

AN INVESTOR'S GUIDE TO METHANE:

ENGAGING WITH OIL AND GAS COMPANIES
TO MANAGE A RISING RISK

October 2016



TABLE OF CONTENTS

ABOUT EDF/PRI & ACKNOWLEDGEMENTS	1
ABOUT THE GUIDE	2
Role of Investors	2
Structure	3
INTRODUCTION TO METHANE	4
The Risks	4
The Opportunities	5
Methane Risk Across the Globe & Natural Gas Supply Chain	6
The State of Play on Global Methane Regulations	7
The Importance of Governance in Managing Methane	9
PREPARING TO ENGAGE	10
Collaborative Engagement on Methane	10
MEASURE	11
Initial Questions for Engagement	11
Follow-up Questions	11
Overview	11
What Investors Should Look for in an Inventory of Methane Emissions	11
REPORT	14
Initial Questions for Engagement	14
Follow-up Questions	14
Overview	14
Action on Methane Disclosure Resolutions	16
REDUCE	18
Initial Questions for Engagement	18
Follow-up Questions	18
Overview	18
Methane Emissions Reductions Can be Cost-Effective	20
Climate and Clean Air Coalition Oil and Gas Methane Partnership	20
Industry Leadership on Methane Includes Supporting Public Policy	20
Additional Recommendations	22
CONCLUSION	23
APPENDICES	24
Appendix 1 - Checklist Summary of Key Points & Performance Assessment Tool	24
Appendix 2 - Additional Resources on Methane	26
Appendix 3 - Emissions Quantification Techniques	28

ABOUT EDF/PRI & ACKNOWLEDGEMENTS

ABOUT ENVIRONMENTAL DEFENSE FUND

[Environmental Defense Fund \(EDF\)](#) is one of the world's largest environmental nonprofit organizations, with more than one million members and a staff of over 500 scientists, economists, policy experts, and other professionals around the world. EDF finds practical and lasting solutions grounded in science and economics to the most serious environmental problems. Working with businesses, scientists and academics, EDF is taking a leading role in minimizing the environmental and health risks associated with the global development of oil and natural gas.

ABOUT PRINCIPLES FOR RESPONSIBLE INVESTMENT

The United Nations-supported [Principles for Responsible Investment \(PRI\) Initiative](#) is an international network of investors working together to put the six principles for responsible investment into practice. Its goal is to understand the implications of Environmental, Social and Governance issues (ESG) for investors and support signatories to incorporate these issues into their investment decision-making process and ownership practices. In implementing the principles, signatories contribute to the development of a more sustainable global financial system.

ACKNOWLEDGMENTS

Special thanks to the following stakeholders for providing feedback on this guide:

Matthias Beer

BMO Global Asset Management

Alexandria Fisher

Alberta Investment Management Corporation

Tim Goodman

Hermes EOS

Martin Kholmatov

Alberta Investment Management Corporation

Jonas Kron

Trillium Asset Management

Derek Lemke-von Ammon

EIG Global Energy Partners

Julia Leske

CAER

Katrina Myers

Regnan

Clare Payne

Legal and General Investment Management

Allan Pearce

Trillium Asset Management

Alison Schneider

Alberta Investment Management Corporation

Tarek Soliman

CDP

Sylvia van Waveren-Severs,

RobecoSAM

A photograph of an industrial facility, likely an oil or gas processing plant, at sunset. The sky is a mix of orange, yellow, and blue. In the foreground, there are large, white, cylindrical storage tanks. In the background, there are several tall smokestacks, some of which are emitting white smoke. The facility is lit up with various lights, creating a warm glow. The overall scene is industrial and atmospheric.

ABOUT THIS GUIDE

Investors and operators face financial, reputational and regulatory risks from methane emissions in the oil and gas industry. The purpose of this guide is to equip investors with key information to constructively engage with staff, management and boards of oil and natural gas companies globally regarding how to mitigate these risks. This guide responds to investor demand for a follow-up and companion piece to EDF's [*Rising Risk*](#) report released in January of 2016. *Rising Risk* provided an overview of the risks from methane emissions, an analysis of the state of corporate methane disclosure, and forward-looking recommendations to improve reporting. While *Rising Risk* addressed the reasons *why* investors should pay attention to methane, this guide provides practical advice on *how* investors can engage and *what* they should expect from companies regarding operational practices and disclosure.

While the guide is aimed at public equity investors, the document can also be useful for investors in private companies, and energy lenders such as investment banks and insurance companies, who may be looking to benchmark methane performance as they implement ESG and risk-management policies. Likewise, this guide can also be a reference for oil and gas companies to benchmark their operations and identify best practices.

ROLE OF INVESTORS

Investors in the oil and gas industry have two primary roles to play in managing methane risk:

COMPANY ENGAGEMENT - Using their influence as equity or debt holders, investors can engage with

a company to ensure it is appropriately managing methane risk, adopting best practices to limit emissions, and disclosing pertinent information. Engagement will help address company-specific financial risk from operational inefficiency and lost product, and regulatory risk, as proactive



management and reporting will help companies prepare for possible regulation and let investors know which companies in their portfolios are prepared and which are not. The primary purpose of this guide is to help inform that engagement and set clear investor expectations for companies to *measure, report* and *reduce* their methane emissions.

POLICY SUPPORT - Investors can also play an impactful and complementary role by supporting public policies that will improve how companies measure, report and reduce their emissions. Broad policies are particularly important for emissions reductions because a company-by-company approach does not sufficiently address the reputational (or “product”) risk that methane represents to the industry at large. A single company’s failure to manage the issue can risk the industry’s social license to operate, whereas proper regulation can ensure that all companies are maintaining natural gas’ reputation as a cleaner energy solution. This guide will also provide guidance on how investors can engage on policy.

STRUCTURE

This guide includes three sections: **Measure**, **Report** and **Reduce**. Each section provides background to help inform investors, initial and follow-up discussion questions to guide constructive dialogue, and expectations for which operational and reporting practices companies should adopt. The guide also contains a tool to assist investors in assessing where a company falls on the spectrum (*beginner, intermediate* or *expert*) on methane management. This structure can help identify next steps that companies can take on their journey to better methane management. The benchmarking structure enables investors to build on and encourage a practice of continuous improvement by oil and gas industry leaders, while holding operators accountable for concrete and specific results to better manage methane emissions.

