develop capacity within local regulatory bodies. The specific needs will depend on the particular case, but this could include increasing staff resources, developing practical knowledge, creating systems to enable reporting, or procuring equipment needed for independent inspections.

Financing options to accelerate action

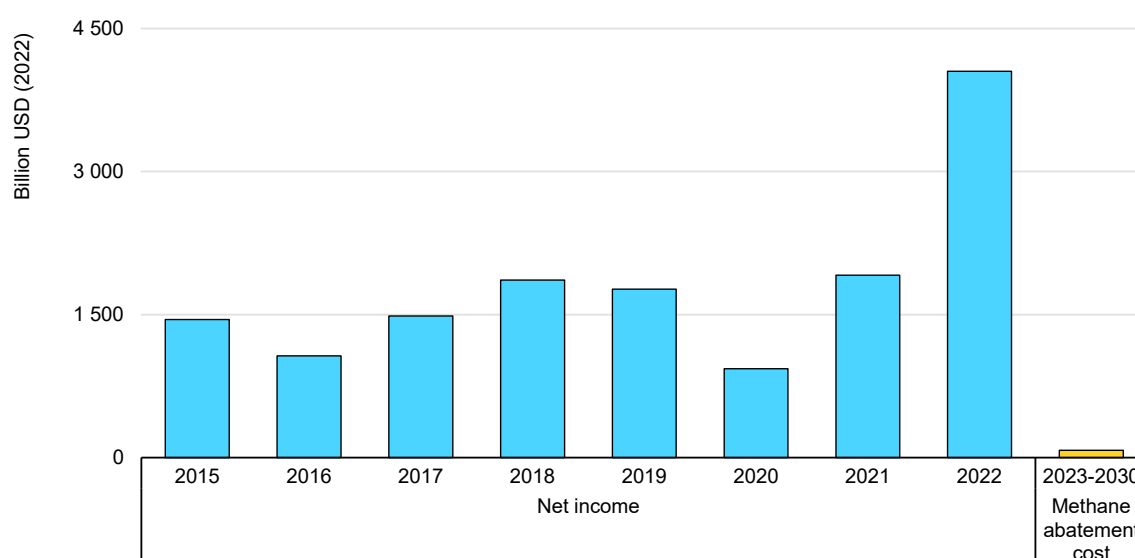
A range of different potential sources of financing are available to support methane abatement activities. These have different roles to play, and a mixture of approaches will be needed, especially if the USD 15-20 billion financing gap in low- and middle-income countries to 2030 is to be filled. The COP28 Climate Change Conference in Dubai offers a unique opportunity for all parties to come together and agree on how to catalyse this necessary investment.

- **Oil and gas companies** can channel revenue from oil and gas sales towards methane abatement. Equipment and petroleum service providers are also increasingly providing up-front financing.
- **Commercial banks and private capital funds** can also support methane reductions. The world's 60 largest investment and commercial banks provided [USD 780 billion](#) of finance each year on average to the oil and gas industry from 2016 to 2022 and there are clear opportunities to link this funding directly or indirectly to methane abatement. Securities, which can be tied to sustainability performance, can also be used to raise money from capital markets.
- **Development finance initiatives** can provide equity investments, long-term loans and guarantees to support investment in emerging market and developing economies. While some have adopted policies limiting investment in oil and gas projects, a number could still provide finance and advice to methane abatement projects.
- **Governments** can provide financial incentives in the form of grants, loans, or other financial mechanisms to accelerate action. They also have a key role in providing the support needed to strengthen regulatory capacity to ensure adequate oversight and compliance.
- **Philanthropic initiatives** have arisen in recent years that support methane abatement. For example, the Global Methane Hub has raised over USD 300 million since its launch and donates funds to methane emissions reduction initiatives.

Oil and gas companies carry primary responsibility for abatement

The profits from oil and gas sales generated by the industry could be reinvested to finance methane abatement. Globally, oil and gas companies [earned record profits in 2022](#) and the industry’s net income doubled to nearly 4 trillion USD. Just 2% of this would be sufficient to provide all the spending in methane emissions reduction measures across the supply chain in the NZE Scenario through to 2030.

