RMI

Mission Critical Methane

Aligning Policies and Markets to Cut Oil and Gas Emissions

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About RMI

RMI is an independent nonprofit, founded in 1982 as Rocky Mountain Institute, that transforms global energy systems through market-driven solutions to align with a 1.5°C future and secure a clean, prosperous, zero-carbon future for all. We work in the world's most critical geographies and engage businesses, policymakers, communities, and nongovernmental organizations to identify and scale energy system interventions that will cut greenhouse gas emissions at least 50 percent by 2030. RMI has offices in Basalt and Boulder, Colorado; New York City; Oakland, California; Washington, D.C.; and Beijing.

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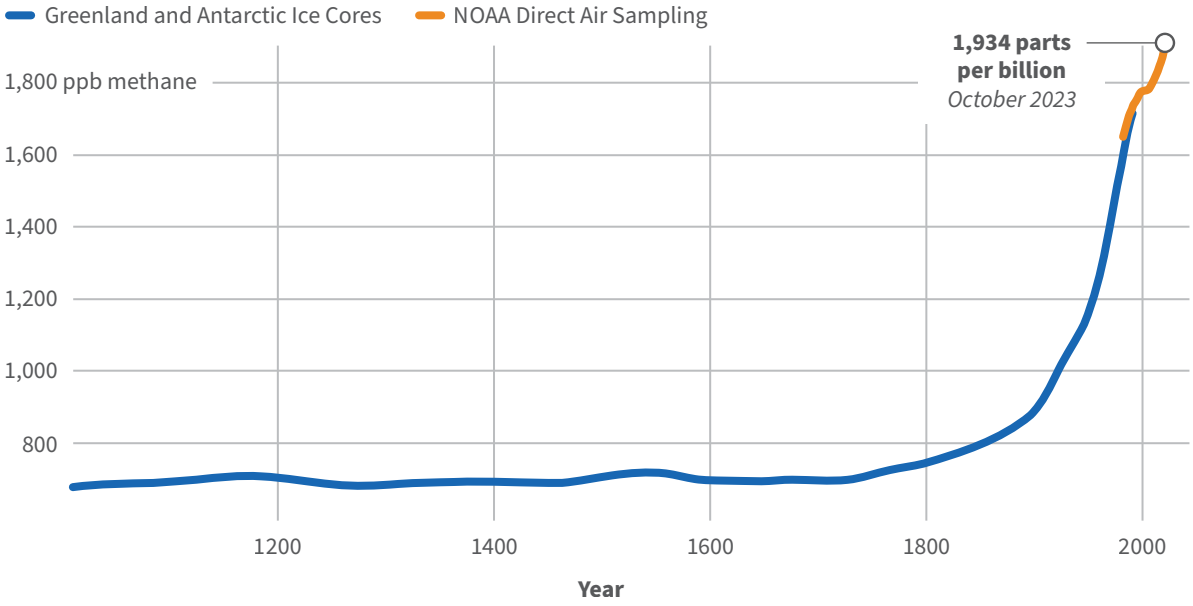
Executive Summary

Methane is the "now" climate pollutant. Atmospheric concentrations are at all-time highs and the rate of increase is undergoing unprecedented acceleration, as plotted in Exhibit 1. As climate change damages mount, a concerted effort to stem methane leakage from oil and gas and other sectors is urgently needed.[1] A recent study found that a rapid cut in methane emissions is the single biggest tool to slow global warming in the near term.[2]

Exhibit 1 Atmospheric methane measurements over the past millennium



Note: For updated methane concentrations, see the National Oceanic and Atmospheric Administration (NOAA), **https://gml.noaa.gov/ccgg/trends_ch4/**.
RMI Graphic. Source: The National Aeronautics and Space Administration, **https://climate.nasa.gov/vital-signs/methane/**

At COP28 — the annual United Nations (UN) climate change conference, held in Dubai in 2023 — a historic agreement was inked to transition the economy away from fossil fuels in a just, orderly, and equitable manner, with developed countries taking the lead.[3] This effort will need to be underpinned by deep sectoral emissions cuts — especially of methane — as underscored by the Oil and Gas Decarbonization Charter (OGDC), also announced at COP28.[4]

This builds on action at COP26 in Glasgow, where the Global Methane Pledge was adopted.[5] Now with 155 nations enlisted, this global agreement (which is not a national reduction target) pledges voluntary actions that contribute to a collective effort to reduce global methane emissions at least 30% from 2020 levels by 2030.

According to the UN, "now all governments and businesses need to turn these pledges into real-economy outcomes, without delay."[6] The first-ever global "stocktake," agreed to in 2015 at COP21 under the Paris Climate Agreement, was conducted at COP28, concluding that "we are not on track" to limit global warming to 1.5°C.[7] Mounting climate change concerns make methane abatement increasingly urgent. And less than a month after the global stocktake on greenhouse gas (GHG) emissions at COP28, 2023 was confirmed as the hottest year on record, with temperature anomalies that are deeply concerning for climate scientists.[8]

The Intergovernmental Panel on Climate Change estimates that since industrial times, methane has been responsible for about one-half a degree Celsius of planetary warming, contributing nearly one-third of overall global temperature rise in 2010–19 relative to 1850–1900.[9] According to the UN, climate alignment with 1.5°C requires cutting methane emissions from the fossil fuel sector 60% and 80% below 2020 levels by 2030 and 2050, respectively.[10]

The oil and gas industry can deliver early GHG reductions if properly directed or incentivized. It is cost effective, and even profitable in many instances, to stop gas from leaking because what is not wasted can be sold. And decommissioning marginal wells as they near the end of their useful life, when they may leak as much methane as they produce, can be an effective mitigation strategy. Investments in oil and gas industry equipment and operational changes are estimated at just 2% of income generated by oil and gas companies in 2022.[11]

Despite the prospect of profitability, stemming methane leakage has been too slow. But the market — supported by public policy — can be an effective accelerator in slashing oil and gas methane emissions during this critical decade. Means of influencing gas buyers and sellers are available today, including:

- Gas buyers from governments, utilities, and industry can stipulate low methane leakage rates (below 0.2%) in their procurement contracts.
- Gas and oil sellers can openly and verifiably certify low-methane gas for preferential treatment.
- Gas buyers and sellers can form trade alliances and stakeholder coalitions committed to using only low-methane gas below 0.2% leakage rates.
- Governments can introduce mandates against the trade of high methane intensity oil and gas and foster the near-term shut-in of marginal wells.

Selecting the optimal strategies will depend on market factors, infrastructure availability, geopolitics, and governmental regulatory and enforcement capacity. The goal is to chart a path for non-leaky, low-methane gas to drive down supplies of leaky, high-methane gas in today's trade and tip the scales to emissions reductions in the global marketplace.

Charting Methane Leakage from Oil and Gas Systems

Methane is the main component of natural gas, which is commonly coproduced with oil. The oil and gas supply chain is global and complex. Oil and gas come from a wide range of sources to meet an array of end uses worldwide, including industry and petrochemicals, power generation, buildings, and households.

The oil and gas supply chain is also evolving as gas trade globalizes. From the wellhead to the end-user, gas transfers from producers to transport and storage before being handled by marketers who sell to end-users. Each of these market entities can leak gas (see Exhibit 2, next page).

Defining the oil and gas supply chain

Sellers

- **Producers:** Oil and gas companies, including integrated international oil companies (IOCs) such as Shell and Exxon; national oil companies (NOCs) such as Qatar Energy and Aramco; independents such as Hilcorp and Koch Industries; limited partnerships such as Atlas Resource Partners and New Source Energy Partners; and individual families. IOCs often operate throughout the supply chain, producing, transporting, storing, and marketing gas.

- **Transport and storage companies:** Those that own and operate pipelines, such as Energy Transfer and Targa; liquefied natural gas (LNG) shippers such as Cheniere Energy; and storage facilities such as DTE Energy and Kinder Morgan.

- **Marketing and trading entities:** Those that sell natural gas either to resellers (other marketers and distribution companies) or end-users. Examples include IOCs, utility companies, and private firms such as Vitol and Tenaska.

