Global Energy Monitor

BRIEFING: APRIL 2024

Mixed messages: New oil and gas extraction areas raise the stakes for methane abatement

Introduction

The world's oil and gas producers have proposed at least seventy-four extraction projects scheduled to go into operation and reach peak production by 2030, according to new data and analysis from Global Energy Monitor (GEM). These projects have the potential to emit 2.4 million metric tonnes of methane annually — nearly the entire fossil fuel production sector in Europe — at a time when deep cuts in methane emissions are necessary to mitigate climate change.

The Global Methane Pledge (GMP) has heightened the stakes for new sources of methane, with 157 countries and the European Union (EU) committed to slash global methane emissions by 30% before the end of the decade. But upcoming oil and gas extraction projects could amount to 3% of 2023 methane emissions from oil and gas production, if they operate using current practices. Under that scenario, countries and operators would need to make steeper cuts in emissions elsewhere to stay on track with the GMP and climate targets.

Additionally, GEM has found that operators which have reported emissions to the United Nation's flagship Oil and Gas Methane Partnership 2.0 (OGMP 2.0) have in-development projects with larger potential emissions than their company-wide figures. This potential underreporting of emissions aligns with the OGMP 2.0's own observation that their 2022 data only accounts for 2% of total methane emissions from the oil and gas industry. Our analysis highlights how underreporting of assets and/or discrepancies in methane intensity could be responsible for the gap.

The International Energy Agency (IEA) has determined that deep decarbonization and methane abatement are necessary to limit warming to 1.5 degrees Celsius under the Paris Climate Agreement. Although "there is no need for investment in new fossil fuel supply" in a Net Zero pathway according to the IEA, GEM recently documented the extent to which major oil and gas producers continue to sanction new projects and explore for new fields.

GEM's analysis provides a first-of-its-kind assessment of global oil and gas methane emissions under development, relying on project data in its Global Oil and Gas Extraction Tracker (GOGET) in combination with oil and gas emissions estimates from its newly released Global Methane Emitters Tracker (GMET), which adapts the Oil Climate Index Plus Gas (OCI+). While detailed equipment-level inventories for projects under development are typically unavailable or proprietary, and direct monitoring is impossible for unbuilt infrastructure, GEM has provided an assessment of potential methane emissions from proposed projects using publicly available information (read the full methodology on page 11).

Key findings:

- Seventy-four new oil and gas projects could emit 2.4 million tonnes of methane annually before 2030.
- Half of those emissions come from just twelve oil and gas fields under development, and over 30% come from four fields in Saudi Arabia and two fields in Guyana.
- Most projects under development are operated by companies or located in countries which have already committed to the Global Methane Pledge, posing a risk to reduction efforts.
- The majority of the top 20 operators pursuing new projects did not provide data to the latest publicly available disclosure report by the International Methane Observatory (IMEO)'s Oil and Gas Methane Partnership (OMGP) 2.0 (2023), a voluntary partnership working to improve measurement and disclosure of methane emissions.
- Every oil and gas company which reported data to the OGMP 2.0 in 2023 provided company-wide emissions that were less than the potential emissions from their projects under development. For some companies, the estimates GEM has made of their fields in development are up to thirteen times larger than the company-wide emissions reported to OGMP 2.0.
- The new European Union regulations that require methane monitoring, disclosure, and abatement from imported oil and gas would likely affect many fields under development. Every field examined here either imports to or is located within an EU member state.

Background

Methane is a short-lived greenhouse gas with an outsized capacity to accelerate global climate change. Despite only remaining in the atmosphere for twelve years, methane has 82.5 times the heat-trapping capability of CO2 when averaged over 20 years, and 29.8 times more when averaged over 100 years (this is referred to as its CO2 equivalent, or CO2e20, or CO2e100). In 2021, a team of scientists led by the Environmental Defense Fund (EDF) determined that reducing methane emissions could mitigate global warming by 30%, preventing 0.5 degrees Celsius of temperature rise by the century's end.