Net income from the oil and gas industry from 2015 to 2022 and total spending in methane abatement required to 2030 in the NZE Scenario



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Investing in methane abatement can require significant upfront capital expenditure, and this often faces competition within companies for how to use available funds. If methane abatement projects have long pay-back options or low internal rates of return, they may lose out to other investments deemed more important to the company’s core business. NOCs face additional constraints given competing priorities for domestic spending, especially in low- and middle-income countries, potentially limiting the amounts available to invest.

Companies need to adopt a more proactive corporate policy to increase investment in methane abatement. If the industry does not significantly reduce its methane emissions, oil and gas would need to be phased out much faster than in the NZE Scenario to limit the temperature rise to 1.5 °C. Many companies have set targets to reduce GHG emissions from their own operations and [tackling methane emissions is the single most important measure](#) to achieve these.

The 40% of emissions that can be avoided at no net cost should be the first port-of-call for all companies. But efforts should go beyond this. Tackling methane is one of the most readily implementable and cost-effective measures available in any sector of the economy to reduce GHG emissions, and forward-leaning companies should aim to tackle all emissions from their operations, not just those that would result in a positive payback.

Companies that take the lead in tackling methane emissions could gain a commercial edge alongside the reputational and environmental benefits. Regulations to reduce methane emissions – including financial penalties – are likely to multiply in the future, especially in economies with net zero targets. Oil and gas importers and consumers are increasingly looking to address methane emissions from their suppliers. For example, a [joint declaration](#) from energy importers and exporters in 2022 called for an international market for fossil energy that minimises flaring, methane, and CO₂ emissions across the supply chain to the fullest extent practicable. Public visibility and scrutiny on emissions from oil and gas supply is also set to increase as the use of satellites and other remote measurement systems and related data becomes more readily available.

A number of companies – including those in the Oil and Gas Climate Initiative – have shown it is possible to make a commitment to [achieve near zero methane emissions](#). Equipment suppliers, petroleum service providers, and project developers are also increasingly adopting [business models that put them effectively in the position of investors](#). Some providers have begun offering the initial capital to deploy reduction technologies with a flexible remuneration model that allows operators to pay them back from the returns over the life of the project. This type of model will be especially relevant for projects that are cost-effective. Where the returns may not cover the initial capital, additional financing may be required.

Private finance can help support robust methane abatement projects

Private sector financing has been a [major source of funding](#) for oil and gas companies in recent years. This suggests that sufficient capital could be available to make the necessary investments in methane abatement, whether through direct financing by commercial banks and private capital funds, or through securities listed on capital markets that are tied to sustainability performance.

Investors and insurers can establish methane performance requirements for future lending, request improvements on disclosure to promote transparency on emissions reporting, and set up underwriting standards that include methane reductions (e.g. [Chubb's insurance coverage](#) is contingent on client adoption of evidence-based plans to reduce methane emissions).

Many private sector banks and funds have their set their own climate goals and some have adopted policies that restrict or limit investment in fossil fuel companies. The NZE Scenario requires a large level of investment into “transition” areas, including methane abatement in the oil and gas sector, that may be precluded by these restrictions. Channels for this investment need to be kept open, although this should not become a loophole for investments that are not aligned with the Paris Agreement or that allow for greenwashing.

New private-sector funds could ensure that finance is available for oil and gas companies that might otherwise struggle to invest in methane abatement measures off their balance sheet, especially those in low- and middle-income countries. Companies would need to signal investment in these categories by setting credible targets aligned with net-zero goals on emissions reductions, measurement, and transparency. This would provide confidence to private financial actors that investment in methane abatement is consistent with their own climate-related commitments.

There are several market-based options available that could potentially be used to finance investment in methane abatement. This includes green bonds, sustainability-linked bonds, and transition bonds, although some standards and taxonomies exclude oil and gas related investments. As a result, it is unclear whether oil and gas companies are eligible to issue green bonds, and by extension, sustainability-linked bonds, under existing international standards. Carbon markets could also provide opportunities to raise finance for methane abatement, although the rapid transition required across the energy sector in the NZE Scenario means the availability and use of offsets should be limited.

Private sector funds often collate financing from multiple companies and actors, and these may have different restrictions and limitations on the types of financing activities they can support. It is therefore essential that the lending conditions for funds are agreed from the outset to ensure its smooth functioning and ability to provide financial support when it is needed.