Buyers

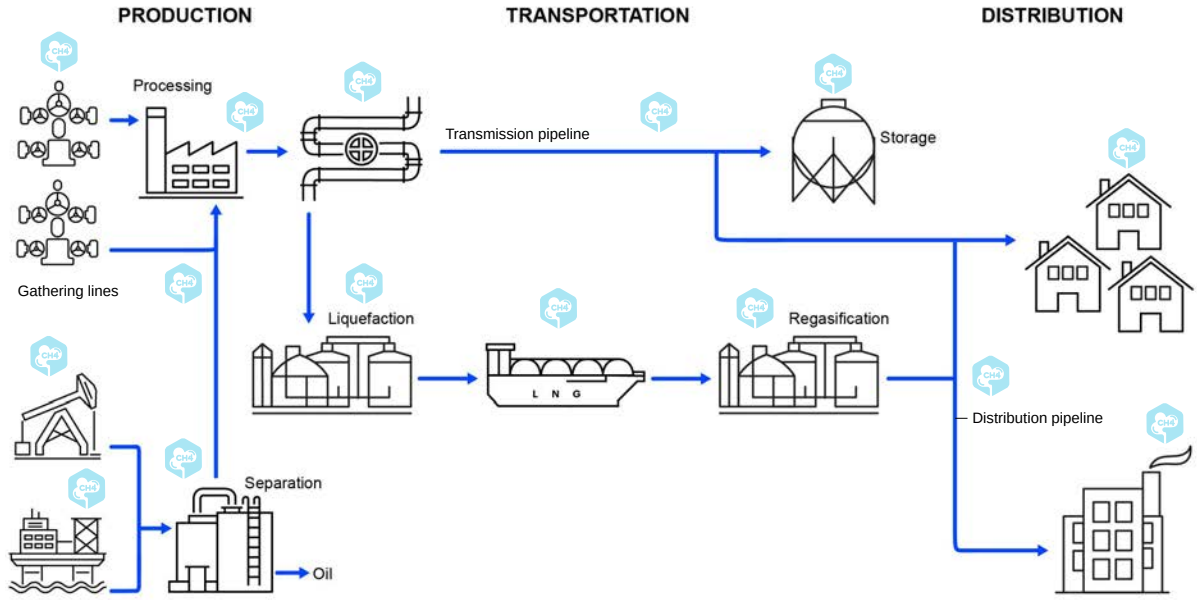
- **Retail buyers:** Natural gas off-takers and end-users in the retail market that buy gas from a regulated gas distribution utility.

- **Wholesale buyers:** Natural gas off-takers and end-users that buy gas directly from midstream suppliers or from a competitive marketplace. Contracts may be long-term or short-term, or through spot markets, depending on the buyer.

End-users

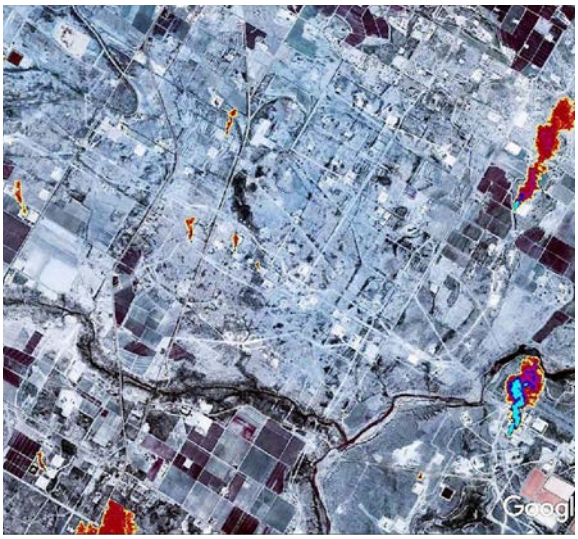
- Public and private utilities
- Power plants
- Industrial facilities
- Commercial entities
- Government facilities
- Households

Exhibit 2 Methane leakage through oil and gas supply chains



Note: CH4 represents the potential for methane leakage in different parts of the system.
Graphic adapted by RMI. Source: International Energy Agency, **https://iea.blob.core.windows.net/assets/465cb813-5bf0-46e5-a267-3be0ccf332c4/Driving_Down_Methane_Leaks_from_the_Oil_and_Gas_Industry.pdf**

Methane leaks can be accidental or intentional. They can also be persistent or intermittent. Because methane is invisible and odorless through much of the supply chain, unless operators are actively looking to stop leakage it can be a routine occurrence. Oil and gas equipment, including tanks, pumps, compressors, flares, and more, is often not designed to entirely prevent leakage, especially as systems age. Moreover, as underground reservoir conditions change, and oils become gassier or gases become wetter, aboveground equipment may no longer be capable of effectively containing gas and mitigating methane emissions. Asset mergers and acquisitions are other factors that can affect leakage. For example, as equipment owners and operators change hands, technical capacity, regulatory capture, and financial decisions can alter methane emissions.

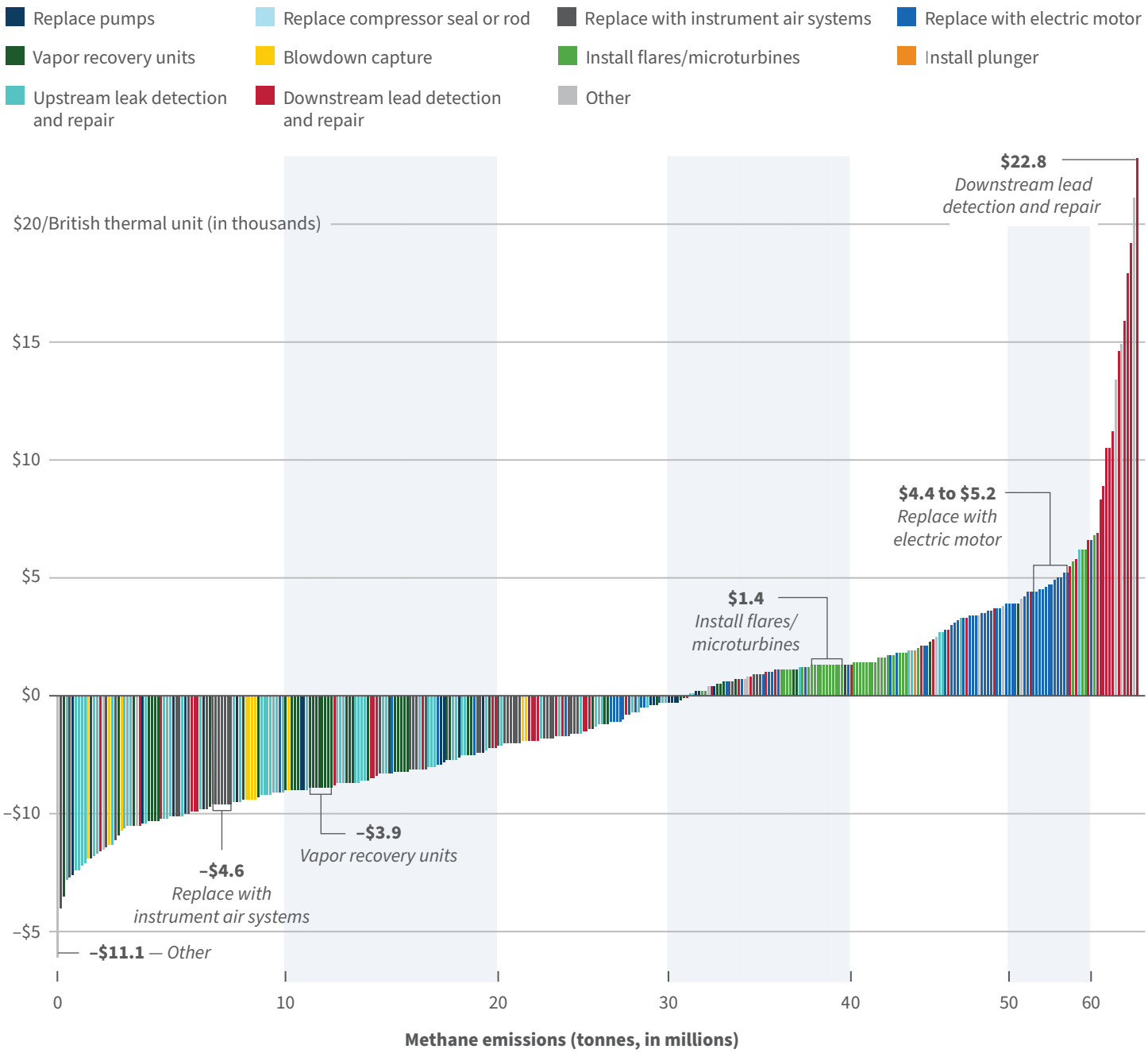


Methane data collected (depicted by colored plumes) with the Global Airborne Observatory over the Permian Basin in 2019, a joint campaign with NASA's AVIRIS-NG (Credit: Carbon Mapper, U. Arizona/Arizona State University/NASA/JPL-Caltech)

According to the International Energy Agency (IEA), oil and gas sector methane emissions can be reduced by 40%–60% at zero net cost based on the 2022 gas price, as shown in Exhibit 3 (next page).[12] As the price of gas increases, it becomes increasingly cost-effective to abate methane emissions. In other words, the higher the market price for gas, the more economically beneficial it is for the industry to prevent leakage and monetize that gas that is no longer emitted and wasted.