INTRODUCTION TO METHANE – RISKS AND OPPORTUNITIES FOR INVESTORS

Methane, the primary component of natural gas, is a climate pollutant 84 times more powerful than carbon dioxide (CO₂) over a 20-year period, and it is responsible for 25% of the global warming we are experiencing today.¹ Emissions from the oil and natural gas industry represent the largest industrial source of methane emissions globally. 2012 methane emissions were equal to 3% of total global natural gas production, and the International Energy Agency (IEA) points to such emissions as one of the five key measures for effectively addressing climate change.² Appropriately addressing the environmental and economic risks associated with climate change requires action on both CO₂ and methane.

THE RISKS

Due to their climate disrupting impacts, methane emissions have drawn increasing scrutiny from the public, environmental and health groups, and global policymakers. Such scrutiny endangers the industry's social license to operate and increases regulatory risks. While the industry can reduce emissions cost-effectively under rules, regulations pose a risk to investors for whom without better reporting it is hard to know which operators are prepared for rules and which are not. Engagement can both help prepare companies for coming rules and differentiate relative performance amongst companies.

Although natural gas is a cleaner-burning fuel than coal, the high potency of methane as a greenhouse gas (GHG) can reduce or eliminate the environmental benefit of natural gas when emitted to the atmosphere directly. Such reputational or product risk is particularly salient given that many operators have staked their futures in a carbon-constrained world on natural gas as a potentially cleaner energy source. As noted by the IEA, “the potential for natural gas to play a credible role in the transition to a decarbonised energy system fundamentally depends on minimizing these emissions.”

As noted by the IEA, “the potential for natural gas to play a credible role in the transition to a decarbonised energy system fundamentally depends on minimizing these emissions.”³

Emissions of methane also represent wasted saleable product where markets exist, with implications for operational efficiency and the bottom line. Although rare, methane-related disasters, such as those experienced in Aliso Canyon ([see video](#)) and San Bruno, California can incur front-page headlines and potentially hundreds of millions in legal liability, while more common emissions violations can trigger fines.

As both pollutant and product, methane entails a series of distinct risks for oil and gas investors globally, requiring heightened scrutiny and company engagement, as well as improved disclosure. Unfortunately, voluntary reporting of methane emissions by the industry is generally lacking. For example, companies are failing to report reduction targets, and few provide details on baseline emissions or how they will lower them over time.⁴



These practices make it challenging for investors to understand the materiality of the problem, identify leaders and laggards and manage risk.

A 2016 report from Société Générale scored operators globally on methane management and disclosure performance. The top score was 48 out of 100 possible points, with many large international oil companies scoring in the single digits and teens. The report showed that there is significant room for improvement even among the current leading operators, which underscores the need for engagement.

Experts predict natural gas production and consumption are set to grow globally⁵, and with them comes the potential for higher methane emissions. The Rhodium Group estimates that methane emissions will grow by more than 20% by 2030 vs. 2012 levels in a business-as-usual scenario.⁶ Investors should engage early and often to address this issue now before it becomes even more significant.

THE OPPORTUNITIES

Of course, along with these risks come opportunities for investors. Engaging with companies to better manage methane can strengthen the strategic goal of the gas business in delivering cleaner energy, lowering emissions and creating more efficient operations while putting more saleable product in the pipeline. A study estimated that globally the oil and gas industry loses \$30 billion a year in methane emissions.⁷

As poor methane management could be indicative of other latent risks, investors may consider

methane management as an additional proxy for strong operational management, along with asset integrity and environmental, health and safety (EH&S) practices. Also, methane risk is carbon risk, and benchmarking methane management will help investors assess how prepared operators are for a carbon-constrained world, enabling operator management of methane risk to be considered in investor capital allocation decisions.

Methane risk is carbon risk, and benchmarking methane management will help investors assess how prepared operators are for a carbon-constrained world

Better data will help not only investors, but also operators. Knowing and understanding where emissions are coming from will improve decision making and operations. Further, operators that comprehensively tackle methane risk will be better positioned to address investor concerns, engage with regulators on what works, and demonstrate responsibility to community stakeholders.



METHANE RISK ACROSS THE GLOBE AND NATURAL GAS SUPPLY CHAIN

One common misunderstanding is that methane emissions are exclusively related to hydraulic fracturing, and thus are primarily a **U.S.** issue. However, the IEA, as well as a [series of 16 studies sponsored by EDF](#), have found these emissions come from all types of production and all parts of the natural gas value chain, including production, processing, transmission and storage, as well as local distribution.⁸ Methane emissions can also occur in upstream oil production where natural gas is a byproduct. Methane emissions are a potential risk to any oil and gas operator and therefore [carry implications for investors globally across the entire supply chain](#).

THE STATE OF PLAY ON GLOBAL METHANE REGULATIONS

NORTH AMERICA LEADING ON METHANE REGULATIONS - The outsized impact of methane on the climate has captured the attention of policymakers and global momentum to address the problem is building. Starting in the **United States**, in February 2014, the state of Colorado introduced the country's first direct regulations on methane. Since then, numerous states have followed Colorado's lead in addressing methane, with Ohio, Wyoming and Pennsylvania putting in place rules



of various scopes to limit emissions. California is on track to establish the most comprehensive and stringent methane rules in the U.S., likely in early 2017.