In all cases, private sector financing of methane abatement needs to be tied to proper technical implementation, operational best practices, and [consistent reporting and measurement of methane emissions](#). Financing instruments should also consider that companies may face barriers to operationalising methane abatement campaigns beyond a lack of capital. These could include a lack of capacity or skills and resources within their organisation. Development of financing instruments should consider these barriers, potentially tying some of the funds to the building of these capacities and pairing them with other forms of support such as training or monitoring frameworks.

Public financing can catalyse private investment and fill gaps where traditional finance struggles

Regulations and policies on methane abatement – including limits on flaring and venting, measurement and reporting requirements, or mandating LDAR – are essential to drive down methane emissions. Public financing, whether directly from governments or through multilateral development banks or philanthropic funds, can also help catalyse private investments and fill in gaps where private sources of finance may not be willing or able to invest at the levels needed.

There have been some examples where governments have made funding directly available to support projects that reduce emissions. For example, Canada's [Emissions Reduction Fund](#) made around USD 610 million available to finance projects to bring down methane emissions and to go beyond what was required in regulations. The United States Inflation Reduction Act created a [Methane Emissions Reduction Program](#) making USD 1.55 billion available to provide financial and technical assistance for methane abatement in the oil and gas sector.

Public financing may be particularly important where private actors would struggle to benefit from abatement, such as reducing emissions from orphaned wells or where the cost of the abatement measure is large relative to the emissions that will be avoided. The [United States](#) has allocated USD 4.2 billion as part of its Methane Action Plan to clean-up and plug orphaned wells and [Canada](#) has announced a similar fund of around USD 1.4 billion.

Public or philanthropic funds can provide financial support in other areas where private funds or banks are less likely to go, such as capacity building and research and technology development. They can also play a role in investing in public goods that can help with methane abatement, such as [funding satellites](#) to monitor methane emissions and detect leaks.

Multilateral development banks and public strategic investment funds could be an important source of financing for methane abatement, especially in cases where de-risking of investment is required. Some of these institutions have announced that they will stop financing oil and gas projects, although it is not clear in all cases if these policies also prohibit funding methane abatement projects that do not otherwise result in an increase in production. Further, even those without this restriction may still be able to provide technical assistance or other support, separate from financing. The World Bank, for example, organises the [Global Gas Flaring Reduction Partnership](#), which provides technical and regulatory support to reduce flaring and methane emissions.

Not all development finance institutions have restrictions on oil and gas financing – including the [African Development Bank](#) and the [Inter-American Development Bank](#). Others, such as the [Asian Development Bank](#) and the [International Finance](#)

[Corporation](#) (IFC), have policies allowing financing of oil and gas projects only under specific circumstances – e.g. support only for mid- and downstream projects. Many of these institutions may still be able to finance mitigation projects under the right circumstances. The IFC, for example, has been able to continue providing financing and advisory services to [methane and flaring reduction projects](#) at existing installations consistent with these limitations.

Even for those with broader restrictions, mechanisms may still be available for them to support methane abatement activities without directly financing reduction projects. For example, the European Bank for Reconstruction and Development (EBRD), which has announced that it would [move away from funding fossil fuels](#), has continued to offer grants directly to governments, including [Kazakhstan](#) and [Uzbekistan](#), to develop methane emissions reduction programmes. National-level strategic investment funds, such as those in China, Nigeria, the United Arab Emirates, Saudi Arabia, and elsewhere have more flexibility to fund projects and could adopt a strategic policy to prioritise them.

Public financing can also help regulators in low- and middle-income countries develop the capacity needed to draft, adopt, and implement new and enhanced regulations. Germany's [Nitric Acid Climate Action Group](#) does this in the context of N₂O abatement, providing both financial support for abatement technologies and support to governments to develop regulatory capacity. Technical assistance through bilateral or multilateral capacity building programmes would also be helpful.

Case studies

There have been several notable efforts in the past to finance methane abatement. Here we examine a selection of examples to draw out lessons that can help inform future financing efforts. This is not intended to be exhaustive, but rather focuses on examples where innovative financing mechanisms have helped to raise funds for mitigation projects, either in the oil and gas sector, or in areas that could hold lessons for oil and gas methane mitigation.