Fixes can include replacing existing devices, including pumps, seals, motors, and controllers. There is also an opportunity to install new devices, such as vapor recovery units, system blowdown capture, microgrids, and highly efficient flares. Enhanced maintenance that involves heightened leak detection and repair is another methane mitigation strategy. All told, depending on the asset and its operation, there are numerous strategies that can add up to meaningful methane emissions mitigation.

Exhibit 3 Marginal abatement cost curve for oil and gas methane mitigation strategies



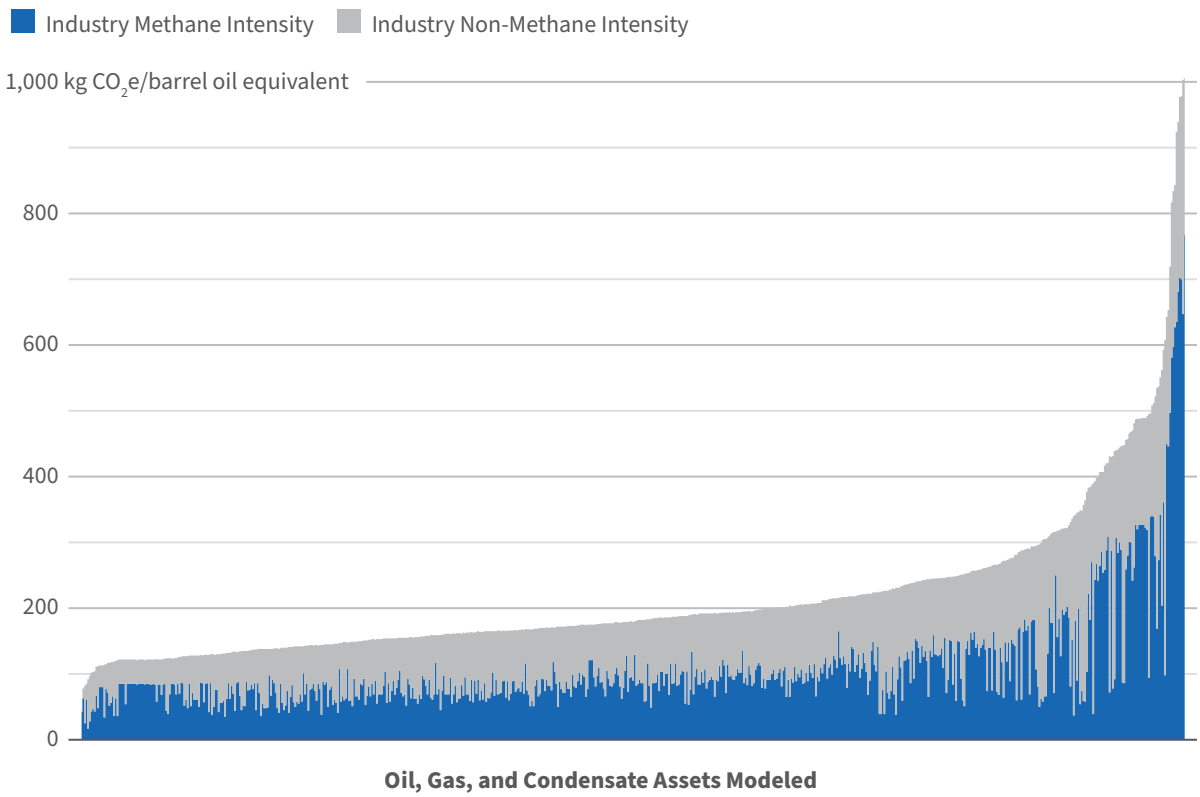
RMI Graphic. Source: IEA, **https://www.iea.org/data-and-statistics/charts/marginal-abatement-cost-curve-for-oil-and-gas-methane-emissions-by-mitigation-measure-2022**

Quantifying Methane Leakage from Oil and Gas

The UN and Climate and Clean Air Coalition estimate that one in every four tons of human-made methane comes from the oil and gas sector.[13] According to the IEA Global Methane Tracker, over 80 million tons per year of methane leaks from global oil and gas systems.[14] This has the effective near-term global warming potential of over 6.4 gigatons carbon dioxide equivalent (CO_2e) per year, roughly the annual emissions of 1.4 billion passenger vehicles — all cars on the road today.[15]

RMI's publicly available Oil Climate Index plus Gas (OCI+) tool quantifies and compares the GHG intensities of nearly three-quarters of the world's oil and gas assets.[16] OCI+ model runs estimate that methane accounts for one-half of the industry's operational emissions (Scopes 1 and 2), on a CO_2e basis, as shown in Exhibit 4.[17] The extent of methane's contribution is a clear climate risk, but also represents an enormous opportunity to immediately slow global warming.

Exhibit 4 Industry greenhouse gas emissions intensity: Methane vs. non-methane sources



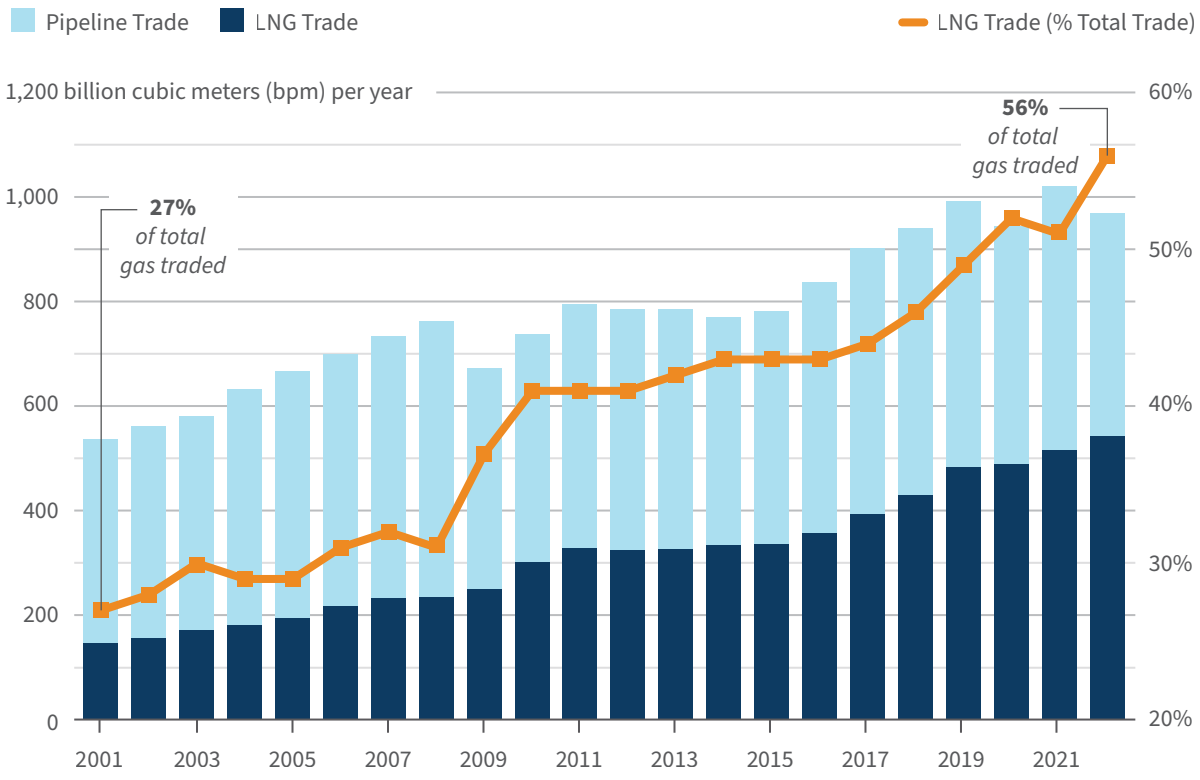
Note: CO_2e emissions are calculated using a 20-year global warming potential of 82.5 for methane compared with CO_2. Industry emissions include production, processing, and transport, but no end uses. Each sliver along the x-axis represents an individual asset that has been modeled. Graph has been updated with OCI+ results published as of January 2024.
RMI Graphic. Source: RMI, **https://ociplus.rmi.org/**

Expanding Global Gas Trade

Even though global gas demand growth has slowed in recent years, the trade of LNG has continued to grow, both as a share of total gas demand (14% as of 2022) and of total gas traded (56% in 2022), as shown in Exhibit 5. The rapid growth in US LNG exports is a key driver.