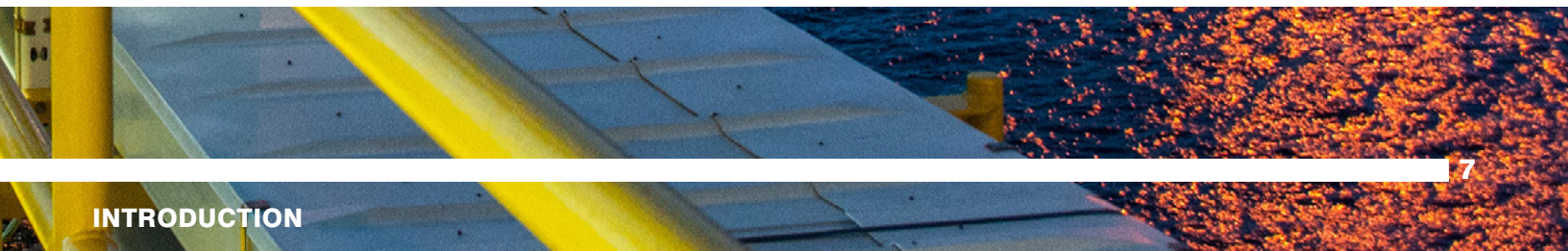
The **U.S.** federal government is also working to limit emissions. In early 2015, the White House announced a [national goal of reducing emissions](#) from oil and gas by 40-45% from 2012 levels by the year 2025. This goal is achievable through adoption of readily available, cost-effective technologies and practices. An ICF study found that a 40% reduction in emissions can be achieved for \$2 billion before considering the value of the methane captured and sold.⁹ Taking the first step toward meeting this goal, the U.S. Environmental Protection Agency (EPA) finalized a rule in May 2016 to limit emissions from new and modified sources for oil and gas development. EPA is moving forward with an Information Collection Request from operators as the first step toward meeting its statutory mandate under the Clean Air Act to regulate emissions from existing sources, which contribute the vast majority of emissions from the oil and gas sector. The U.S. Bureau of Land Management is likely to finalize a rule that will reduce the waste of natural gas and limit emissions from new and existing sources for oil and gas development on federal and tribal lands, potentially by the end of 2016.¹⁰

It is not just the United States that is taking action.

In 2016, both **Canada** (spurred by Alberta's 2015 announcement of a 45% methane reduction goal) and **Mexico** agreed to reduce their oil and gas methane emissions by 40-45% by 2025. All three countries are expected to enact new regulations to meet these targets, with the **U.S.** having already issued some rules, while **Canada** has committed to releasing its draft regulations in early 2017.

The IEA has noted "Outside North America, the absence of robust policy action in this area represents a major missed opportunity to tackle near-term warming."¹¹

EUROPE SLOWLY STARTING TO TAKE ACTION ON METHANE - As a large hydrocarbon importer, user, and home to leading multinationals, Europe has an opportunity to expand its climate leadership to oil and gas methane emissions. European methane emissions are capped under the [Effort Sharing Decision](#), but there is still a need for specific oil and gas methane emissions regulations to reduce those emissions and ensure the cap is met. All five **Nordic** countries have also agreed to help [develop a global oil and gas methane reduction goal](#) "by ensuring each country has developed a national methane reduction plan or otherwise identified and implemented enhanced actions to significantly reduce our overall methane emissions, and by expanding technical cooperation, where appropriate."¹²



AUSTRALIA HAS LIMITED STATE-LEVEL RULES -

In **Australia**, some states and territories have limited regulations to control emissions. **New South Wales**, for example, requires leak detection and repair (LDAR) programs for all natural gas production (including coal-seam gas) as well as a required supplement to annual Environmental Protection Authority compliance reporting that summarizes the details of the program. **Australia** has yet to introduce federal methane standards; however, steps have been taken to capture fugitive emissions data through the National Greenhouse and Energy Reporting Scheme, introduced in 2007.

While certain countries are developing rules, this does not negate the need for corporate engagement, as rules may cover only a portion of any company's assets by geographic legal jurisdiction, require reductions but not reporting, or have insufficient requirements on accurately measuring emissions.

KEY REGIONS LACK EFFECTIVE REGULATIONS

- While some countries have or are considering methane rules, **many of the largest sources globally such as Russia, Nigeria and Iraq have a significant lack of effective regulations.**

Given this absence, in certain ways the onus will be on large international oil companies (IOCs) to limit emissions by implementing globally consistent best practices and operational policies as they partner with state-owned companies in such jurisdictions.

PARIS AGREEMENT HELPS BUILD MOMENTUM FOR GLOBAL METHANE RULES

– The 2015 historic **Paris** Conference of Parties (COP) 21 agreement represented a critical turning point and unprecedented international consensus that business must incorporate a fundamental pivot toward a lower-carbon and climate-resilient world.

As countries look for ways to fulfill their international greenhouse gas reduction commitments stemming from the **Paris** climate accord, and as certain oil and gas companies look to prove they can be part of the climate solution, leading countries and operators are looking to achieve methane reductions as a low-





cost and readily available lever to reduce the rate of climate change. The emissions from the oil and gas industry are the largest industrial source, but notably, they are also associated with a singularly well-capitalized sector with a strong governance capacity. This suggests that progress can be much more rapid than in agriculture and is likely to become a strong priority for regulators.

THE IMPORTANCE OF GOVERNANCE IN MANAGING METHANE

Engagement on methane requires that investors consider related governance issues as they can be foundational to how successfully a company measures, reports and reduces their methane emissions. For example, if the board of a company does not comprise people with the relevant skills, knowledge, and experience, and/or does not have appropriate incentive structures, then a material issue like methane may not be recognized as a significant risk to the company or managed appropriately. In this respect, investors cannot engage on methane (or other environmental issues) in a vacuum, and must make sure to address the relationship between proper governance practices and addressing methane risk.

Leading operators will have governance structures in place where:

- Company board composition contains appropriate skills and recent/relevant environmental experience to effectively manage methane emissions and associated risks.
- Compensation structures are in place to incentivize senior management and staff for methane emissions reductions.
- Demonstrable cultural commitment and senior leadership buy-in (e.g. tone at the top) exist to address material ESG risks, including methane.

PREPARING TO ENGAGE

There are several steps to consider before engaging with an oil and gas company on methane to ensure a successful and impactful dialogue. This guide can help with many of these preparatory steps:

- 1. Build knowledge on methane:** Review the Rising Risk report, this guide, and other relevant literature¹³ to understand the business case for the company to measure, report and reduce their methane emissions. Next, talk with subject matter experts to expand your knowledge on methane. EDF and PRI are happy to be considered key resources (see contact details in back of report).
- 2. Conduct company-specific research:** Use existing public company material, external benchmarks and research (for example: CDP oil and gas sector supplement responses, Société Générale research on methane, and [Disclosing the Facts¹⁴](#)) to understand what, if anything, a company is doing to manage and report on methane emissions.
- 3. Conduct gap analysis:** Using the company research, determine the areas for improvement. The beginner, intermediate and advanced indicators under each section in this guide can help establish the current level of company methane performance.
- 4. Develop an engagement plan:** Identify the objectives of the engagement using the gap analysis. The performance indicators in this guide can help determine actionable next steps for company improvement (for example, to move from beginner to intermediate). Work with the company to develop a plan for continued improvement over time.
- 5. During and after engagement:** Track and evaluate the engagement progress made against the objectives set and company performance within a specified timeline. Plan to re-engage or develop an escalation strategy if progress is not evident as agreed.