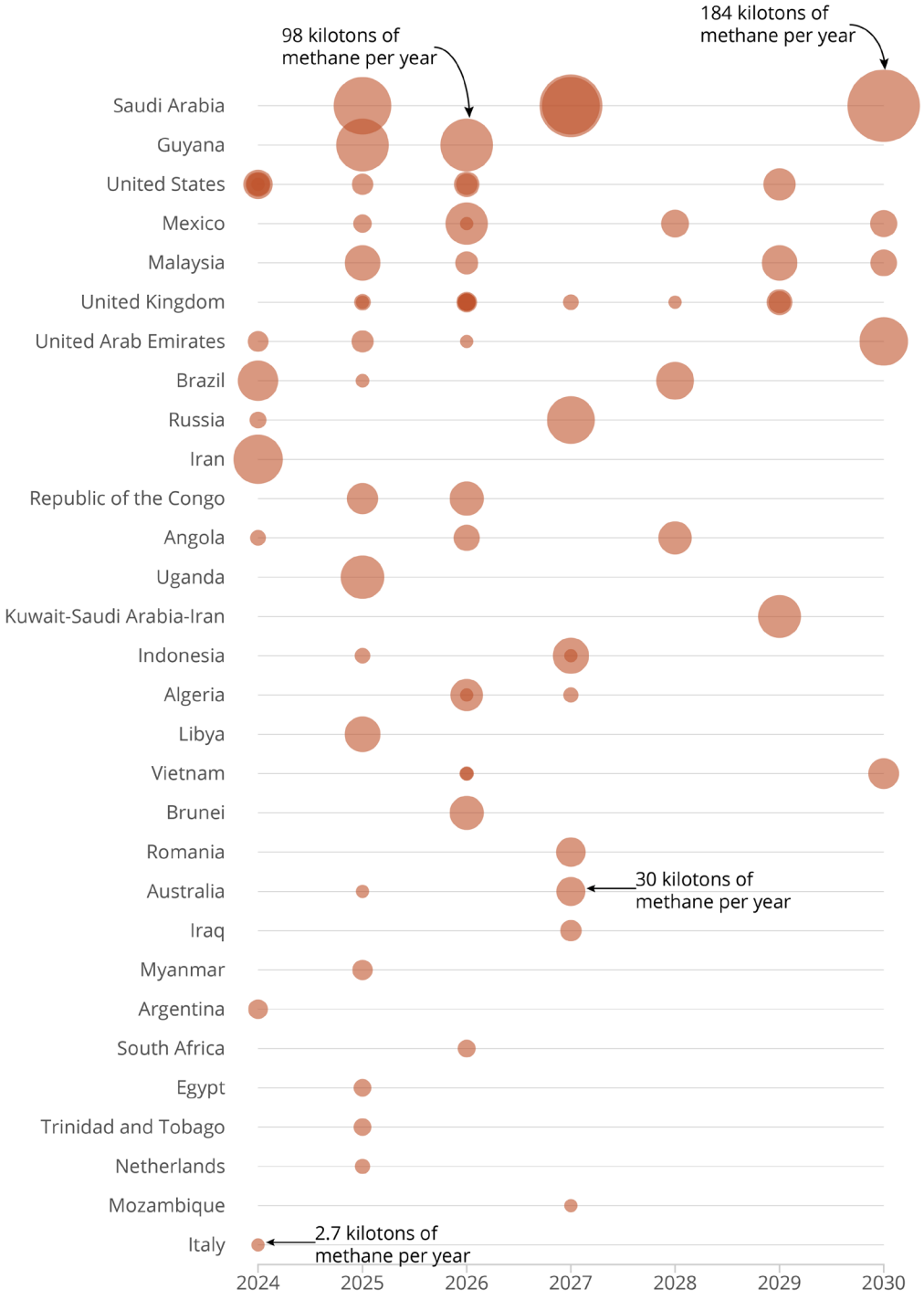
The fossil fuel sector accounts for almost 34% of human-induced methane emissions, according to the IEA, amounting to approximately 120 million metric tons of methane emitted in 2023. As of 2024, 157 countries and the EU have signed the Global Methane Pledge (GMP) to collectively reduce global methane emissions by 30% by 2030. The UN's International Methane Emissions Observatory likewise introduced the OGMP 2.0 in 2022. The OGMP 2.0 is a voluntary partnership between oil and gas producers, United Nations and intergovernmental stakeholders, and major environmental non-governmental organizations working to improve measurement and disclosure of methane emissions.

Top fields: Where are new sources of potential emissions?

Just twelve oil and gas fields account for the majority of potential methane emissions from projects sanctioned and under development. While none of these fields individually rank in the top 20 oil and gas extraction areas for methane emissions worldwide, they collectively could contribute concerning amounts of methane.