International emissions pricing schemes

The World Bank's [Pilot Auction Facility for Methane and Climate Change Mitigation \(PAF\)](#) was a “pay-for-performance” mechanism that disbursed investment based on the delivery of pre-determined and independently verified results. The PAF used funds from both private and public sources and was backed by several donors, including Germany, Sweden, Switzerland, and the United States. It was not used for oil and gas methane but helped support projects to reduce methane from landfills, animal waste, and wastewater sites.

The PAF used [competitive auctions](#) where companies bid on the right to sell future emissions credits at a price established through the auction. Project developers were then secured a minimum price guarantee for the credits they gained from methane abatement projects. Investors received payment only after achieving independently verified methane emissions reductions. However, the mechanism also allowed investors to sell their bonds to other companies if they could not deliver the required emission reductions, de-risking the investment.

There were a total of [four auctions](#), three that addressed methane abatement from landfills, animal waste, and wastewater sites and one that addressed nitrous oxide emissions from nitric acid production. The auctions had a total budget of USD 62 million with 83 bidders and 41 winners. A total of [USD 54.7 million](#) was paid to investors in exchange for emissions credits, avoiding around 19 Mt CO₂-eq of methane.

Another emissions trading scheme, the [Clean Development Mechanism \(CDM\)](#), provided finance to methane abatement projects in the oil and gas sector, although the impact of the CDM in this sector has been very limited. The CDM allows advanced economies to partially meet their emissions reduction targets by purchasing certified emissions reduction credits from projects in developing countries. Oil and gas methane projects can create these credits through the [recovery and utilisation of associated gas](#) or [LDAR in natural gas facilities](#). There have been 45 of these projects since the inception of the CDM – including in

[Bangladesh](#), [India](#) and [Oman](#) – although only 7 projects have been registered since the crash in the price of CDM credits in 2012. The future of the CDM is uncertain pending the outcome of negotiations under Article 6 of the Paris Agreement.

Lessons learned

The World Bank has explored [the suitability of the PAF model](#) for methane reductions in the oil and gas sector and indicated that it could help remove barriers in the sector. To be most effective, the World Bank highlighted that any future facility would need to carefully consider the size and scale of projects in their design, use existing verification standards for resource saving, and ensure that they are well marketed to attract a wide investor pool. LDAR programmes and equipment investments are likely to be the most suitable project categories for any future replication in the methane abatement for oil and gas sector.

If emissions markets include different types of GHG emissions, a key issue is the conversion rate of one tonne of methane to CO₂ equivalent. There is no universally-recognised standard for this and the specific choice can have large implications for the attractiveness of methane abatement compared with other emissions reduction measures.

The Alberta Emission Offset System: a sub-national emissions pricing scheme that has stimulated new methane abatement financing

In Canada, the province of Alberta has a goal to reduce methane emissions from upstream oil and gas operations by 45% by 2025 (relative to 2014 levels). To meet this goal, Alberta is using a combination of [regulatory requirements](#) and economic instruments to create incentives for companies to reduce emissions. Alberta's regulatory scheme requires companies to implement LDAR programmes, places limits on flaring, and sets specific emissions limits for different types of equipment. If regulated entities can demonstrate that they have reduced their emissions beyond what is required by regulation, they can generate credits under the [Alberta Emission Offset System](#) (AEOS), which can be sold on the open market.

To generate tradeable offsets, companies must be evaluated using Alberta's quantification protocols, undergo a third-party verification process, and be registered in the [Alberta Emission Offset Registry](#). Since its induction, there have been 560 projects in which [operators convert existing pneumatic equipment to more efficient options](#) and 230 projects that [capture or reduce vented gas](#). These have avoided around 9 Mt CO₂.eq methane emissions.

The system encourages third party companies to provide financing for emissions reductions without imposing any direct costs on the asset owner or operator. One

example is the [Methane Reduction Program](#) developed by Bluesource. Bluesource creates a methane reduction plan for a specific site and outsources the installation of equipment and logistics for installing new, lower-emitting equipment. Upfront spending is partly financed by ATB Financial, a public-owned financial institution in Alberta, with projects generating revenue both from selling emissions credits and from selling captured methane that would have otherwise been lost. Once it has recuperated the upfront capital expenditure or the project breaks even, proceeds are shared with other project partners, including the asset owner. Around 200 projects have been developed for 35 companies in Alberta since its creation in 2017, saving around 1.7 Mt CO₂-eq methane emissions.