COLLABORATIVE ENGAGEMENT ON METHANE – Collaboration with investors sends a unified, aligned and effective signal to a company¹⁵ that methane is a material risk. This approach can help investors leverage knowledge and skills of the group, engage in a more efficient manner and increase the weight of the business case for action and engagement asks. Collaborative engagements on methane are facilitated by the [PRI Collaboration Platform](#), which connects investors globally on engagement initiatives.¹⁶

MEASURE

INITIAL QUESTIONS FOR ENGAGEMENT

- How do you improve the accuracy of your emissions inventory each year?
- What have you learned from direct measurement of emissions conducted to date? What are the main constraints to increasing direct measurement?
- If not incorporating direct measurements, how do you know your emissions inventory is accurate and that you do not have unidentified problems in your system?

FOLLOW-UP QUESTIONS

- If you are not doing any inventory at all, how are you optimizing operational efficiency without understanding your emissions baseline?
- What percentage of your assets are you directly measuring annually and what percentage are you measuring using emission factors?
- Who in your organization is directly accountable for measuring methane emissions?
- What are your plans to increase the level of direct measurement in your emissions inventory process? By when?

OVERVIEW

Under the oft-heard principle of “what gets measured gets managed,” the first step for a company in reducing methane risk is to understand its baseline methane emissions. Creating a robust

and accurate inventory of emissions and sources is a prerequisite for a company to:

- 1) Spot opportunities to improve operational efficiency and financial gain;
- 2) Accurately gauge methane risk; and
- 3) Create emissions reduction plans and targets

WHAT INVESTORS SHOULD LOOK FOR IN AN INVENTORY OF METHANE EMISSIONS

Embodying three principles can ensure a robust measurement program. Measurement should:

- 1. Be comprehensive** – All potentially material sources of methane emissions should be part of an emissions inventory, including emissions from joint venture partnerships.¹⁷
- 2. Employ frequent observation** – Fugitive emissions, or leaks, have been shown to often be intermittent. Because of this, frequent monitoring is therefore suggested to detect and measure these emissions (and repair them).
- 3. Use rigorous quantification** – Companies are encouraged to incorporate direct measurement of emissions whenever possible, as opposed to estimating emissions in a desktop analysis. Direct measurement provides for much greater accuracy in emissions data, particularly for fugitive emissions.

A detailed explanation of the benefits of direct measurement vs. making emission estimates can be found in Appendix Three.



COMPANY LEADERSHIP ON METHANE MEASUREMENT – In 2015, Southwestern Energy bought a Hi-Flow sampler that enables them to quantify the emissions detected from fugitive leaks as part of its comprehensive Leak, Detection and Repair program.

Companies will likely rely on a combination of estimates and direct measurement to develop their emissions inventory. The methodologies companies employ to estimate non-measured emissions should be made available so that investors may compare relevant datasets across a given industry and understand uncertainty factors. Today, many companies do not measure their emissions at all, or rely strictly on generic estimates from historic emissions factors. Leading companies will incorporate robust direct measurement into

their processes to build stakeholder confidence in the accuracy of reported emissions.

PERFORMANCE ASSESSMENT TOOL – The below table is designed to help investors understand where a company falls on the spectrum of methane performance and enable investors and operators to identify concrete next steps to improve performance over time as they move from beginner to intermediate and onto expert level methane management. A performance assessment table is included in each of the main sections of the report.

TABLE 1 – PERFORMANCE ASSESSMENT TOOL FOR MEASUREMENT

BEGINNER	INTERMEDIATE	EXPERT
<ul style="list-style-type: none"> • Estimates emissions using generic emissions factors (which are less accurate) in a desktop analysis. • Developing plans to take measurements within one year. 	<ul style="list-style-type: none"> • Creates a strategic plan for how and where measurements need to be taken and has begun using some direct measurement. • Uses direct measurements to develop company-specific emission factors (more accurate than generic industry factors) to better estimate company methane emissions either at the component or facility level. • Companies support international science efforts by sharing their measurement data. 	<ul style="list-style-type: none"> • Implements a policy where every facility is measured 1x or more every 3 years (vs. doing leak detection quarterly). • Uses company-specific emissions factors when estimating emissions by source. • Companies join international science efforts, provide site access for measurements and funding.

EMISSIONS INVENTORIES FOR COMPLIANCE VS. INVESTOR REPORTING

– Certain countries, like the U.S., Canada and Australia, have regulatory requirements for operators to report methane emissions data to policymakers. Such compliance reporting programs can have fairly prescriptive guidelines for how to estimate emissions, may not require or allow direct measurement, and often are not inclusive of all sources, thus producing incomplete data. The guidelines can also rely on the use of outdated emissions factors which can often be inaccurate by several orders of magnitude.

Emissions inventories created for investor reporting can be an opportunity for companies to develop more accurate and complete information, particularly by including more direct measurement.¹⁸ In general, compliance reporting is strictly focused on quantitative emissions data, and provides little to no qualitative details about how a company is planning to reduce emissions through adoption of best management practices of setting of targets.

As such, investors should encourage companies to go beyond the requirements of compliance measuring and reporting, and make clear such programs are insufficient for investor needs.

In December of 2015, Total, ENI, EDF and others [announced an effort to better understand global oil and gas methane emissions](#). This data can help narrow uncertainty about global oil and gas emissions and help policymakers and investors better understand this risk. This effort is open to other companies to join to help fund the research and provide access to assets for measurements. Additionally, as companies incorporate more direct measurements that data can be shared with this international science effort.



INITIAL QUESTIONS FOR ENGAGEMENT

- What are your plans to expand your methane reporting and what are the potential challenges to overcome?
- What form of a quantitative methane reduction target would work best for your company?
- What is your position on the role of regulations in reducing industry emissions and what would help make you more supportive?