A third of all potential methane emissions analyzed could come from oil and gas fields in Saudi Arabia and Guyana

Estimated annual methane emissions in kilotons, by proposed oil and gas fields based on expected peak production year; circles sized by estimated emissions



Source: Global Methane Emitters Tracker, Global Energy Monitor
Note: Does not include 77 fields beginning production before 2030 which do not report production design capacity data.

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The Jafurah oil and gas field in Saudi Arabia ranks top of the list and is also likely the largest shale gas development outside of the United States. In 2020, the unconventional field was reported to need upwards of $110 billion to begin operating, representing a major investment in expanding fossil fuel production. Two Guyanese fields, Uaru and Yellowtail, represent ExxonMobil's largest buildout of oil and gas extraction outside of the Permian basin in the United States. In 2023, ExxonMobil lost a lawsuit in Guyana that would have limited its commitments to clean up potential spills. Hail and Ghasha, in the United Arab Emirates, ranked eighth on this list, has been promoted by the Abu Dhabi National Oil Company (ADNOC) as its first "net-zero emissions" gas project. This moniker has been met with criticism, as ADNOC is not counting emissions from end-use combustion of the gas, nor the methane escaping from across its supply chain. (The estimates in this report only include the upstream segment and do not consider emissions from processing, transport, or end-uses.)

Table 1. Top 20 in-development fields slated to reach peak production by 2030

Field Name	Methane (metric tons)	Year the field is expected to reach its production design capacity	Operator	Country
Jafurah	184,000	2030	Saudi Aramco	Saudi Arabia
Safaniya Expansion	139,000	2027	Saudi Aramco	Saudi Arabia
Zuluf Expansion	117,000	2027	Saudi Aramco	Saudi Arabia
Marjan Expansion	116,000	2025	Saudi Aramco	Saudi Arabia
Uaru	97,60	2026	ExxonMobil	Guyana
Yellowtail	97,600	2025	ExxonMobil	Guyana
Kish	85,400	2024	Iranian Offshore Oil Company	Iran
Hail and Ghasha	82,400	2030	Abu Dhabi National Oil Company	United Arab Emirates
Kamennomysskoye-Sea	80,100	2027	Gazprom	Russia
Lake Albert Development	66,600	2025	TotalEnergies & CNOOC	Uganda
Dorra	64,600	2029	Khafji Joint Operations	Kuwait-Saudi Arabia-Iran
Zama	63,000	2026	PEMEX	Mexico
Bacalhau	57,600	2024	Equinor	Brazil
BM-C-33	50,30	2028	Equinor	Brazil
Gendalo-Gehem	46,000	2027	Eni S.P.A.	Indonesia
Bahr Es Salam (Structures A&E)	44,800	2025	Mellitah Oil & Gas	Libya
Kasawari	44,400	2025	Petronas Carigali	Malaysia
Rosmari-Marjoram	44,400	2029	Sarawak Shell Berhad	Malaysia
Litchendjili (Phase 3)	40,900	2026	Eni S.P.A.	Republic of the Congo
Geronggong-Jagus East	40,800	2026	Brunei Shell Petroleum	Brunei

Top operators: Who could emit new sources of methane?

The majority of the operators pursuing new projects do not have data included in the latest IMEO report on the OGMP 2.0.

While the OGMP 2.0 produces company level methane emissions estimates for the public, the asset-level inventories and measurements underlying those estimates are not disclosed. However, for every company which reported data to the OGMP 2.0 in time for the 2023 report, the methane emissions estimated are larger than the company-wide emissions the operators reported in 2022.

The discrepancy could signal a combination of underreporting of assets to the OGMP 2.0 and/or methodological differences in emissions estimates. The IMEO itself acknowledges this variance, and describes in its 2023 report that the 2022 OGMP 2.0 data only accounts for 2% of methane emissions from the oil and gas sector. The coming year will be critical for teasing out the sources of these discrepancies within OGMP 2.0, as roughly half of member companies are expected to report actual measurement data, as opposed to emissions factor-based estimates.

Discrepancies in reported emissions

The production design capacity of Eni's four in-development fields described is less than 20% of the company's self-reported annual production (on an operated basis) for 2022: 110 million barrels of oil equivalent (BOE) per year, in comparison with 980 million BOE per year.

But GEM estimates that these four fields could emit nearly 2.75 times the methane emissions that the company reported to the OGMP 2.0 for 2023 (124,000 tonnes as compared to 45,120 tonnes.)

