Low-Hanging Plumes
An Investor's guide to Methane

Executive summary

December 2025

First Sentier MUFG
Sustainable Investment Institute

Foreword

Terms like carbon footprint and decarbonization can make it easy to forget that carbon dioxide is not the only molecule driving climate change. Methane, though less often discussed, is responsible for roughly a third of the warming we experience today. Over the near term, cutting methane emissions is one of the fastest and most cost-effective ways to slow global warming.

Yet methane remains something of a mystery, which helps explain why it is frequently overlooked. Carbon dioxide emissions stem largely from the combustion of fossil fuels: an activity that is visible, measurable, and tied to economic costs. Methane, by contrast, is often fugitive, escaping undetected from industrial systems or produced through microbial processes less directly under human control.

This report helps to dispel that mystery. It offers financial professionals a clear picture of methane's sources, trends, and abatement opportunities. It provides timely insight as the issue moves rapidly up the policy and investment agenda. From the Global Methane Pledge at COP26 to the Oil and Gas Decarbonization Charter at COP28, the focus on methane has been building. The EU's Methane Emissions Regulation, which went into effect in August 2024, shows how awareness is turning into concrete action. Elsewhere, initiatives such as the Coalition for LNG Emission Abatement toward Net-zero (CLEAN), a project led by Japanese and South Korean LNG buyers to increase transparency and reduce methane emissions throughout the LNG supply chain, are building on that momentum.

Another reason methane is not always well understood is the great variation in emissions sources and the diverse strategies needed to address them. Methane from oil and gas operations - where leak detection and repair are key - differs markedly from emissions from livestock, where feed and manure management play central roles. This report provides valuable details into these differences and highlights promising, cost-effective solutions across sectors.

We hope readers use these insights to engage companies and policymakers in accelerating methane reductions: an essential and achievable step toward avoiding the worst impacts of climate change.

Andrew Howell, CFA
Head of Research, Sustainable Finance
Environmental Defense Fund

About the institute and its sponsors and partners

About the Institute

The First Sentier MUFG Sustainable Investment Institute (the Institute) provides research on topics that can advance sustainable investing. As investors, both First Sentier Group and MUFG recognise our collective responsibility to society and that investment decisions should be made with consideration to our communities both now and in the future.

The Institute commissions research on Environmental, Societal and Governance (ESG) issues, looking in detail at a specific topic from different viewpoints. The Institute recognises that investors are now looking in far greater depth, and with far greater focus, at issues relating to sustainability and sustainable investing. These issues are often complex and require deep analysis to break down the contributing factors. If as investors we can better understand these factors, we will be better placed to consider our investment decisions and use our influence to drive positive change for the benefit of the environment and society.

The Institute is jointly supported by First Sentier Group (FSG) and Mitsubishi UFJ Trust and Banking Corporation, a consolidated subsidiary of MUFG. Representatives of both organisations will provide input to the activities of the Institute.

An Academic Advisory Board advises the Institute on sustainability and sustainable investment research initiatives. The Academic Advisory Board comprises prominent leaders from academia, industry and nongovernmental organisations in the fields of Responsible Investment, climate science and related ESG endeavours. The Board provides independent oversight to ensure that research output meets the highest standards of academic rigour.

Contact

institute@firstsentier.com
www.firstsentier-mufg-sustainability.com
www.mufg-firstsentier-sustainability.jp

The Institute's sponsors and partners

About First Sentier Group

First Sentier Group (formerly First State Investments) is a global asset management group focused on providing high quality, long-term investment capabilities to clients. We bring together independent teams of active, specialist investors who share a common commitment to responsible investment and stewardship principles. These principles are integral to our overall business management and the culture of the firm.