As global gas trade has expanded and the gas value chain has become more complex, the risk of methane leaks has risen in parallel. With growing trade comes more pumps, valves, seals, controllers, flanges, compressors, flares, tanks, and other equipment that can potentially leak gas and emit methane.

Exhibit 5 LNG's role in global gas trade



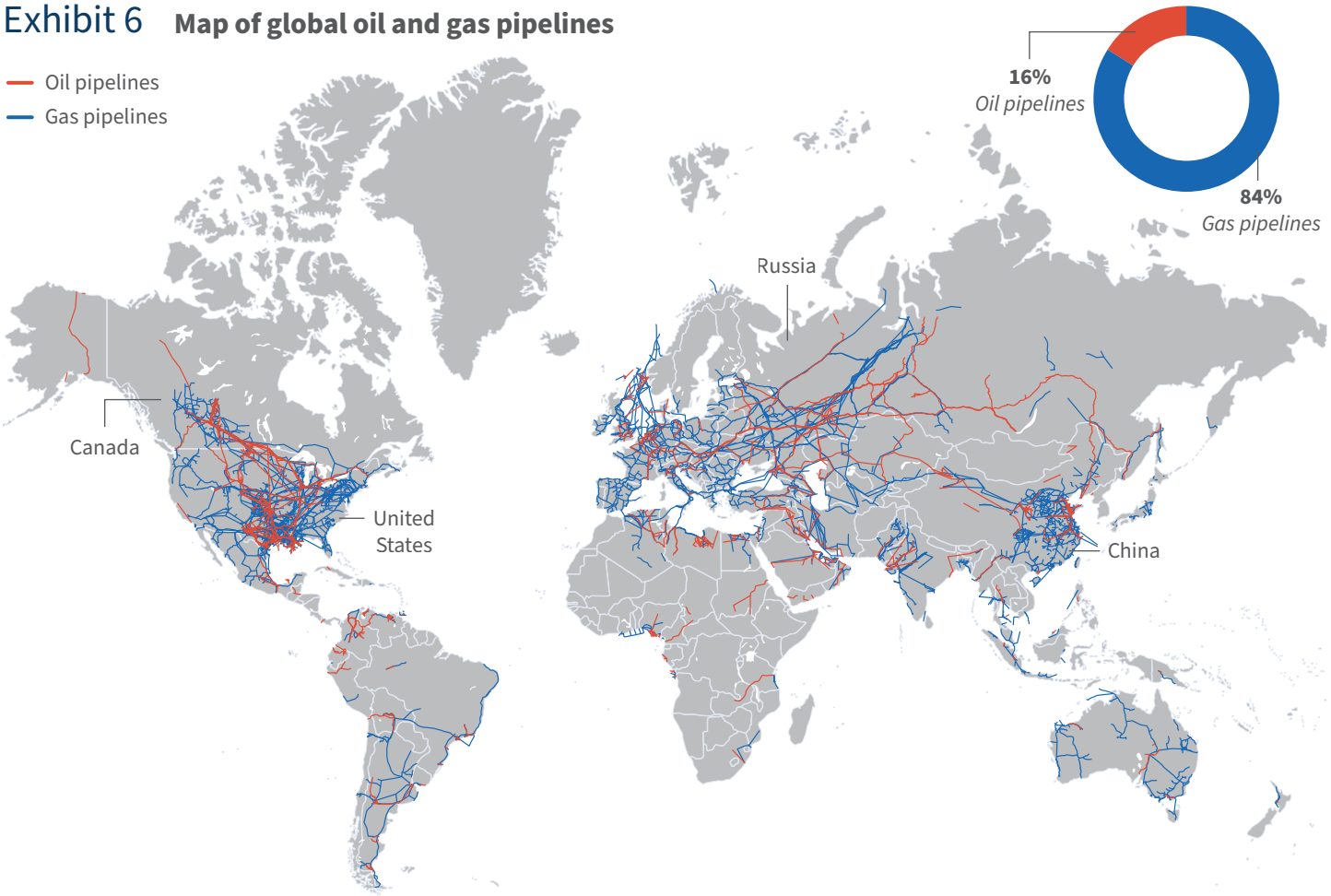
RMI Graphic. Source: Energy Institute, **https://www.energyinst.org/statistical-review**

Pipelines remain the backbone of the gas midstream and pose significant risks of methane leakage (visualized in blue in Exhibit 6). It is estimated that nearly 2,500 operational oil and gas pipelines span the world with a combined length of 730,000 miles.[18] The majority (84%) are dedicated to moving gas.[19] And the United States leads the world with the most miles of pipelines followed by Russia, Canada, and China.

Pipelines are critical to global LNG trade as well. Shipping gas globally requires pipelines to transport gas to liquefaction facilities in export terminals that cryogenically liquefy the natural gas. LNG is then loaded onto marine vessels that ship gas transcontinentally to import terminals that regasify cargos. Gas then is pumped through transmission and distribution pipelines to end-users for power generation and industrial, commercial, and residential consumption.

The world's largest gas exporters today include the United States, Australia, and Qatar, while the majority of LNG is imported by Japan, China, South Korea, and EU countries.[20] LNG faces numerous operational and environmental challenges. Terminals' coastal locations expose them to severe weather conditions, including hurricanes and tsunamis, which are expected to worsen as the Earth warms. The globalization of gas requires complex operations whose expansion can result in more gas leaks with methane emissions that further warm the planet.

Exhibit 6 Map of global oil and gas pipelines



RMI graphic. Source: Global Energy Monitor, **https://globalenergymonitor.org/projects/global-gas-infrastructure-tracker/tracker/** and **https://globalenergymonitor.org/projects/global-oil-infrastructure-tracker/tracker-map/**

Certifying Low-Leakage Gas Systems

As gas globalizes, market competition between sellers and buyers increases. This opens the door for the introduction of new regulations, voluntary certification, and commercial arrangements that can incentivize demand for lower methane intensity gas supplies. As shown in Exhibit 4 (page 10), producers that outperform the median methane intensity volumes have a competitive advantage from the outset.

COP28 may prove to be a turning point for oil and gas methane emissions reductions. Through the OGDC announced at the conference, 50 major oil and gas companies representing nearly half of global production pledged to reach near-zero methane emissions and end routine flaring in their operations by 2030.[21]

Stemming leakage is paramount for the climate. Limiting gas system methane leakage below 0.2% is gaining consensus among scientists, governments, nongovernmental organizations (NGOs), and industry. As such, new bodies are emerging that quantify and certify low-methane gas.[22]

For example, MiQ is a nonprofit certification body that uses open-source, accredited, third-party, verifiable procedures to grade gas industry facilities' methane intensity (i.e., leakage rate). Under MiQ, a methane intensity rate below 0.2% is consistent with a "B" grade, assuming quarterly benchmarks for emissions monitoring and corporate practices are also met. Even lower leakage rates, more robust monitoring, and stricter company practices offer operators' facilities a higher "A" grade, as shown in Exhibit 7.

Exhibit 7 MiQ certification grade levels

Accredited third-party certifying bodies audit and verify

Calculated Intensity

$= \frac{\text{Methane emitted}}{\text{Natural gas produced}}$

Robust **Monitoring Technology Deployment** at Facility and Source Levels

Company Practices
Policies and procedures for methane emissions management

≤ 0.05%	**Quarterly**	**Stringent**	**A**
≤ 0.10%	**Semiannually**	**High**	**B**
≤ 0.20%	**Semiannually**	**Medium**	**C**
≤ 0.50%	**Annually***	**Mandatory minimum**	**D**
≤ 1.00%	**Annually***	**Mandatory minimum**	**E**
≤ 2.00%	**Annually***	**Mandatory minimum**	**F**

GRADE

Note: *source-level only.
Source: MiQ, **https://miq.org/the-technical-standard/**

The focus on methane emissions from oil and gas should not preclude simultaneous action on coal. At COP28, unabated coal was declared to be so hazardous for the climate that its imminent phase down was agreed to.[23] Yet, gas can rival coal in terms of net GHG emissions. An RMI emissions calculator allows users to quantify the leakage rate at which there is GHG parity between these two leaky fossil fuels.[24] Whereas coal can leak methane at the mine, gas tends to leak throughout the entire supply chain — from production equipment, transport infrastructure, processing plants, refineries, petrochemical facilities, LNG vessels, power plants, and end-use appliances.

Policy Advances to Reduce Methane Intensity of Natural Gas

Although it is cost-effective for oil and gas operators to stop leaking gas, accelerated progress is needed. In response, efforts are underway through an array of mechanisms:

U.S. federal regulations in 2023/2024

The Environmental Protection Agency (EPA) adopted a new rule in 2023 leveraging the latest cost-effective, innovative technologies and proven solutions to reduce methane from oil and gas systems.[25] The rule aims to achieve a nearly 80 percent reduction below the future methane emissions expected without the rule. This is one of many actions taken by the federal government to implement the U.S. Methane Emissions Reduction Action Plan.