Lessons learned

The AEOS provides flexibility to oil and gas companies to reduce emissions in a cost-effective manner while fostering innovation and the adoption of new technologies. It is complemented in Alberta by regulatory standards, including both command-and-control requirements and a province-wide emissions-reduction target to ensure reductions are made across the sector.

The AEOS entails some transaction costs, and it requires careful measurement and quantification of savings. However, since it is paired with another climate finance mechanism (the Alberta carbon offset market), it has encouraged specialist businesses and new sources of finance to enter the market as service providers. These providers have been able to assist oil and gas operators that would otherwise struggle to finance the deployment of emissions reduction measures or that do not have the necessary technical expertise or capacity. The specialist providers can significantly reduce financing risks and remove capacity barriers to implementation.

This approach may be of value to companies with limited investment capacity, including NOCs and companies in low- and middle-income countries. Sales of emissions credits also provide an additional source of revenue for technologies that may otherwise struggle to generate a positive rate of return.

Transition bonds and sustainability-linked financing are helping to fill the gap with private funding

Global bond markets are a huge potential source of climate-related financing. They are the largest asset class in global financial markets with more than [USD 110 trillion in value](#) outstanding as of 2021. Green, social, sustainability, and sustainability-linked bonds have been growing as well, reaching [USD 860 billion in 2022](#); within this, there were USD 3.5 billion transition bonds issued in 2022.

These bonds are linked to the sustainability performance of a company or by compliance with external third-party criteria. If the company fails to meet the goals

outlined in the bond issuance, then the interest rate on the bond increases and the company is required to pay more upon maturity. Green bonds are usually tied to specific projects while transition bonds and sustainability-linked bonds tend to be more flexible. There are a number of examples of oil and gas companies using these bonds to raise capital for methane abatement.

- Repsol, the Spanish energy company, issued the first [green bond](#) in the sector in 2017 for EUR 500 million with a five-year maturity. The proceeds were linked to energy efficiency projects and low-emission technologies, including methane emissions mitigation and reductions in flaring, and aimed to avoid around 1.2 Mt CO₂-eq emissions. Following maturity of the bond, the company issued a [Final Report](#) that describes how the proceeds were used to achieve the green bond objectives. The findings were independently verified by a third-party.
- SNAM, the Italian infrastructure company, issued a EUR 300 million [Climate Action Bond](#) in 2019 with a four-year maturity. The bond is being used to help achieve its target to reduce its methane emissions by 40% from 2016 levels by 2030 by replacing old generation heaters and implementing a campaign for identifying and repairing methane leaks.
- Cadent Gas, the UK gas distribution company, issued a [transition bond](#) in 2020 for EUR 500 million with a 12-year maturity. It is being used to retrofit and repair the company's gas distribution networks to reduce methane leakage.
- Eni, the Italian oil and gas company, issued a sustainability-linked bond for EUR 1 billion with a 7-year maturity. The bond was issued for general corporate purposes but is linked to the company's achievement of two Sustainability Performance Targets: increasing installed renewable energy capacity and lowering net GHG emissions from upstream activities. Activity under the bond is outlined in the company's [Sustainability-linked Financing Framework](#), which includes methane emissions reductions.

Lessons learned

The potential of climate bonds to finance methane abatement is substantial but their effectiveness is heavily dependent on the robustness of the frameworks to which they are linked. To ensure measurable reductions, the use of proceeds needs to be tied to credible and clear performance indicators that can be objectively and independently evaluated. External auditors can help by reviewing plans before a bond is issued and verifying that objectives have been met when it matures.

There has been some criticism about the labelling of these bonds as green, transition, or sustainability-linked. Discussions are ongoing in this area and the Climate Bonds Initiative (CBI), an international organisation working to mobilise

global capital for climate action, released a [Green Bond Database Methodology](#) in 2022 that lists methane LDAR as an investment category that requires further review.

Financial taxonomies can provide guidance around best practices for investors and bond issuers. These can encourage debt market financing for methane abatement by providing a tool to investors and bond issuers while ensuring that goals for methane emission reduction are clearly defined and implemented. Many current taxonomies do not specifically allow financing for methane abatement in the areas where it could be most relevant and impactful.