FOLLOW-UP QUESTIONS

- If you have a methane reduction target, how did your company decide on the target? What are the key drivers to building on your positive step and achieving the target?
- What is your company's assurance process for methane emissions reporting?
- How can your company work to build trust with the public through greater public reporting on methane?

OVERVIEW

Investors require actionable data from oil and gas companies in order to manage methane risk, assess company performance and understand the materiality of methane for any given company. In addition to reporting absolute methane emissions on a stand-alone basis (i.e. not in a consolidated carbon dioxide equivalent figure), leading companies will report against the methane metrics detailed in Table Two:



TABLE 2 – SUMMARY OF METHANE METRICS

METRIC	DESCRIPTION	WHY IT'S IMPORTANT	HOW/WHERE TO REPORT				LEADING COMPANY EXAMPLES
				SUSTAINABILITY REPORT		US 10-K FILING	
			CDP	GRI	IPECA	SASB	
EMISSIONS RATE	Methane Emissions/ Gas Production (or throughput) ¹⁹	Enables comparison of company performance over time, and comparisons in methane performance between companies.	OG 7.5	SRS 505-4, page 21 line 412	E1-C3, page 45	NR0101-01 and NR0102-01	Marathon Oil, Chevron, and EOG report a methane emissions rate.
EMISSIONS REDUCTION TARGET	Quantitative, time-bound target to reduce emissions.	Targets signal importance of issue, and drive management and staff performance.	OG 7.7	SRS 302-2-c-iii, page 12 line 144	N/A	N/A	Southwestern Energy reports a goal of keeping methane emissions below 0.36 percent of production.
LEAK DETECTION AND REPAIR (LDAR) PROTOCOL	Frequency, scope (% of assets covered), and methodology (i.e. type of equipment used) of LDAR program.	LDAR is the most important operational practice to identify and fix accidental leaks, and all three aspects drive effectiveness.	OG 7.3	SRS 301-2-c-iii, page 12 line 144	N/A	NR0101-03 and NR0102-02	Southwestern Energy reports conducting LDAR at least once a year on 88% of total well count using an OGI/FLIR camera.
METHANE POLICY POSITION	Company position on the role of regulation to limit industry emissions and how this position differs from that of trade associations and other third party organizations to which the company is a member.	Leading corporate actors not only have best-in-class operations to limit emissions, but also support policies which reduce reputational and product risk for the whole industry.	N/A	SRS 615-1.2, page 10 line 102	SE14-01, page 124	NR0101-25	Statoil has disclosed a public policy position on methane regulations to “support with minor exceptions.” ²⁰

A NOTE ON METHANE METRICS AND REPORTING PLATFORMS

– While the methane metrics included in the table above can, in some instances, be used in various reporting platforms, **only CDP has formally incorporated these metrics into their methodology and so should currently be considered a leading option for methane reporting.** Adoption of these methane metrics by [GRI](#), [SASB](#) and other reporting frameworks like [IPIECA](#) can be achieved through investor input and support. Such harmonization of reporting across platforms can help manage reporting burdens on industry.

TARGET SETTING – EDF research demonstrates that oil and gas companies, with limited exceptions, are not setting methane reduction targets. Target setting is a key practice to drive management attention and affect change. Investors should encourage companies to set and disclose targets, and be flexible to the form of the target, given that each company may have its own approach to this issue.

Companies may wish to set intensity targets based on their methane emissions rate. For example, the industry led [One Future](#) initiative seek to limit upstream and midstream emissions to no more than 0.36% and 0.30% of production by 2025, respectively. Alternatively, companies can set absolute emissions reduction targets based on tonnage or a percentage reduction over time. With the North American countries aiming to reduce emissions 40-45% by 2025, investors may wish to ask how companies can set targets that meet or exceed these national targets.

With the North American countries aiming to reduce emissions 40-45% by 2025, investors may wish to ask how companies can set targets that meet or exceed these national targets.

ACTION ON METHANE DISCLOSURE RESOLUTIONS

Over the last few years, investors like [Trillium](#) and [CalSTRS](#) have filed methane-focused resolutions, urging companies like WPX Energy, Gulfport Energy and Occidental Petroleum to provide better reporting on how they manage methane emissions. Methane disclosure resolutions filed in the U.S. during the spring 2016 proxy season have also been supported by proxy advisory firms ISS and Glass Lewis. In the U.S., organizations such as [Ceres](#) and the [Interfaith Center on Corporate Responsibility \(ICCR\)](#) can help investors support and file shareholder resolutions concerning methane.

“Given the existing and potential regulation regarding mitigating methane emissions, considerable reputational risks and the increased local and national attention regarding this issue, we believe shareholders could benefit from the disclosure on how a company is monitoring and managing the level of methane emissions from its operations, including a company-wide review of the policies, practices and metrics related to its methane emissions risk management strategy.”

- Glass Lewis methane resolution opinion



TABLE 3 – PERFORMANCE ASSESSMENT TOOL FOR REPORT

BEGINNER	INTERMEDIATE	EXPERT
<ul style="list-style-type: none"> • Reports on one of the methane metrics in Table 2 • Reports methane emissions data separate from other GHGs. • No methane reduction target or firm plans to set one. • Does not support shareholder resolutions seeking improved methane disclosure. 	<ul style="list-style-type: none"> • Reports against 2-3 methane metrics. • Uses best management practice quantitative target, (e.g. conducting LDAR on a % of assets, reducing methane leaks incidence rate per inspection, improve frequency of LDAR) • Neutral stance on methane disclosure resolutions. 	<ul style="list-style-type: none"> • Reports against all the above metrics. • Reported information is audited by third-party. • Transparently reports progress against public methane reduction targets. • Supports appropriate methane disclosure shareholder resolutions, if applicable.



REDUCE

INITIAL QUESTIONS FOR ENGAGEMENT

- What best management practices do you have in place and what percentage of your operations are controlled for emissions? How will this look in three years?
- What specific steps are planned to reduce methane emissions next year?
- What governance elements support holistic, rigorous methane management and how do you evaluate success?