Among other things, the rule will:

- phase in a requirement to eliminate routine flaring of natural gas that is produced by new oil wells;
- require comprehensive monitoring for leaks of methane from well sites and compressor stations, while giving oil and gas companies flexibility to use low-cost and innovative methane monitoring technologies; and
- establish standards that require reductions in emissions from high-emitting equipment like controllers, pumps, and storage tanks.
- help states use their existing programs in plans for limiting methane emissions from existing sources.
- institute a new Super Emitter Program that will utilize third-party expertise in remote sensing to detect large methane releases or leaks known as “super emitters,” which recent studies have indicated account for almost half of methane emissions from the oil and gas sector.

EPA’s final rule will work hand in hand with the Methane Emissions and Waste Reduction Incentive Program in the Inflation Reduction Act to cut emissions of methane from the oil and natural gas industry.

Together, these methane policies will require empirical data to calculate and inventory emissions, apply advanced leak detection and repair techniques, and establish the Super Emitter Program. Aerial methane detection using satellites and aircraft, such as Carbon Mapper, can play an important role in advancing these goals.[26]

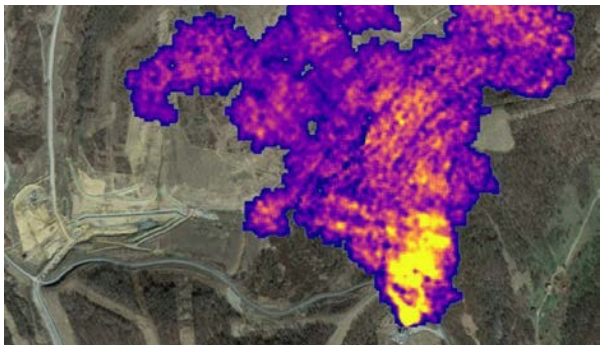
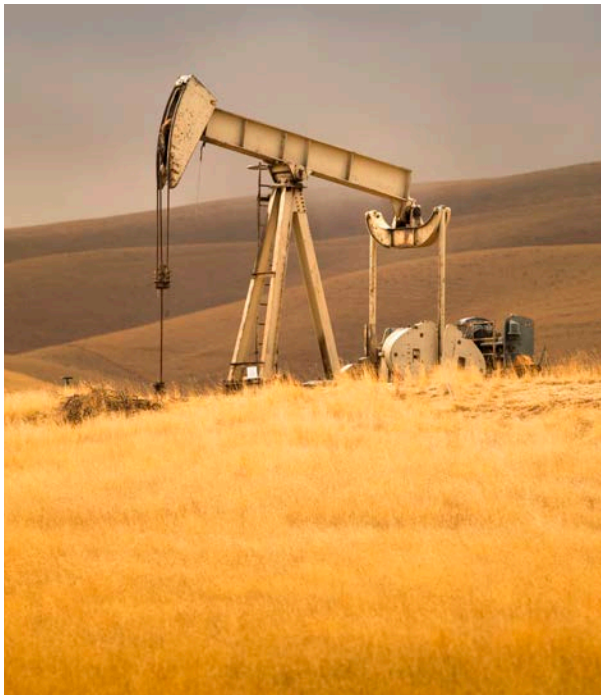


Image of super-emitting methane plume from oil and gas found in aerial detection by Carbon Mapper.
Source: **https://carbonmapper.org/wp-content/uploads/2022/09/PA-basin-methane-emissions_Carbon-Mapper-PNAS.jpg**

California legislation in 2023



In 2023, California was the first state to introduce a low-methane natural gas leakage procurement standard with Senate Bill (S.B.) 781.[27] While S.B. 781 advanced through the Senate and key Assembly committees, it was held up by the Appropriations Committee. The vote history is detailed in Appendix A.

If adopted, this policy would require state agencies to prioritize strategies to reduce methane emissions, including emissions from gas imported into the state. Since California imports the vast majority (92%) of the gas it consumes, S.B. 781 could have a material effect on methane emissions from gas supplied by producers in Canada, Colorado, New Mexico, Texas, and Wyoming. Within a year's time, the California Air Resources Board (CARB) would establish a certification standard for natural gas producing low methane emissions. The bill would require CARB to publish information from utilities and other large gas users regarding any contract for and use of natural gas certified to have a methane emissions intensity of less than 0.2% across the natural gas supply chain. The bill would also require use of best practices to minimize emissions of methane and GHGs from natural gas supplying California. The overriding goal of S.B. 781 was to encourage natural gas procurement on behalf of the state to shift to certified low-methane natural gas.

Model low-methane gas procurement policy

S.B. 781 is a useful starting point for what states and subnational policy can do to push for methane management. Moreover, open-source standards, like MiQ, have already established public certification for 19 facilities that are continuously monitoring 1,400 oil and gas wells, and have issued 6 billion certificates (each representing one million British thermal units [BTU] of gas) on their registry.[28] Certified low-methane gas currently exists in increasing production volumes in the marketplace, and procurement legislation can stimulate methane emissions reduction in a swift and cost-effective manner. States and municipalities can serve as optimal buyers for currently available openly certified and third-party verified low-methane gas. Model policy language for low-methane gas procurement is presented in Appendix B.

Creating alliances of gas buyers and sellers

While LNG opens market access to gas worldwide, the set locations of pipelines and terminals will determine commercial options between sellers and buyers. Depending on available gas infrastructure and the direction of gas flows, buyers of low-methane gas can form strategic alliances with select low-methane sellers to exert their considerable market influence. Moreover, when importing states already have strict climate regulations on the books, buyers and sellers may be predisposed to purchase low-methane gas.

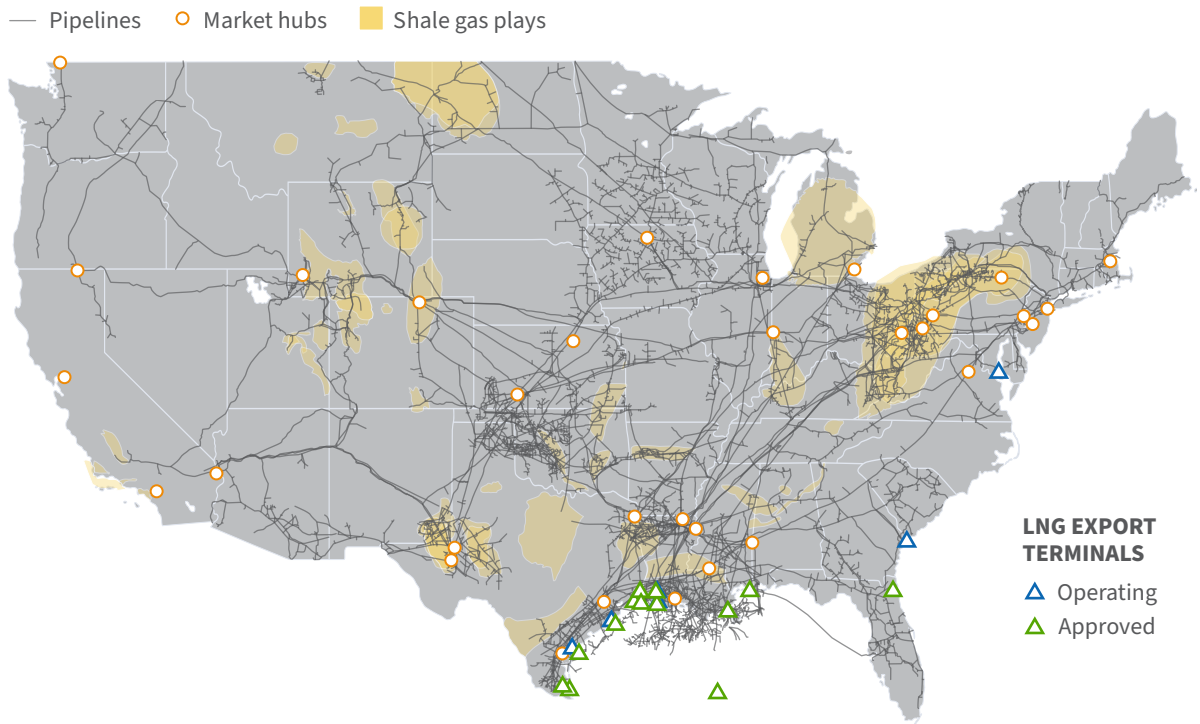
Like California, potential candidates for low-methane gas buyers' alliances could include Montana, Nevada, Washington, and states in the Northeast. There may be other alliances to form in America and beyond. The most effective opportunities can be discerned by using a triangulation approach that considers dependence on gas imports, infrastructure characteristics, regulator capacity, local partner availability, and general political will.