Canada's Emissions Reduction Fund: direct public funding for emissions reduction projects

The [Emissions Reduction Fund](#) in Canada provides funding through repayable and non-repayable contribution agreements from the government to companies to undertake oil and gas methane mitigation projects. The USD 610 million fund had [two key objectives](#): to ensure continued progress on methane emissions mitigation and to maintain jobs for oil and gas workers. Funding was available in three intake rounds from 2020 to 2022 to onshore and offshore oil and gas companies for methane abatement projects to be completed by March 2024.

The [funding](#) for onshore operations was distributed through partially repayable contribution agreements to be repaid over five years that could cover up to 75% of eligible costs of a project. The percentage of the contribution that the company is required to repay is based on the per tonne cost of abatement: projects with lower abatement costs are required to pay back a smaller percentage of the initial contribution. Companies receiving funds are ineligible to retain any emissions credits generated by the project, although companies that chose to forgo the partial repayment could then retain any generated credits.

93 projects were funded from 28 companies in the first two funding rounds for the onshore programme, with most projects implementing reductions that went beyond the minimum levels required by regulations. Natural Resources Canada [estimated](#) that these projects avoided 4.7 Mt CO₂eq of methane in the first year. The results are subject to change pending the final assessment of the programme.

All companies receiving funding under the programme are [required to install meters to continuously track](#) the amount of emissions avoided by the projects. Companies are required to report this data annually for five years to enable the validation of emissions reductions. Natural Resources Canada will release the aggregated data publicly.

Lessons learned

Direct public funding for emissions abatement can help mobilise the industry and reduce potential regulatory costs. In the Canadian context, when the fund was announced, the federal and provincial governments had forthcoming compliance deadlines and the funding helped companies meet – and go beyond – their regulatory obligations.

Governments are often reluctant to provide direct funding to the oil and gas industry, and those that exist are often in the context of abandoned or orphaned wells. To mitigate these difficulties, the Emissions Reduction Fund tied performance to going above and beyond compliance and the government justified the measure in part as an effort to maintain jobs in the industry at a time of low prices.

By providing repayable and non-repayable contributions, the fund helps to offset a large portion of the upfront cost of abatement projects. The option to forego the partially repayable portion of the contribution in exchange for the right to keep any generated emissions offsets helps to ensure that companies still have an incentive to access alternative sources of financing.

The funding includes a clear requirement and mechanism to quantify emissions reductions and ensure additionality. The requirement that companies must measure and annually report emissions reductions achieved will help to improve the state of data. There were still questions, however, from lawmakers in Canada about [how emissions reductions were quantified](#), particularly for estimates of reductions that were additional to regulatory requirements. The [government has committed](#) to publish a report in mid-2023 with additional details on this.

Technical annex

Our estimates of methane emissions from oil and gas operations rely on generating country-specific and production type-specific emission intensities that are applied to production and consumption data on a country-by-country basis. More information about the approach taken is available in the IEA's [Global Methane Tracker Documentation](#). Emissions from onshore, offshore, unconventional oil and gas production, and downstream operations are allocated to 91 equipment-specific sources. This is generally based on proportions from the United States, with modifications made for countries where other information is available, including discussions with relevant stakeholders.

Abatement costs for methane emissions from oil and gas production are also based on the IEA's [Global Methane Tracker](#). Our approach looks to reconcile all available information in a consistent manner, recognising that there is relatively limited publicly available data on methane mitigation costs globally.

A total of 45 options are available to reduce methane emissions, each with an applicability and reduction potential, capital and operational costs, and technical lifetime. Costs are based upon information for the United States modified according to labour costs within each country, whether the equipment is imported or manufactured domestically (which impacts the capital costs and whether import taxes are levied), and other country-specific or region-specific information.

Emission levels in the NZE Scenario take into account changes over time in oil and gas supply in each country, with abatement measures deployed gradually over time until the current technical abatement is achieved in full by 2030. All non-emergency flaring is eliminated by 2030 in the NZE Scenario, reducing methane emissions due to the incomplete combustion of natural gas in flares.