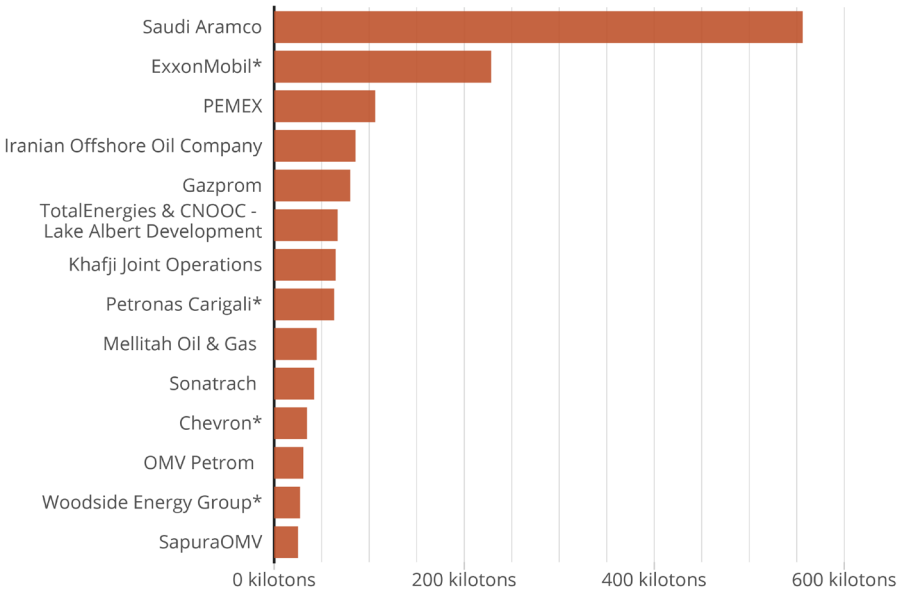
Eni reported 45,120 tonnes of emissions with 980 million BOE yield, which suggests a total methane intensity of 0.046 kg methane/BOE. This value is more than four times smaller than the smallest upstream methane intensity value for any field in OCI+ in 2022 (the median upstream methane intensity in OCI+ in 2022 was 0.85 kg/BOE). While Eni is certainly not the only company with these discrepancies, many companies do not report their annual production on an operated basis in addition to an equity basis. Equinor does, however, and reported an estimated annual production of 457 million BOE in 2022. Using its 9,910 tons of methane reported to the OGMP 2.0, Equinor's company-wide methane intensity would be 0.02 kg methane/BOE.

The potential annual amount of methane represented here for a small number of in-development fields greatly surpasses the company-wide values recently reported by their operators. This finding also suggests that there are large amounts of methane emitted by these operators which are not currently publicly reported and/or attributed. GEM's emissions factors are conservative with respect to OCI+: As detailed in the methodology section, the median emissions factor used in this report was 0.75 kg methane/BOE, lower than the median upstream emissions factor in OCI+.

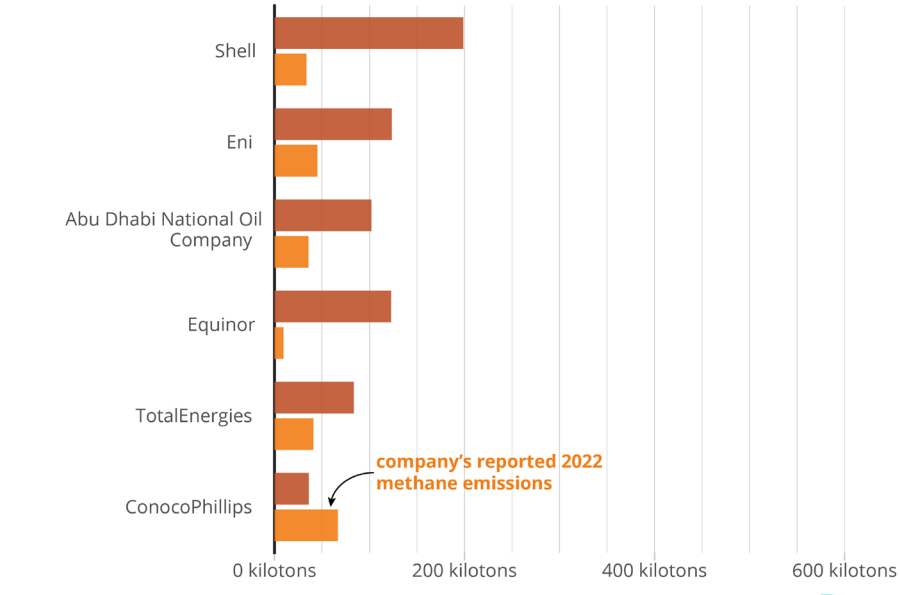
Which operators could emit the most methane from oil & gas fields in development?