Legal action can also make the difference. For example, a landmark lawsuit in Montana granted young people the constitutional right to a healthful environment and required the state to consider potential climate damage when approving projects.[29] Establishing a low-methane procurement standard in Montana would be consistent with the court's finding and could influence methane reductions from current gas operations in Montana as well as out-of-state actions of suppliers in Canada, North Dakota, and Wyoming.[30]

Likewise, buyers served by sellers that are already certifying their gas, such as operators in the Marcellus and Haynesville basins or states that regulate oil and gas methane emissions like Colorado and Pennsylvania, are well positioned to participate in alliances of buyers and sellers to accelerate climate action nationwide.[31]

In the United States, the country with the most existing gas infrastructure (mapped in Exhibit 8), careful analysis is required to motivate market forces for low-methane gas. This is not only a domestic undertaking, however. Numerous pipeline projects are underway to move gas to Gulf Coast LNG export terminals planned to come online in coming years. According to analysts, however, the next wave of LNG export capacity additions will be complicated and less predictable.[32] Whether or not new LNG export terminals are eventually approved and built, the large volume of gas that Louisiana, Oklahoma, and Texas currently export to Europe, Asia, and elsewhere means that alliances of international buyers are another opportunity to reduce methane emissions.[33]

Exhibit 8 US pipelines, market hubs, shale plays, and operating and approved LNG export terminals in the Lower 48



RMI graphic. Sources: U.S. Energy Atlas, **https://atlas.eia.gov/**; Federal Energy Regulatory Commission, **https://www.ferc.gov/media/us-lng-export-terminals-existing-approved-not-yet-built-and-proposed**

Marginal well-plugging policy

As oil and gas wells age, their production typically declines. Nearing the end of their life, they are characterized as "marginal wells," which the US Internal Revenue Service defines as one that produces less than 15 barrels of oil or 90 million cubic feet of gas per day.[34] Some states and other entities may set these production limits slightly lower.[35] Sometimes marginal wells are abandoned or orphaned. And too often these marginal assets are transferred to owners who cannot or will not properly manage them.[36]

Marginal wells are a national — and global — problem. In the United States, there are an estimated 1 million producing wells.[37] But most of them — about 80% — are considered marginal producers that supply roughly 7% of the nation's oil and gas.[38] As such, "marginal wells are the dominant type of well in the US," according to the US Energy Information Administration, and require policy attention to mitigate their methane emissions. One study estimates that marginal wells are responsible for 11% of methane emissions in the US GHG Inventory.[39] And this likely undercounts the problem, which requires fixing so that production thresholds in current regulations do not prevent small producers from including marginal wells in the inventory.

In 2023, California signed a bill into law (A.B. 1167) that requires new owners of idle or low-producing, marginal oil and gas wells to "set aside funds to cover the costs of plugging, abandoning, and restoring the site of the well."[40] Successful implementation will relieve the state of paying the high price of plugging abandoned wells in the future. It will also reduce emissions of methane and other toxins. This policy should discourage oil and gas companies from off-loading old, unprofitable wells to smaller entities and limited partnerships that cannot afford to clean them up or safely shut them in.[41]

EU low-methane gas import standards

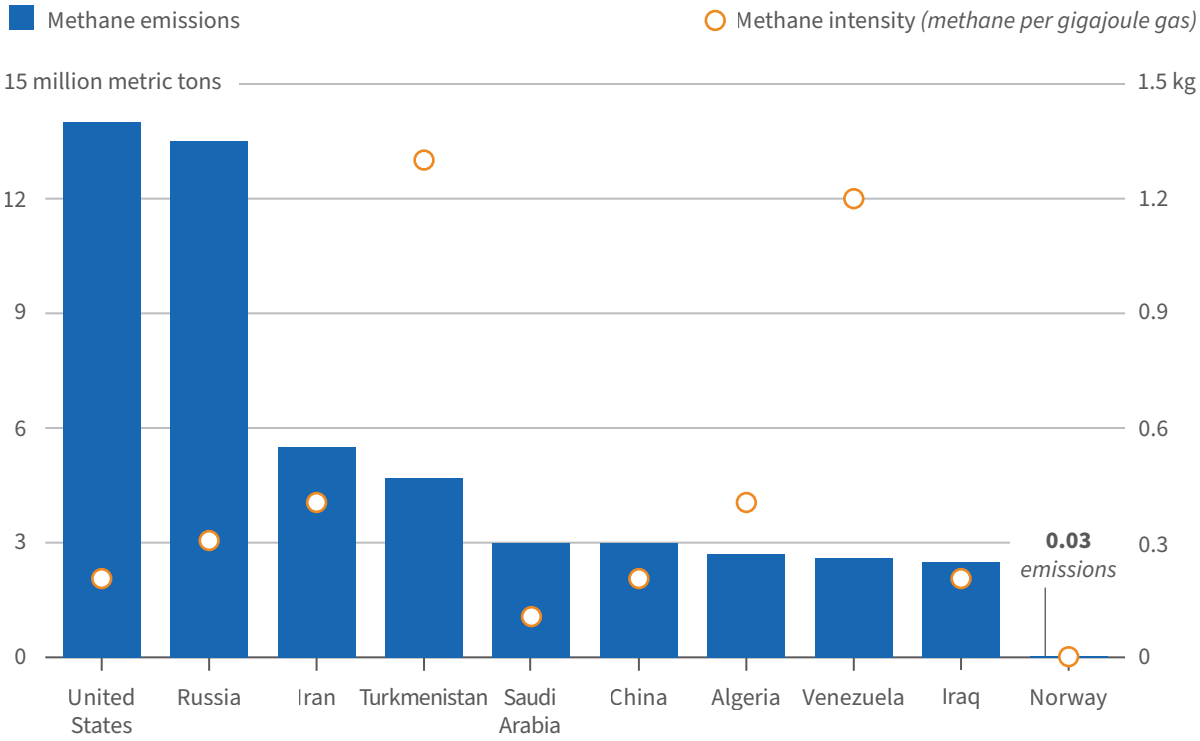
In 2023, the EU placed a limit on methane emissions from oil and gas Europe imports that goes into effect in 2030. The goal of the European Parliament's deal is to "reduce energy sector methane emissions in Europe and in our global supply chains" and pressure international suppliers, including Algeria, Qatar, and the United States to ensure that the gas they sell is low in methane intensity.[42]

In addition to imposing a fee on EU nations buying from suppliers of high-methane fuels, this law will:

- Require operators to report regularly to the competent authorities about quantification and measurement of methane emissions at source level, including for non-operated assets
- Oblige oil and gas companies to carry out regular surveys of their equipment to detect and repair methane leaks on the EU territory within specific deadlines
- Ban routine venting and flaring by the oil and gas sector and restrict nonroutine venting and flaring to unavoidable circumstances such as safety concerns or equipment malfunction
- Limit venting from thermal coal mines (which implicates coal bed methane gas supplies) from 2027, with stricter conditions in 2032
- Require companies in the oil, gas, and coal sectors to inventory closed, inactive, plugged, and abandoned assets such as wells and mines, monitor their emissions, and adopt a plan to mitigate these emissions as soon as possible

Gas supplied to Europe has highly variable methane intensity, as shown in Exhibit 9. Supplies from Norway via pipeline are among the world's lowest reported methane intensity owing to strict regulations.[43] Given the EU nations' large collective gas buying power — nearly 500 billion cubic meters per year, or more than 10% of global consumption — following up these regulations with an alliance of buyers and sellers to procure low-methane gas throughout the region is the next step to move global gas markets toward low-leakage gas.[44]

Exhibit 9 Oil and gas methane emissions and methane intensity of production in selected countries, 2022



RMI Graphic. Source: IEA, **https://www.iea.org/data-and-statistics/charts/oil-and-gas-methane-emissions-and-methane-intensity-of-production-in-selected-countries-2022**

Global buyer-seller alliances emerging: MMRV and CLEAN initiatives

In November 2023, the US Department of Energy's (DOE) Office of Fossil Energy and Carbon Management officially launched an international working group to develop a measurement, monitoring, reporting, and verification (MMRV) framework to facilitate the global trade of gas differentiated by GHG emissions. The aim is to "forge agreement among importing and exporting countries on a transparent and credible framework that will help provide suppliers, buyers, investors, and policymakers the information they need to help drive continuous reductions in greenhouse gas emissions over time across the international natural gas supply chain," according to the DOE.[45]

The MMRV initiative coincides with the "Coalition for LNG Emission Abatement toward Net-zero" (CLEAN) initiative first announced by the Japan Organization for Metals and Energy Security in July 2023.[46] CLEAN, similarly, is a global buyer-seller alliance comprising Australia, the European Commission, Japan, South Korea, and the United States.