FOLLOW-UP QUESTIONS

- If you have an LDAR program, what have been the biggest learnings in terms of emissions hot spots, and what plans are underway to prevent future emissions?
- How is the reduction in methane emissions incentivized through compensation structures at the board, senior management and staff levels?
- Is your company constructively participating in shaping regulations of methane in the U.S., Canada and Mexico (or, if applicable, other countries of operation)? Please explain.
- Does methane fit into your overall GHG emissions management plan? How?
- How prepared is the company for anticipated regulations? What impacts do you see coming from regulations concerning methane emissions?
- What time frame are you using and what cost/

benefit analysis are you doing to determine whether to invest in methane reduction technologies and practices? How are you incorporating other factors like risk reduction, social license to operate and worker safety into these decisions?

- How could joining an industry voluntary initiative like OGMP help your company develop and adopt leading practices?
- What efforts are being made by your board to consider the risk and opportunities of methane emissions?

OVERVIEW

Lowering emissions will help secure a role for natural gas in the transition to lower-carbon economies and prepare companies for coming regulations. Because reducing methane emissions often reduces co-emitted pollutants such as volatile organic compounds and hazardous air pollutants, emission reduction efforts can help address public health and regional air quality concerns which can improve a company's social license to operate. There are also potential economic benefits of reducing emissions, with some reduction options providing a positive payback for operators (depending on the price of gas and market access). Without addressing methane emissions, the industry's already scrutinized license to operate is further jeopardized.

Companies and investors can drive reductions in methane emissions by: 1) encouraging the broad adoption of proven best management practices and 2) supporting public policy.

TABLE 4 – SUMMARY OF BEST MANAGEMENT PRACTICES AND TECHNOLOGIES TO REDUCE METHANE EMISSIONS

SOURCE OF EMISSIONS	TECHNOLOGY/ PRACTICE SOLUTION	DESCRIPTION	DEVELOPMENT	NOTES
Fugitive Emissions (i.e. unintended leaks)	Leak, Detection and Repair (LDAR)	The process of finding and fixing Fugitive emissions (i.e. leaks).	LDAR should be conducted at least quarterly on all assets using best available technology (i.e. wOGI infrared cameras).	ICF International Found LDAR to be the single biggest opportunity to reduce methane emissions. Many firms offer leak detection as a service, eliminating capital cost for operators.
High-bleed pneumatic controllers and pneumatic pumps	Low-bleed or intermittent pneumatic controllers/ zero emissions alternatives	Pneumatics regulate process conditions and pump chemicals using the pressure of the gas which then “bleeds” (i.e. vents) into the atmosphere. Low or intermittent bleed emission valves vent less gas than high-bleeds. Emissions-free alternatives such as solar electric pumps have zero emissions.	Companies should always use low-bleed or intermittent pneumatics depending on which has lower emissions in a given situation and emissions-free alternatives where applicable. Companies should retrofit high-bleed pneumatics with lowering emitting options.	Sites with access to electricity access can eliminate pneumatic emissions by replacing with alternatives such as instrument air pneumatics or electric actuators and pumps.
Storage Tanks	Flares or Vapor Recovery Unit (VRU)	<ul style="list-style-type: none"> Flares burn off emissions from tanks. It is the cheapest option, but still emits carbon dioxide emissions from combustion, and can emit methane from incomplete combustion. VRU captures, compresses, and then directs emissions to a sales line. It is a higher cost, but results in no methane or carbon emissions. 	All tank emissions should be controlled. Deployment of flares vs. VRU will depend on size of tank and potential for emissions.	Flares and VRUs are only effective if properly designed and maintained. Operators should assure that tank control devices are adequately sized and frequently inspected to avoid issues such as unlit flares.
Liquids Unloading	Plunger Lifts	Plunger lifts are designed to improve productivity on older wells with water build up that limits gas flow.	While plunger lifts are one option used to remove water build up in wells, they also may limit emissions in the process compared to simply opening the well to atmospheric pressure to remove water.	Smart automation of plunger lifts and artificial lifts can reduce emissions in cases where plunger lift-equipped wells have high emissions.
Centrifugal Compressor Vents	Dry seal retrofit or vent gas capture	<ul style="list-style-type: none"> Retrofit wet seal compressors with dry seals, which emit less emissions. Gas capture controls vented gas by re-routing it to the compressor intake line. 	All compressors should be controlled to limit emissions. Both options have similar economics and reduction potential, so operator will likely choose which is most optimal given operating conditions.	

METHANE EMISSIONS REDUCTIONS CAN BE COST-EFFECTIVE

Many studies have identified numerous cost-effective and proven technologies to reduce emissions.²¹ Certain estimates show that the entire U.S. natural gas industry could reduce emissions by 40% for around \$2 billion, less than 1% of total industry capex.²² Parallel studies have shown similar levels of reduction opportunities and results in Canada and Mexico.^{23,24}

Investors can make the business case for reducing methane emissions knowing companies can do so with minimal costs.

Robust and comprehensive measurement is an important first step towards planning a reduction strategy. Companies that create and maintain a detailed inventory of their emissions will be better positioned to prioritize the largest and most cost-effective reductions first, providing the biggest return in terms of reductions per dollar of capital deployed.

Table Four summarizes some of the most effective best management practices that should be encouraged as a means for companies to meet reduction targets. For more details on these technologies and others, refer to [ICF International's report on the economics of emissions reductions](#).

Best management practices are not an end in themselves, but merely a means to the end of reducing emissions. Results matter most. For this reason, adoption of best management practices (BMPs) should be coupled with robust measurements and transparent reporting that demonstrates a declining trend in emissions over time.

CLIMATE AND CLEAN AIR COALITION OIL AND GAS METHANE PARTNERSHIP

One way companies can learn, develop and share best practices is by joining industry initiatives like the Climate and Clean Air Coalition's Oil and Gas Methane Partnership (OGMP), hosted by the United Nations Environment Program. The OGMP creates a global platform for companies to understand and systematically manage their methane emissions more fully. Current partner companies, including ENI, PEMEX, BP, PTT, Repsol, Total, Statoil and Southwestern Energy, represent about 10% of global gas production. The OGMP provides an international venue for participating companies to report on and lower emissions, as well as to share experience and knowledge. Participant companies decide which of their operations to include in the program and then establish the viability of control options for emissions sources.