Estimated methane emissions in kilotons based on project operator, from 74 oil and gas fields in development analyzed by Global Energy Monitor

Operators pursuing new projects that **did not** report data to International Methane Observatory for 2023 report



For almost all operators pursuing new projects that **did** report data to the International Methane Observatory, the potential methane emissions from select fields in development were larger than previous company-wide figures reported



Source: Global Methane Emitters Tracker

* Operators that joined the Oil and Gas Methane Partnership 2.0 after the International Methane Observatory 2023 report.

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Table 2. Top 20 operators with in-development assets slated to reach peak production by 2030

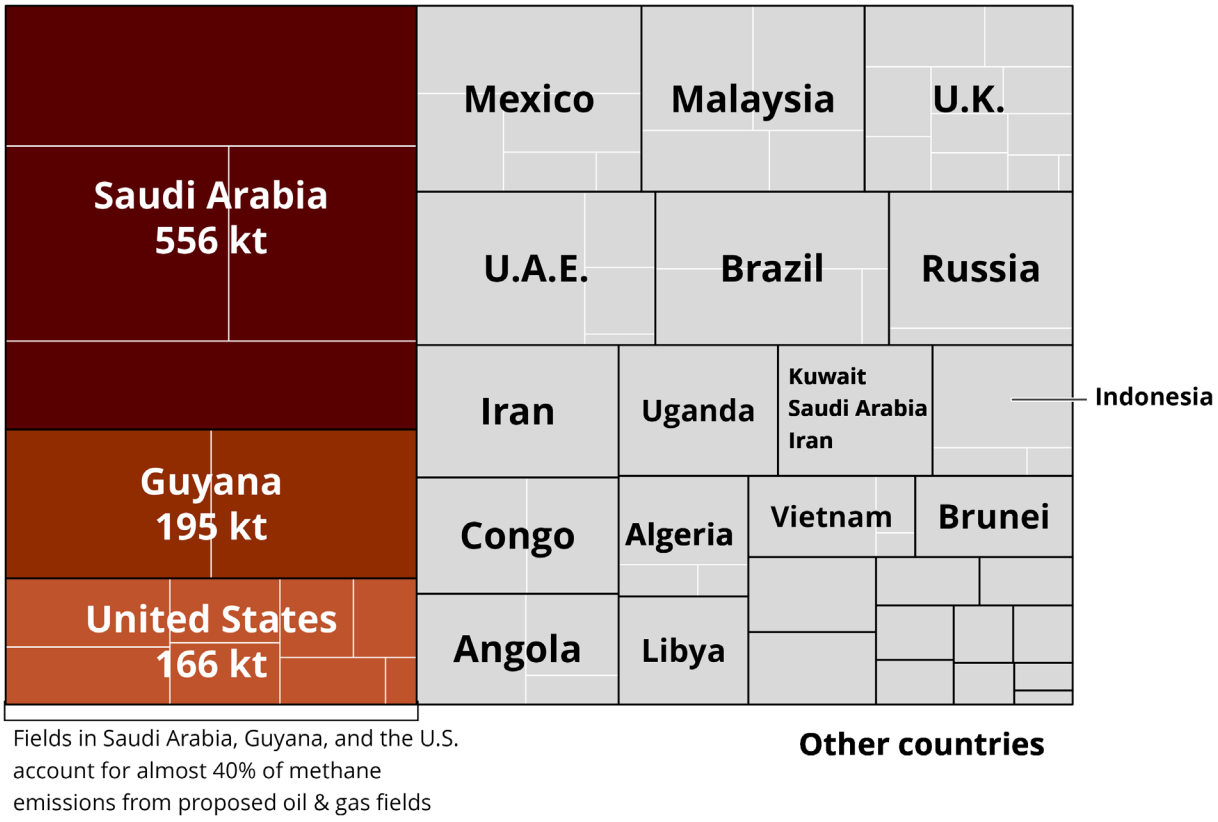
Operator	Methane (metric tons)	Number of fields	2022 Company-wide methane emissions, as reported to OGMP 2.0 (metric tons)
Saudi Aramco	556,000	4	Non-member
ExxonMobil	228,00	3	Joined after report
Shell plc	199,000	9	33,600
Eni S.P.A.	124,000	4	45,120
Equinor	123,000	3	9,440
PEMEX	106,000	4	Non-member
Abu Dhabi National Oil Company	102,000	3	35,740
Iranian Offshore Oil Company	85,400	1	Non-member
TotalEnergies	83,600	6	40,960
Gazprom	80,100	1	Non-membe
TotalEnergies & CNOOC - Lake Albert Development	66,600	1	JV with TotalEnergies (member) and CNOOC (non-member)
Khafji Joint Operations	64,600	1	JV with ADNOC (member) and Kuwait Gulf Oil Company (non-member)
Petronas Carigali	63,000	2	Joined after report
Mellitah Oil & Gas	44,800	1	Non-member
Sonatrach	41,900	2	Non-member
ConocoPhillips	36,100	1	66,800
Chevron	34,400	2	Joined after report
OMV Petrom S.A.	30,600	1	Non-member
Woodside Energy Group	27,200	2	Joined after report
SapuraOMV	25,000	1	Non-member
Azule Energy	24,200	1	Joined after report