Natural gas is a valuable product and methane recovered through some measures can be sold. These measures can therefore result in overall savings if the value of the methane sold is greater than the cost of deploying the measure. The value of the methane captured is based on well-head prices consistent with the gas price trajectory of the NZE Scenario in each country. Costs and savings examine methane abatement from a global, societal perspective meaning that well-head gas prices can be substantially different from subsidised domestic gas prices. No external emissions prices are included in the estimates of costs and savings. A rate of 8% is used to discount costs and savings over the lifetime of each abatement measure when calculating net present values.

Region	Income bracket	Emissions in 2022 (Mt)	Spending to 2030 (billion USD)	Majors (billion USD)	NOCs (billion USD)	Others (billion USD)
North America		18	24.3	1.0	1.1	22.2
Canada	High	2	2.6	0.1	0.1	2.4
United States	High	14	20.9	0.9	0.2	19.8
Mexico	Upper-middle	1	0.8	0.0	0.8	0.1
Central and South America		6	5.7	0.4	3.7	1.6
Colombia	Upper-middle	0	0.2	0.0	0.1	0.1
Brazil	Upper-middle	1	1.2	0.1	0.8	0.3
Argentina	Upper-middle	1	1.1	0.1	0.4	0.6
Ecuador	Upper-middle	0	0.2	0.0	0.2	0.0
Trinidad and Tobago	High	0	0.2	0.0	0.0	0.2
Venezuela	Low	3	2.4	0.1	2.0	0.2
Europe		2	2.0	0.4	0.8	0.9
Romania	High	0	0.3	0.0	0.3	0.0
United Kingdom	High	0	0.2	0.0	0.0	0.1
Ukraine	Lower-middle	0	0.2	0.0	0.1	0.1
Africa		9	6.8	0.9	4.1	1.8
Algeria	Lower-middle	3	2.3	0.1	1.9	0.2
Egypt	Lower-middle	1	0.8	0.2	0.2	0.4
Libya	Upper-middle	2	1.3	0.2	0.9	0.2
Angola	Lower-middle	1	0.2	0.1	0.1	0.1
Congo	Lower-middle	0	0.1	0.0	0.0	0.0
Gabon	Upper-middle	0	0.1	0.0	0.0	0.1
Nigeria	Lower-middle	2	1.5	0.3	0.7	0.5
Middle East		16	13.3	0.7	11.2	1.5
Iran	Lower-middle	6	4.0	0.0	4.0	0.0
Iraq	Upper-middle	3	1.5	0.2	0.9	0.3
Kuwait	High	1	1.5	0.0	1.5	0.0
Oman	High	1	0.8	0.1	0.1	0.5
Qatar	High	1	1.0	0.2	0.7	0.2
Saudi Arabia	High	3	2.6	0.0	2.6	0.0
Syria	Low	0	0.2	0.0	0.2	0.0
UAE	High	1	1.3	0.2	0.9	0.2
Eurasia		21	17.3	0.6	11.1	5.6
Russia	Upper-middle	13	12.9	0.0	7.8	5.0
Azerbaijan	Upper-middle	0	0.2	0.0	0.1	0.1
Kazakhstan	Upper-middle	2	1.4	0.5	0.6	0.3
Turkmenistan	Upper-middle	5	2.3	0.0	2.2	0.1
Uzbekistan	Lower-middle	1	0.5	0.0	0.3	0.2

Region	Income bracket	Emissions in 2022 (Mt)	Spending to 2030 (billion USD)	Majors (billion USD)	NOCs (billion USD)	Others (billion USD)
Asia Pacific		8	7.6	0.4	4.0	3.2
Australia	High	1	0.5	0.0	0.0	0.4
China	Upper-middle	3	2.7	0.0	2.0	0.7
India	Lower-middle	1	0.8	0.0	0.5	0.4
Indonesia	Lower-middle	1	1.0	0.1	0.4	0.5
Malaysia	Upper-middle	0	0.2	0.0	0.1	0.1
Thailand	Upper-middle	0	0.3	0.0	0.2	0.1
Bangladesh	Lower-middle	0	0.3	0.2	0.1	0.0
Pakistan	Lower-middle	0	0.7	0.0	0.4	0.3
World		80	77	4.3	35.9	36.8
High-income		26	33.7	1.9	6.8	25.0
Upper-middle income		34	26.8	1.3	17.3	8.2
Lower-middle income		17	13.4	1.0	9.1	3.2
Low-income		3	3.2	0.1	2.7	0.4

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