All our investment teams – whether in-house or individually branded – operate with discrete investment autonomy, according to their investment philosophies.

www.firstsentierinvestors.com

About MUFG

Mitsubishi UFJ Financial Group, Inc. (MUFG) is one of the world's leading financial groups. Headquartered in Tokyo and with over 360 years of history, MUFG has a global network with approximately 2,000 locations in more than 40 countries. The Group has about 150,000 employees and offers services including commercial banking, trust banking, securities, credit cards, consumer finance, asset management, and leasing. The Group aims to "be the world's most trusted financial group" through close collaboration among our operating companies and flexibly respond to all of the financial needs of our clients, serving society, and fostering shared and sustainable growth for a better world. MUFG's shares trade on the Tokyo, Nagoya, and New York stock exchanges.

www.mufg.jp/english

About the Trust Bank

Mitsubishi UFJ Trust and Banking Corporation, as a core member of MUFG, provides its customers with a wide range of comprehensive financial solutions leveraging unique and highly professional functions as a leading trust bank. Such financial solutions include real estate, stock transfer agency, asset management and investor services, and inheritance related services, in addition to banking operations. The Trust Bank aims to realize its vision to be the trust bank that can create a safe and enriching society and future alongside customers through trust; as such, its key concept is "Create a Better Tomorrow".

https://www.tr.mufg.jp/english

About Discern Sustainability

Discern Sustainability is a boutique sustainable investment consultancy. Our purpose is delivering impartial analysis, insight and practical ways forward for our financial services clients. Managing Director Niall O'Shea draws on a quarter of a century of experience in the area. Prior to forming Discern in 2017, Niall pioneered the development of market-leading Sustainable funds, corporate engagement and ESG integration at institutional investors.

Our work is across all asset classes: from deep research to strategy, implementation tools and training for sustainable investment.

Discern Sustainability was commissioned by the Institute to author this report. It was produced with guidance from Sudip Hazra (Director, the Institute), Yuichi Nakao (Manager, the Institute) and Elena Zharikova (ESG Associate Analyst, the Institute).

This report was authored by Niall O'Shea (Managing Director, Discern Sustainability) and Ana Carloto (Research Director, Discern Sustainability).

www.discernsustainability.com

Purpose of this report

In 2023, the International Energy Agency (IEA) and the U.N. [1] estimated that **20% of the warming expected between the 1.5°C and 2°C policy thresholds could be prevented by implementing feasible reductions of methane in the fossil fuel sector alone.**

This was under the least ambitious 'Stated Policies Scenario' or STEPS, that is to say, assuming governments implemented whatever concrete pledges they had made at that point, even if they are inadequate for meeting these warming targets.

The cost, to the fossil fuel industry? In the seven years from the date of the report to the target year for implementation, 2030, **the cost would be just 2% of net income in 2022** said the IEA in that same report. Concessionary finance would be needed on top for some lower-income countries.

More shockingly, and encouragingly, the same analysis also inferred that **to obtain around the same level of temperature reduction by 2050 through carbon dioxide reductions, it would be roughly equivalent to immediately deleting all carbon emissions in Heavy Industry.** These figures were arrived at using a methodology found widely in the IPCC Sixth Assessment Report.

Like all long-term modeling of such complexity, it is prudent to assume this one too is at least inaccurate, perhaps even wrong. But the IEA/UN analysis would have to be extravagantly wrong to not represent a great opportunity to take some heat out of the atmospheric system.

These arresting conclusions prop up a truism in climate circles. Cutting methane is an accessible emergency brake on warming, and we should apply it now.

This report will explain why that is. It will provide the backdrop in terms of: climate negotiation agreements, regulations, sources and action by industries, emission pathways and developments in technology, data and monitoring. It goes on to identify where institutional investors, in alliance with other actors, can leverage their influence via engagement, products and advocacy to help reduce methane emissions. In doing so, they can contribute to the long-term stability of their asset owners' portfolios in a safer world. And they can evidence their credentials as Responsible Investors and develop new revenue opportunities.

Figure 1: Methane observation by NASA in the Everglades.