Top countries: What's the potential impact on the Global Methane Pledge?

Nearly all of the top ten countries are signatories of the Global Methane Pledge, with the exceptions of Russia, Iran, Uganda, and Brunei. For many of these countries, the potential methane emissions from their new fields are substantial in comparison with the total amounts of methane emissions from their entire oil and gas production sectors in 2023, per the IEA. (E.g., Saudi Arabia's fields in development analyzed here could emit 24% of its 2023 oil and gas production emissions. For Guyana — 287%, for the United States — 1.5% for Mexico — 12%, for Malaysia — 21%, and for the United Kingdom — 107%). These countries in particular will need to make major cuts in methane emissions in other sectors or strongly improve the methane abatement from their oil and gas production processes in order to meet their agreements under the Global Methane Pledge.

Almost 40% of all methane emissions from proposed oil and gas fields could come from three countries

Estimated annual methane emissions in kilotons (kt), by oil and gas fields in development reporting production design capacity data



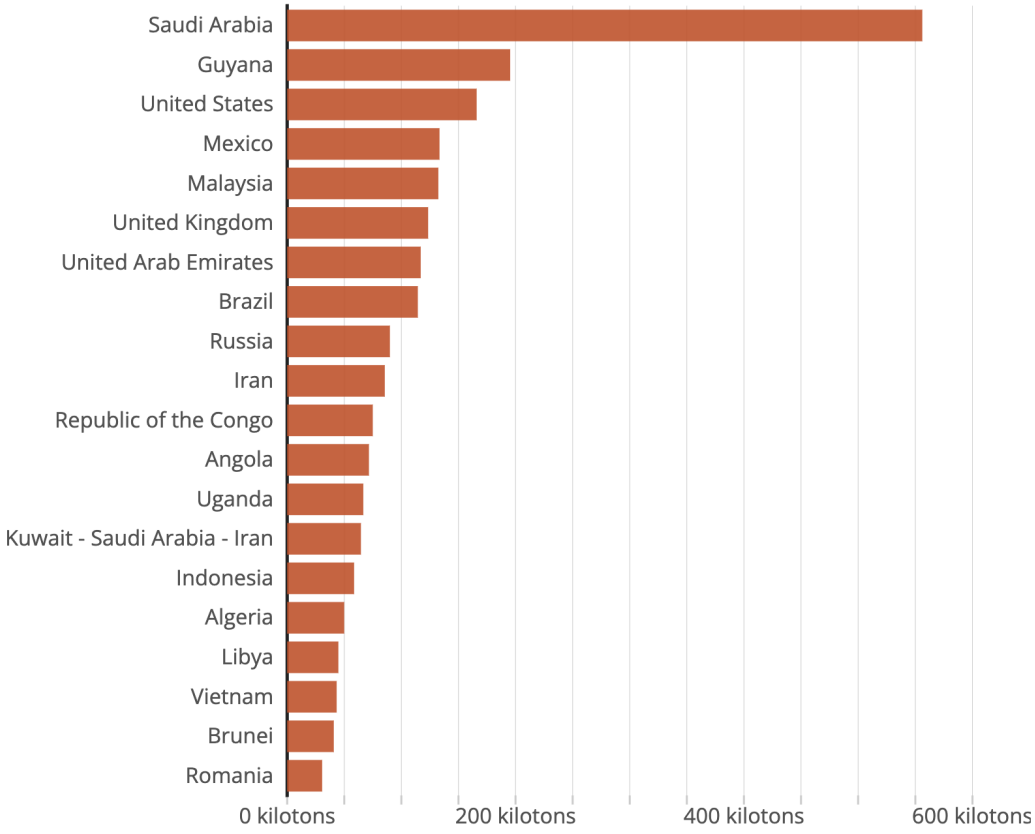
Source: Global Methane Emitters Tracker, Global Energy Monitor