Together, these initiatives will establish robust standards for measuring, monitoring, reporting, and verifying gas and LNG emissions across the global value chain. These standards will increase transparency of the emissions intensity of traded gas, facilitate differentiated pricing, and drive methane emissions reductions across the supply chain.

Given the market power of the buyers and sellers involved in the MMRV and CLEAN initiatives, other LNG suppliers will likely have strong incentives to comply with these standards. This will include NOCs as well as nascent oil and gas producing countries, like Mozambique and Senegal. However, many NOCs and early producers have low institutional capacity and access to key technologies. There will be a growing need to hold countries and companies to their methane mitigation commitments, and to provide the needed technical and financial support to enable them to meet these climate goals.

Tipping Gas Markets to Low-Methane Emissions

In the comprehensive Global Methane Assessment, the UN and its coauthors issued several reasons for urgency, stating that methane mitigation now:

> *" '(i) Reduces damage due to climate change over the next few decades, including those dependent on the pace of climate change such as biodiversity losses; … (iii) reduces the risk of potential non-linear changes such as release of carbon from permafrost or ice sheet collapse; (iv) increases the probability of staying below 2° C through mid-century…; (v) reduces long-term cumulative climate impacts; (vi) reduces costs of meeting temperature targets relative to late mitigation…; and (vii) stimulates progress toward the longterm 2° C target through achievement of nearterm benefits…' Reductions in methane emissions can thus provide near-term climate benefits while carbon dioxide emission reductions are implemented for long term stabilization."* [47]

Global efforts underway to cut methane emissions from the oil and gas sector call for a strategic plan involving four key pillars:

1. **Emissions visibility:** Advances in measurement of methane emissions — especially with the launch of pioneering satellites (e.g., Carbon Mapper and MethaneSAT) — and synthesis of this data through publicly available models like OCI+ give stakeholders from government, industry, and civil society the intelligence required to detect, quantify, and cut oil and gas methane emissions in line with targets.

2. **Policy action:** Implementation of robust methane measurement, modeling, and mitigation policies and regulations — with emphasis on demand-side pressures at the US subnational level — spurs rapid and deep methane reductions along the global oil and gas supply chain.

3. **Market activation:** Policymakers, companies, and civil society act to incorporate low-methane standards into market decisions bringing "tipping points" in US and global low methane gas markets. Demand for gas with methane intensity below 0.2% expands rapidly when certified low-methane gas penetration exceeds 20% of the global market.

4. **Accountability and technical support:** Companies and governments have detailed their commitments and are on pace to meeting their 2030 goals, especially those set out in the OGDC owing to actionable intelligence, credible accountability mechanisms, as well as technical support and financial support from leading civil society groups and other stakeholders.

Using these four intertwined and aligned strategies that target subnational and nation-state targets, tipping points can be created for rapid adoption of climate policies and market activation to cut methane from oil and gas operations. Direct decarbonization efforts start with ground-up action at the US subnational level to stop methane leaks from the oil and gas sector. A primary objective involves increased demand-side pressure to procure oil and gas with a methane intensity below 0.2% leakage. This level is consistent with the announcement of "near-zero" methane emissions by 2030 launched at COP28 through the OGCD.

Complementing demand-side action, the goal is to pursue opportunities to inform state-level regulation and policy on the supply side to hold all actors to "near-zero" leakage that is clearly codified at less than 0.2% methane intensity. Ensuring that the US Inflation Reduction Act of 2022 and recently enacted oil and gas methane rules by the EPA are effectively implemented to cover the majority of emissions sources is also a priority, with special focus on leaks from super-emitters and orphaned and marginal wells.

Robust, effective market-activation solutions do not stop there. US gas is not just traded domestically. It is also being exported as LNG into the global market, boosted by Europe's decisive steps to cut its dependence on Russian gas starting in 2022. As such, US export policy priorities must support global gas markets with methane leakage below 0.2%. This necessarily involves DOE MMRV priorities that intend to establish a global framework for estimating and accounting for methane emissions across the global oil and gas value chain.

The aim is to incentivize rapid emissions reductions by buyers, sellers, traders, and investors in the global market. This requires alignment with major LNG buyers, such as Japan and South Korea, as well as top global LNG suppliers, from Australia to Qatar. Suppliers in greatest need of support to achieve this goal are in the Global South.

Leaky gas is costly, wasteful, and harmful to the climate and to people. Bringing systemwide gas intensity to below 0.2% leakage can serve as a force multiplier to reduce global methane on the order of 60 million tons by 2030, which equates to a five gigatons CO_2e emissions reduction in the short term when methane's warming is most potent. This reduction would put the world well on its way to meeting the Global Methane Pledge.

Many groups benefit from slashing methane emissions from oil and gas systems, including individuals and communities that are exposed to methane emissions (which is often co-emitted with benzene and other air toxins) from oil and gas. Companies that curtail leakage will be treated more advantageously than their wasteful competitors with higher emissions. And the 155 countries that have now signed the Global Methane Pledge will be far closer to meeting agreed-upon emissions reductions.

Focusing on methane — a superpotent greenhouse gas — is the most attainable, cost-effective climate win in this decisive decade.

Appendix A

California S.B. 781 Vote History

Date	Chamber	Action
2023-09-01	Assembly	September 1 hearing: Held in committee and under submission.
2023-08-16	Assembly	August 16 set for first hearing. Placed on suspense file.
2023-07-13	Assembly	From committee: Do pass and re-refer to Com. on APPR. (Ayes 10. Noes 0.) (July 12). Re-referred to Com. on APPR.
2023-06-28	Assembly	Read second time and amended. Re-referred to Com. on U. & E.
2023-06-27	Assembly	From committee: Do pass as amended and re-refer to Com. on U. & E. (Ayes 8. Noes 3.) (June 26).
2023-06-19	Assembly	From committee with author's amendments. Read second time and amended. Re-referred to Com. on NAT. RES.
2023-06-15	Assembly	Referred to Coms. on NAT. RES. and U. & E.
2023-05-31	Assembly	In Assembly. Read first time. Held at Desk.
2023-05-30	Senate	Read third time. Passed. (Ayes 29. Noes 5. Page 1350.) Ordered to the Assembly.
2023-05-18	Senate	Read second time. Ordered to third reading.
2023-05-18	Senate	From committee: Do pass. (Ayes 5. Noes 2. Page 1183.) (May 18).
2023-05-16	Senate	Set for hearing May 18.
2023-05-15	Senate	May 15 hearing: Placed on APPR suspense file.
2023-05-05	Senate	Set for hearing May 15.
2023-05-01	Senate	Read second time and amended. Re-referred to Com. on APPR.
2023-04-27	Senate	From committee: Do pass as amended and re-refer to Com. on APPR. (Ayes 14. Noes 2. Page 871.) (April 24).
2023-04-12	Senate	Set for hearing April 24.
2023-04-10	Senate	Read second time and amended. Re-referred to Com. on E., U. & C.
2023-03-30	Senate	From committee: Do pass as amended and re-refer to Com. on E., U. & C. (Ayes 5. Noes 2. Page 572.) (March 29).
2023-03-07	Senate	Set for hearing March 29.
2023-03-01	Senate	Referred to Coms. on E.Q. and E., U. & C.
2023-02-21	Senate	From printer. May be acted upon on or after March 20.
2023-02-17	Senate	Introduced. Read first time. To Com. on RLS. for assignment. To print.

RMI Graphic. Source: LegiScan, **https://legiscan.com/CA/bill/SB781/2023**

Appendix B

Draft Language

Certified Low-Methane Gas Procurement

Developed by RMI, MiQ.org, and the Planning and Conservation League, with input from various other government and NGO stakeholders

Overview of Proposed Legislation

The act requires natural gas procured for state agencies to use certified gas with low methane intensity no later than (December 31, 2025). This bill would additionally require state agencies to develop and implement strategies to reduce methane emissions, including emissions from imported natural gas. The bill would require the relevant state agency or board, no later than (December 31, 2024), to adopt and publish the criteria for certified natural gas producing low-methane emissions, including criteria for approving third-party certification standards.

The bill would require natural gas procurement on behalf of the state to shift to certified natural gas producing low-methane emissions.

The bill would also require the state board or agency, public utilities commission, and/or other relevant agencies to timely consider programs, or changes to existing programs, to reduce methane emissions, including emissions from imported natural gas procured by utilities and other large gas users.