Credit: Best-Backgrounds

Responsible for about one third of anthropogenic global warming so far [13], the major sources of anthropogenic methane globally are summarised in Figure 2 (see the full report).

Executive summary:

Key observations for investor action on methane

1 | Some awareness of the methane risk/opportunity is found across industry and lending institutions but methane lacks special recognition in treaty negotiations. Investor engagement has been sporadic, overlooked in favour of CO_2.

2 | Targeted capital flows to methane reduction from Financial Institutions have been minuscule (estimated at <1% of climate finance) despite the relative urgency in terms of avoiding/removing short-term warming.

3 | Leading International Oil Companies have shown progress in cutting methane intensity by making simple fixes and upgrades to reduce fugitive emissions (leaks, venting) and unnecessary flaring (burning off excess gas). NOCs are mostly far behind, accounting disproportionately for the remaining low-hanging fruit. NOCs are more insulated from pressure on methane but there are signs of willingness to level up and inter-company partnerships are key.

4 | Coal Mine Methane and Waste (landfill in particular) have large headroom for cuts using proven technologies. Operators are unable to justify the cost without supporting regulation, incentives and infrastructure, usually in emerging and developing economies. The waste sector is mostly in public hands, so there is less scope for investor action despite large operational footprint and scope for methane reductions.

5 | Agriculture is a separate case: it is not amenable to dramatic cuts for reasons explained in chapter 5. The huge scope for productivity improvements and input efficiency could be accompanied by cuts in methane intensity. But increased affordable protein supply from this productivity could stimulate increased demand, leading to spiraling absolute methane emissions. Moderating meat consumption remains the only reliable remedy but remains politically unpalatable especially in developing economies. Protein producers and FMCGs are the most engageable supply-side companies responsible for agricultural methane.

6 | Satellites, other remote sensing, ground-level sensing and AI are generating rich, high-resolution monitoring of methane plumes and super-emitters. This could be game-changing. So far, a lack of institutional will and capacity is stopping converting alerts into remediation.

7 | Methane regulations in the U.S, EU and elsewhere offer systems of carrots and sticks to emitters, aided by enhanced transparency requirements. Presently, they are highly vulnerable to politics, trade wars and the primacy of the energy security/affordability imperative.

8 | Gross underestimation is the ongoing ironic lesson from better detection, making methane targets flawed. Get ready for revised baselines of anthropogenic methane sources to look significantly worse, and consequently prior targets and cuts to get re-written.

9 | Technology is not the problem, in most cases. Marginal Abatement Cost Curves show plenty of potential methane cuts with no net cost or have a positive ROI, but opportunity costs and poor technical capacity can be enough to disfavour even those interventions.

10 | Level playing fields via regulation, cap-and-trade systems, methane taxes, support via technology assistance, incentives, and supporting infrastructure must underpin any lasting curtailment of anthropogenic methane. There is no parlaying these needs away, however difficult they appear presently.

11 | Mainstream commercial investors' ownership leverage is concentrated in the following order: 1) Oil and Gas; 2) coal miners 3) food producers (as scope 3 emissions) and protein producers (as Scope 1 emissions) Like the waste sector, whole swathes of non-industrialised agriculture and waste disposal exist outside private investment, but come into contact with corporate lending, where banks' Environmental & Social criteria can screen and in principle impose conditionalities to clean up methane (true for all sectors).

12 | Financial Institutions, as holdings, may be engaged by investors to understand their influence over and underwriting criteria for methane-intensive activities. Governments, by means of sovereign bonds, may be encouraged to incorporate methane-specific commitments into their Nationally Determined Contributions towards climate accords, especially where these concentrate in strategically important reserves like oil in the Middle East, coal in India etc.

13 | Continued progress on methane in the Oil and Gas sector poses no threat to its business model in terms of the Energy Transition. Methane management is increasingly viewed by mature operators as just good operational management. It allows companies to go on saying that they are continuing to reduce their upstream emissions. Investors should double down on this all-weather rationale during engagement. They should emphasise that maintaining focus on it even when there is less pressure to do so will benefit them when the 'inevitable policy response' arrives.