The majority of countries with oil and gas projects under development export oil or natural gas to the EU or are a member state (Romania). In 2023, the EU adopted a new set of methane regulations which phase-in requirements for enhanced monitoring, disclosure and leak repair, super-emitter rapid-response, as well as maximum methane intensity values. These regulations will affect operations both within and importing to the EU, though on different timeframes. The new rules are expected to have a major impact on global methane emissions, reducing global emissions in the oil and gas sector by 30%. Nonetheless, 52 new fields in development in EU importer countries will reach peak production before 2027, the year when EU importers will be subject to the same monitoring, disclosure, and repair standards as EU fields.

None of the fields operating outside of the EU are subject to the regulation's bans on routine flaring and venting, though they must meet methane intensity performance standards by 2030. GEM estimates that these fields could contribute an annual 1.3 million metric tonnes by the start of 2027 if they continue current operational practices.

Which countries could emit the most methane from oil & gas fields in development?

Estimated methane emissions in kilotons in the top 20 countries, from 74 oil and gas fields in development analyzed by Global Energy Monitor



Source: Global Methane Emitters Tracker •
Note: Of the countries above, all except Russia, Iran, and Uganda are signatories of the Global Methane Pledge.

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Table 3. Top 20 countries with in-development assets slated to reach peak production by 2030

Country	Methane (metric tons)	Number of fields)	Signatory of the Global Methane Pledge?
Saudi Arabia	556,000	4	Yes
Guyana	195,000	2	Yes
United States	166,000	8	Yes, Champion
Mexico	133,000	5	Yes
Malaysia	132,000	4	Yes
United Kingdom	123,000	11	Yes
United Arab Emirates	117,000	4	Yes
Brazil	114,000	3	Yes
Russia	89,900	2	No

Iran	85,400	1	No
Republic of the Congo	74,900	2	Yes
Angola	71,600	3	Yes
Uganda	66,600	1	No
Kuwait-Saudi Arabia-Iran	64,600	1	Kuwait & Saudi Arabia: Yes; Iran: No
Indonesia	58,600	3	Yes
Algeria	49,900	3	Yes
Libya	44,800	1	Yes
Vietnam	43,300	3	Yes
Brunei	40,800	1	No
Romania	30,600	1	Yes

Methane abatement: What's at stake?

The scientific, technological, and political landscape around methane abatement is evolving rapidly. New public and NGO-led satellites offer unprecedented transparency in methane emissions, including the ability to rapidly detect super-emitters. Simultaneously, advances in leak detection and repair and other mitigation technologies have made methane abatement one of the most cost-effective and rapid levers for slowing global climate change. According to the IEA, application of these technologies at no or low net-cost can reduce methane emissions from the fossil fuel sector by 30%. Implementing full abatement with available technology can be done at 20 USD/ton of CO2e, and would stave off 0.09 degrees Celsius of warming by mid-century, in comparison to the IEA's Stated Policies Scenario (STEPS), which builds off actually implemented energy policies and those under development, rather than pledges.

With respect to the fields investigated in this report, it is reasonable to assume that methane emissions factors will decrease over the coming years, especially with the new EU regulations. At COP28, 50 oil and gas companies pledged to achieve "near zero" methane emissions and eliminate routine flaring by 2030, though the pledge is legally non-binding. Based on the STEPS scenario, the application of methane abatement technologies is expected to reduce methane emissions by 40% by 2050, even as the IEA projects fossil fuel production to decrease only slightly. Nonetheless, only full abatement, in addition to deep declines in fossil fuel demand (80% in oil and natural gas, and 90% in coal) can keep warming to 1.5 degrees Celsius. The projects in development that are modeled threaten progress made by improvements in methane mitigation.