This bill would require the state board to annually request information from utilities and other large gas users regarding the methane intensity of procured natural gas, including certified low-emissions gas. This information request should include the methane intensity of gas from across the supply chain from which the gas was transported, as data is available.

Bill Language

Section 1

(a) The Legislature finds and declares all of the following:

(1) According to the United States Environmental Protection Agency, methane is a potent short-lived climate pollutant with an estimated global warming impact of 27 to 30 times that of carbon dioxide over 100 years and 81 to 83 times that of carbon dioxide over 20 years.

(2) There exists a broad array of significant climate, health, and economic benefits associated with quick action to reduce short-lived climate pollutant emissions from all addressable sources.

(3) Significant volumes of natural gas are supplied by out-of-state sources, and more needs to be done to address emissions from these sources.

(4) Fugitive methane emissions from out-of-state sources of natural gas supplying (state) in 2020 were the equivalent of (x metric tons) of carbon dioxide. Methane emissions from out-of-state natural gas production would represent the (ranking) largest source of methane emissions in (state). This represents a (greater/lesser) source of methane from emissions from landfills or oil and gas production, processing, and distribution in (state).

(5) It is the intent of this legislation to require methane intensity certification on a facility-wide scale in order to provide facility-wide transparency, and also, when available, to require operators to report on their overall methane emissions across all of their operations. Reporting based on a standardized methane intensity calculation will allow for better comparisons and more informed purchasing decisions.

(6) (include if applicable) Existing climate change policies in (state) incentivize greenhouse gas emissions reductions from imported electricity and transportation fuels; however, no similar policy exists for natural gas, which is largely imported. Emissions from this source are readily addressable using best management practices.

(7) Incentivizing greenhouse gas emissions reductions from natural gas supplies to (state) will help to expand the use of best practices and reduce methane emissions associated with not only (state's) energy use, but those associated with other states as well.

(8) Near-term efforts to reduce methane emissions from natural gas supplies will support (state's) climate change priorities and its transition away from the emissions impacts from fossil-based energy.

(b) It is the intent of the Legislature that (state) take steps to reduce methane emissions associated with natural gas imported and used in the state in a manner that supports efforts to reduce the use and reliance on fossil fuels and the state's transition to clean energy.

Section 2

(a) Definitions

(1) 'Certification' means the certification of a facility by the certification organization for the certified gas under a certificate.

(2) 'Certificate' means the information generated by a certification authority under a certification of the attributes including, but not limited to, methane intensity.

(3) 'Certification organization' means the entity that certifies that the delivered and received natural gas constitutes a certified methane intensity under an applicable certification.

(4) 'Certified gas' and 'certified gas with low methane intensity' means natural gas that meets the state board or agency's criteria, in accordance with those set for in (Section 38592(d)), for demonstrating low methane intensity by undergoing certification by an approved certification organization and is produced at a facility that has a methane intensity of no greater than 0.2%.

(5) ‘Facility’ means the organizational unit being certified as defined in the United States Environmental Protection Agency in CFR Title 40, Chapter I, Subchapter C, Part 98, Subpart W, Section 98.238 and includes all onshore petroleum and natural gas production equipment associated with all wells that the person or entity owns or operates in a basin.

(6) ‘Methane intensity’ means the volume of methane emissions from a facility as a percentage of the volume of the total gas marketed. The state board or agency is hereby authorized and directed to engage in a rulemaking process to further define ‘methane intensity’ consistent with existing standards.

(b) All state agencies, public higher education institutions, and organizations and projects that are recipients of state funding shall consider, prioritize, and implement strategies to reduce methane emissions, including emissions from imported natural gas.

(c) As soon as practicable, but no later than (December 31, 2025), all natural gas procured on behalf of state agencies, public higher education institutions, and organizations and projects that are recipients of state funding is required to be certified gas with a methane intensity at the production site of no greater than 0.2%.

(d) The state board or agency, the Public Utilities Commission, and other relevant agencies shall consider programs, or changes to existing programs, to reduce greenhouse gas emissions, including methane emissions from imported natural gas procured by utilities and other large gas users.

(e) The Public Utilities Commission shall allow natural gas utilities to include in their fuel portfolios certified gas with low methane intensity in order to reduce the emissions intensity of utility fuel portfolios.

(f) State procurement authorities shall give preference to those certified gas purchases wherein:

(1) The entirety of the production, processing, and transmission stages are certified; and

(2) The production facility certification methane intensity is no more than 0.2%.

(g) This section shall not be construed to require any additional natural gas utility procurement or to promote the expanded use of natural gas from fossil resources and is not intended to interfere with state efforts to reduce the use of natural gas.

(h) This act does not relieve any person, entity, or public agency of compliance with other applicable federal, state, or local laws or regulations, including state air and water quality requirements, and other requirements for protecting public health or the environment.

Section 3

(a) The state board or agency shall do all of the following:

(1) Quantify and publish annually, commencing (date), and based on the best available science and information, the amount of greenhouse gas emissions, expressed in metric tons of carbon dioxide equivalents, resulting from the loss or release of uncombusted natural gas to the atmosphere and emission during all processes associated with the production, processing, and transporting of natural gas that is imported into the state from out-of-state sources.

(2) As part of the quantification in Section 3(a)(1) annually request and incorporate information regarding any contracts for and the use of natural gas certified to have a production methane emissions intensity of less than 0.2% from:

(i) utilities and other large gas users; and,

(ii) state agencies.

(3) As part of the quantification in Section 3(a)(1) annually request the methane intensity of natural gas procured by:

(i) utilities and other large gas users; and,

(ii) state agencies.

(4) This paragraph does not expand, contract, or otherwise alter other requirements for greenhouse gas emissions reporting by sources or for the statewide greenhouse gas emissions limit.

(5) The state board or agency shall periodically review and redefine a methane intensity threshold lower than 0.2% for the production of certified gas, with the intention of supporting the lowest methane emissions possible associated with (state's) energy use and reducing methane emissions, including development of transportation and processing thresholds.

(6) By July 31, 2024, publish a process for approving third-party certification standards for natural gas.

(i) In determining the regulatory criteria for certified gas and the criteria for approving third-party certification standards, the state board or agency shall engage in a multistakeholder information collection process.

(ii) The board or agency shall collect information from organizations and individuals with experience in natural gas certification including, but not limited to, public interest and environmental organizations, academic researchers, methane performance certification organizations, and natural gas operators.

(7) No later than (December 31, 2024), the state board or agency shall adopt and public the criteria for certified gas producing low-methane emissions. In determining these criteria, the state board or agency shall include the following:

(i) A requirement for the use of facility-wide certification and reporting by the operator for either certified methane intensity across all an operator's assets, even those that are non-operated, or, if not all assets are certified, reporting of the percentage of total asset-level production, including operated and non-operated assets, that is certified.

(ii) A requirement that certified gas be determined on a third-party certification standard that is approved by the state board or agency and is fully transparent and publicly accessible.

(iii) A requirement that the methane intensity at the production facility level is certified to be 0.2% or lower.

(iv) The methane intensity threshold must be determined from an auditable standard and based on accurate and empirical data from material emissions derived from:

(A) Appropriate, fit for purpose, and previously validated measurement technologies to quantify population-based site-level emissions; and,

(B) Sufficient measurement coverage and frequency to support sufficiently accurate quantification of emissions, and granularity to allow reconciliation with source-level reporting.

(v) A requirement that low-methane natural gas certificates are tracked on a digital registry to avoid double counting of certificates.

(vi) A requirement that operational audits of operator reporting and results as part of the certification process are conducted using third-party auditors that:

(A) Have no financial interest in the outcome of the certification;

(B) Do not complete annual emissions inventories or related engineering consulting related to methane emissions reductions; and,

(C) Are independent of both certification organization and operator.

(vii) A requirement that third-party auditors that review operator-reported data for certification also review available basin-level emissions data and compare that to independent facility-level empirical estimates data from the basins or origin. This information, when available, shall be provide to the state board or agency to ensure accuracy and completeness in the operator-reported data.

(8) No later than (December 31, 2027), the board or agency shall set a new and lower methane intensity level. This new methane intensity level:

(i) Will apply to state procurement of certified gas;

(ii) Shall be less than or equal to 0.1%;

(iii) Will apply to certification at the production facility; and

(iv) The state board or agency, the Public Utilities Commission, and other relevant state agencies shall also develop and implement programs, or make changes to existing programs, to reduce methane emissions, including emissions from imported natural gas procured by utilities and other large gas users through the procurement of certified gas with low methane intensity that is consistent with the new low methane intensity level recommended by the state board or agency in Section 3(8).

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