Membership in this initiative is an indication that a company is taking a systematic approach to dealing with its emissions. Investors should encourage operators to join OGMP and recognize those already in the program while also encouraging them to extend its practices to all assets, both directly owned and in joint ventures.

In 2015, ministers of France, Germany, Italy, Japan, Republic of Korea, Netherlands, Poland, Singapore, Spain, United Kingdom, and the European Union acknowledged the role that reducing methane emissions plays in limiting near-term warming. The coalition encouraged all oil and gas companies headquartered or operating within their countries to join the Oil and Gas Methane Partnership.

INDUSTRY LEADERSHIP ON METHANE INCLUDES SUPPORTING PUBLIC POLICY

Investors should encourage operators to play an active and supportive role in public policy development. Companies have a wealth of information on technology and operating practices they can share with policymakers to ensure rules are crafted in smart, cost-effective ways.

INDUSTRY PLAYS LEAD ROLE IN DEVELOPING COLORADO METHANE REGULATIONS – In February of 2014, the state of Colorado put in place the first direct regulations of methane in the U.S., in large part due to the support of the three largest oil and gas operators in the state: Noble Energy, Anadarko and Encana. All three operators worked closely with Governor Hickenlooper and the environmental community (including EDF) to develop a regulatory solution to the state’s methane problem that would work for all parties.

Data-driven policy that utilizes proven technologies and sets a floor for best practices will be an important part of the solution to reducing global methane emissions. While some in the oil and gas industry are taking robust steps on a voluntary basis, a majority of companies are exposed to disproportionate risk by not measuring, reporting and reducing their methane emissions. Some trade associations have impeded regulatory development, even filing lawsuits against the U.S. Environmental Protection Agency regulations that aim to reduce emissions by requiring twice-annual inspections for lost product. An individual company’s failure to manage methane responsibly can put the entire industry’s license to operate at risk. Effective public policy can ensure a level playing field for operators.

In November of 2015, Alberta announced a new climate strategy which included a methane reduction goal of 45% below 2012 levels by 2025. Canadian Natural Resources Limited, Cenovus Energy Inc., Shell Canada Limited and Suncor Energy Inc. have all publicly endorsed the climate plan, including the goal to limit methane emissions.



TABLE 5 – PERFORMANCE ASSESSMENT TOOL FOR REDUCE

BEGINNER	INTERMEDIATE	EXPERT
<p>Best Management Practices</p> <ul style="list-style-type: none"> • Methane emissions rate slowing in growth towards a flat trend. • Only partially controls sources of emissions. • Does not participate in OGMP or other voluntary initiatives, but uses OGMP technical guidance to develop methane management plans. <p>LDAR – frequency (f), scope (s) and methodology (m)</p> <ul style="list-style-type: none"> • (f) – Inspect assets, but less than once a year • (s) – Inspect less than a third of assets annually • (m) – Looks/listens for leaks and/or uses soap bubbles 	<ul style="list-style-type: none"> • Methane emission rate is decreasing • Substantially controls and adopts BMPs for new sources of emissions and retrofits some existing infrastructure. • Participates in voluntary initiatives like OGMP but with less than 50% of company assets. <p>LDAR – frequency (f), scope (s) and methodology (m)</p> <ul style="list-style-type: none"> • f) – Inspect assets between once and twice a year • (s) – Inspects between a third and less than 100% of assets annually • (m) – Uses Method 21 	<ul style="list-style-type: none"> • Methane emissions rate and absolute emissions significantly decreasing • Substantial retrofits of existing assets with leading emissions reduction activities. • Supports development and adoption of innovative technologies to reduce emissions. • Requires joint venture partners to adopt best practices and operational policies on par or more stringent than their own. • Participates in voluntary initiatives like OGMP with more than 75% of company assets. <p>LDAR – frequency (f), scope (s) and methodology (m)</p> <ul style="list-style-type: none"> • (f) – Inspect assets 4 – 12 times a year • (s) – Inspects virtually all assets with limited exceptions • m) – Uses optical gas imaging (OGI) cameras
<p>Policy</p> <ul style="list-style-type: none"> • Does not publicly oppose public policy or encourage trade associations to oppose policy. 	<ul style="list-style-type: none"> • Neutral on role of regulations to reduce emissions. • Publicity articulates policy differences between company and any trade association memberships.²⁶ 	<ul style="list-style-type: none"> • Publicly supports public policy to reduce emissions <i>and</i> share technical information with regulators to improve public policy.

ADDITIONAL RECOMMENDATIONS:

HOW INVESTORS CAN ENGAGE ON POLICY -

Investors should support regulations that require industry to utilize proven and cost-effective technologies to manage methane emissions. While investors can engage with companies to reduce company-specific risks, only standards that apply to all actors can comprehensively address the industry-wide risk that natural gas faces from methane. Unless all operators work to reduce emissions, methane has the potential to undermine the environmental benefits of natural gas, with negative implications for long-term demand.

Investors can be supportive of policy in many ways, including meeting with regulators and government

officials, providing comments on proposed rules, publishing op-eds, and signing on to investor statements of support.

Example - In April of 2016, 76 global investors representing \$3.6 trillion in assets under management [signed a public letter](#) supporting the March 2016 U.S.-Canada announcement where both countries committed to reduce methane emissions by 40-45% by 2025 and to adopt regulations to achieve this goal. The \$3.6 trillion, which included \$2.1 trillion from European investors, represented a more than ten-fold increase in investor support for methane action in less than two years. This support helped the U.S. Environmental Protection Agency strengthen a draft methane regulation in its final version.



CONCLUSION

Methane is a key frontier for investor engagement with oil and gas operators. Investors in the oil and gas industry face a number of material risks from emissions of methane which require heightened scrutiny to assess operator performance and risk management, as well as to improve disclosure from companies. Operators face a changing societal, political and regulatory environment in a globally carbon-constrained world and must choose whether to adapt and lead or incur the consequences of lagging.

Unmanaged emissions of methane will directly undermine the industry's ability to play a role in this environment, impairing its social license to operate and public trust while representing lost product and operational inefficiency. Conversely, active methane management can inspire investor and stakeholder confidence while driving efficiencies and cutting risk. Despite the importance of methane risks and opportunities, there is a distinct gap in disclosure that impairs investor's ability to distinguish leaders from laggards and appropriately manage the issue.