Conclusion

A flurry of in-development oil and gas projects add pressure to efforts to reduce methane emissions in accordance with the Global Methane Pledge. Methane management requires accurate measurement, and there are large discrepancies between data reported to the OGMP 2.0 and peer-reviewed estimates of methane emissions from the oil and gas sector. Even as some companies have committed to emissions reductions and improvements in their monitoring and abatement regimes, new oil and gas projects add unnecessary and risky fuel to the fire of climate change mitigation.

Methodology

Fields in development were identified in a preliminary version of GEM's Global Oil and Gas Extraction Tracker, which includes data on field status and when fields are expected to reach peak production. Importantly, GOGET includes data on 77 other fields in development which are expected to begin production before 2030. These were not included in this analysis because they do not report their production design capacity: Either the fields do not publicly report any production data at all, or they provide a reserve figure which is incompatible with an annual emissions estimate.

The production design capacity figures were multiplied against proxy emissions factors identified in OCI+. Specifically, we selected the OCI+ emissions factor for upstream methane intensity, in order to directly represent emissions from production, rather than from processing or transport. Proxy emissions factors were chosen for two reasons: 1) Broadly, OCI+ does not contain data on fields in development 2) As detailed in the methodology for the Global Methane Emissions Tracker, fields in the OCI+ database do not always share a definition with GOGET, though alignment is high in conventional fields outside the U.S. and Canada. 3) Running the models underlying OCI+ requires inputs which are not generally publicly available for fields in development.

Proxies were selected on a few bases. First, if the GOGET asset was an expansion of an existing asset in the OCI+ database (e.g. the GOGET unit "Zuluf Expansion" and the OCI+ unit "Zuluf"), then the emissions factor for the existing OCI+ asset was used. Name matches were also confirmed to be in close (~5 km) geographic proximity. If a GOGET asset was not matched by name to an OCI+ asset, it was matched manually by a combination of location, resource type (e.g. oil, gas, or condensate), and operator. The list of proxy emissions factors used can be found here. Only two of these GOGET fields were in countries without an OCI+ asset and without an OCI+ asset in the region with the same operator. For these assets a generic emissions factor well below average for the region was used, in order to hew to a conservative approach.

The fields described here produce a mix of oil, gas, and condensate. Volumes for natural gas were converted to barrels of oil equivalent (BOE) using the Statistical Review of World Energy conversion factors. Barrels of condensate (or "oil and condensate") were treated as BOE without further conversion.

There are two main limitations with respect to GEM's approach. The first is that methane leaks are stochastic. Production doesn't necessarily scale with methane emissions: Low-producing wells can emit disproportionate amounts of methane. The equipment- and component-level statistical models underlying OCI+ can match top-down estimates at the field scale. However, many of the key inputs necessary for running OCI+ (well counts, methane mole fraction, gas-to-oil ratio, and others) are often proprietary, particularly outside of the United States. It is reasonable to assume that many of the OCI+ fields GEM has chosen as proxies differ from the GOGET assets in development in these key dimensions. The second main limitation is that GEM chose the latest available emissions factors in OCI+ based on current operational practices — typically from 2022. As discussed above, it is likely that emissions factors across the oil and gas industry as a whole will improve over time.

On the other hand, this particular methodology lends multiple strengths to GEM's analysis. First, it highlights how and where companies and governments may be attempting to trade methane abatement for infrastructure transitions. In this respect, drawing attention to individual assets can highlight potential for carbon lock-in. That is, even as macroeconomic indicators suggest that demand is peaking for oil and gas, plans for new oil and gas fields trouble the idea that this peak will necessarily result in reduced extraction. These asset-scale, back-of-the-envelope estimations of methane from planned

projects underline the need for both methane mitigation and decarbonization.

More information on GEM's methane related data and analyses can be found on the Global Methane Emitters Tracker (GMET) landing page. GMET provides estimates of fossil fuel emissions at oil and gas and coal extraction sites, natural gas transmission pipelines, proposed projects and reserves, and attribution of remotely-sensed methane plumes. Data underlying this report can be found separately at here.

Background on Global Energy Monitor

Global Energy Monitor (GEM) develops and analyzes data on energy infrastructure, resources, and uses. We provide open access to information that is essential to building a sustainable energy future. Follow us at www.globalenergymonitor.org and on Twitter/X @GlobalEnergyMon.

About the Global Methane Emitters Tracker

The Global Methane Emitters Tracker (GMET) provides estimates of fossil fuel emissions at oil and gas and coal extraction sites, natural gas transmission pipelines, proposed projects and reserves, and attribution of remotely-sensed methane plumes.

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