14 | Responsible Investors could have the most impact by simultaneously advocating for a stable and supportive policy environment as described in point 11. They should urge protection of existing regulations like the EU's Methane Regulation especially as regards to imports, to set a floor for scientifically sound minimum performance in key supplying markets, where the most capturable methane originates.

Responsible Investors could have the most impact by simultaneously advocating for a stable and supportive policy environment.

Important information

This material is intended for professional investors, sophisticated or wholesale clients or professional or institutional clients (or equivalent) as may be defined in the jurisdiction in which the material is received and should not be relied upon by other persons including retail clients. It is made available to you for information purposes only and does not constitute investment or financial advice, an offer of asset management services, a recommendation or an offer or solicitation to buy, hold or sell any security and has not been prepared in connection with any such offer. It does not take into account any objectives, financial situation or needs of a reader.

This material is neither directed at nor intended to be accessed by persons resident in, or citizens of any country, or types or categories of individual where to allow such access would require any registration, filing, application for any licence or approval or other steps to be taken by First Sentier Group in order to comply with local laws or regulatory requirements in such country.

This material does not constitute investment research. Accordingly, this information has not been prepared in compliance with the legal provisions promoting independent investment research, and it is not subject to any restriction prohibiting the execution of transactions prior to the dissemination of investment research. Any research in this document has been procured and may have been acted upon by First Sentier Group for its own purposes.

Reference to specific securities (if any) is included for the purpose of illustration only and should not be construed as a recommendation to buy, sell or hold the same. All securities mentioned herein may or may not form part of the holdings of First Sentier Group, Mitsubishi UFJ Trust and Banking Corporation ("the Trust Bank") or Mitsubishi UFJ Financial Group, Inc. ("MUFG") portfolios at a certain point in time, and the holdings may change over time.

Although the information presented here is from sources believed to be reliable and reputable, neither First Sentier Group, the Trust Bank nor MUFG make any representation or warranty in relation to the accuracy, completeness or reliability of any information contained here. The information and views expressed are those of the authors and not necessarily those of either First Sentier Group, the Trust Bank or MUFG. The opinions expressed are subject to change without notice. Reliance upon information in this material is at the sole discretion of the reader. To the extent permitted by law, no liability is accepted by the Trust Bank, MUFG or First Sentier Group, nor their affiliates for any loss or damage as a result of any reliance on or use of this material.

References to "we" or "us" are references to First Sentier Group, a global investment management business, the ultimate owner of which is MUFG. First Sentier Group includes a number of affiliate investment teams in different jurisdictions.

For readers located in the United Kingdom, this document is issued by First Sentier Investors (UK) Funds Limited, authorised and regulated by the Financial Conduct Authority. Registered office: Finsbury Circus House, 15 Finsbury Circus, London EC2M 7EB (company number 02294743, FCA reference number 143359).

For readers located in the EU, this document is issued by First Sentier Investors (Ireland) Limited, authorised and regulated by the Central Bank of Ireland. Registered office: 70 Sir John Rogerson's Quay, Dublin 2, (company number 629188, CBI registration number C182306)

For readers located in Hong Kong, this document is issued by First Sentier Investors (Hong Kong) Limited and has not been reviewed by the Securities & Futures Commission in Hong Kong.

For readers located in Singapore, this document is issued by First Sentier Investors (Singapore) whose company registration number is 196900420D. This advertisement or publication has not been reviewed by the Monetary Authority of Singapore.

For readers located in Australia, this document is issued by First Sentier Investors (Australia) IM Limited (ABN 89 114 194311 AFSL 289017). This material is not intended for persons who are "retail clients" (as defined under the Corporations Act).

In the US, this document is issued by First Sentier Investors (US) LLC registered with the Securities Exchange Commission (RIA 801-93167).