Engagement from investors will be required to gain the data they need to factor methane management into portfolio selection, while encouraging continuous improvement as operators progress across the spectrum. This guide is designed to be a tool to support such constructive dialogue, holding companies accountable for managing methane and driving results. Each company will fall on a different part of the spectrum of methane management, but well-managed companies that work to limit material risks will demonstrate forward progress as they measure, report and reduce their emissions.

An Investor's Guide to Methane: Engaging with Oil and Gas Companies to Manage a Rising Risk

Below is a summary of the main points from the measure, report and reduce sections of An Investor's Guide to Methane, as well as a consolidated performance assessment tool for quick reference

KEY POINTS FOR MEASURING, REPORTING, AND REDUCING EMISSIONS

	MEASURE	REPORT	REDUCE
SUMMARY	The first step for a company in reducing methane risk is to understand their baseline methane emissions and significant sources	Actionable methane data is required to benchmark company performance and identify opportunities for continued improvement in reducing emissions	Lowering emissions reduces risk as it helps to prepare for coming regulations, improve social license to operate and operational efficiency, and secures a role for natural gas in a lower-carbon economy
GUIDING PRINCIPLES	<ul style="list-style-type: none"> • Create a complete inventory of methane emissions, including robust use of direct measurement • Employ frequent observation especially for unpredictable leaks • Use rigorous quantification 	<ul style="list-style-type: none"> • Report methane emissions rate • Report frequency, scope and methodology of LDAR program • Set and disclose quantitative methane emissions reduction targets 	<ul style="list-style-type: none"> • Adopt cost-effective best management practices and technologies • Demonstrate declining trend in emissions • Establish governance practices to address methane risk • Investor and operators should support public policy to reduce emissions from all operators
SAMPLE DISCUSSION QUESTIONS	<ol style="list-style-type: none"> 1. How do you improve the accuracy of your emissions inventory each year? 2. What have you learned from direct measurement of emissions conducted to date? What are the main constraints to increasing direct measurement? 3. How do you know your emissions inventory is accurate without direct measurement? 	<ol style="list-style-type: none"> 1. What are the plans to expand methane reporting and potential challenges? 2. What form of a quantitative methane reduction target would work best for your company? 3. What is your position on the role of regulations in reducing industry methane emissions? 	<ol style="list-style-type: none"> 1. What best management practices are in place and what percentage of sources are controlled? How will this look in three years? 2. What specific steps are planned to reduce methane emissions next year? 3. What governance elements support holistic, rigorous methane management and how do you evaluate success?



SUMMARY PERFORMANCE ASSESSMENT TOOL

	BEGINNER	INTERMEDIATE	EXPERT
MEASURE	<ul style="list-style-type: none"> Estimates emissions using generic emissions factors Developing plans to take measurements within one year 	<ul style="list-style-type: none"> Strategic plan for how and where measurements need to be taken Uses direct measurement to develop company-specific emissions factors Share data with international science efforts 	<ul style="list-style-type: none"> Measures all facility emissions 1x or more every three years Robust use of company-specific emissions factors Active participant in and funding of international science efforts
REPORT	<ul style="list-style-type: none"> Reports one of the recommended methane metrics Methane emissions reported separately from other GHGs Methane reduction target 	<ul style="list-style-type: none"> Reports against 2-3 methane metrics Uses best management practice quantitative targets (e.g. conducting LDAR on a % of assets, achieve % reduction from certain emissions sources) 	<ul style="list-style-type: none"> Reports action taken and progress made against all recommended metrics, incl. quantitative reduction target; reports comprehensive methane management approach Information audited by a third-party
REDUCE	<ul style="list-style-type: none"> Methane emissions rates trending downward to flat Only partially controls emissions Less than 1x/yr leak inspection No public opposition of regulation 	<ul style="list-style-type: none"> Methane emissions rate decreasing Adopts BMPs for new emissions sources 1 – 2x/yr leak inspection Neutral on regulations 50% of assets covered under voluntary initiatives 	<ul style="list-style-type: none"> Methane emissions rate and absolute emissions significantly decreasing Substantial retrofits of existing assets 4 – 12x/yr leak inspection Publicly supports regulation More than 75% of assets covered under voluntary initiatives

TO DOWNLOAD THE FULL REPORT AN INVESTOR'S GUIDE TO METHANE GO TO www.edf.org/investorguide

APPENDIX 2

ADDITIONAL RESOURCES ON METHANE

To stay up to date on methane news, including science, policy and industry updates, follow the Environmental Defense Fund [Energy Exchange](#) and [Business](#) blogs.

ENVIRONMENTAL DEFENSE FUND METHANE SCIENCE STUDIES - Sixteen methane science studies measuring emissions across the entire supply chain conducted by EDF in partnership with leading academics and industry.

[Methane Research: The 16 Study Series](#)

ENVIRONMENTAL DEFENSE FUND RISING RISK REPORT – An in-depth overview of the state of methane disclosure in the oil and natural gas industry. The report includes a deep-dive analysis looking at industry disclosure practices, while providing forward-looking recommendations on ways to improve reporting practices.

[Rising Risk](#)

INTRODUCTORY GUIDE TO COLLABORATIVE ENGAGEMENT: HOW INSTITUTIONAL INVESTORS CAN EFFECTIVELY COLLABORATE IN DIALOGUE WITH COMPANIES (PRI) – This handbook is designed to provide a practical introductory guide on engaging collaboratively with listed companies on environmental, social and governance (ESG) issues.

[Introductory guide to collaborative engagement](#)

METHANE EMISSIONS REDUCTION TECHNOLOGIES AND PRACTICES – For more detailed information and diagrams about the

reduction technologies and practices referenced in this guide, in addition to others, please consult the following reports:

ICF International. [“Economic Analysis of Methane Emission Reduction Opportunities in the U.S. Onshore Oil and Natural Gas Industries”](#) pgs. 3-9 – 3-23 and Appendix D

ICF International. [“Economic Analysis of Methane Emission Reduction Opportunities in the Canadian Oil and Natural Gas Industries”](#)

ICF International. [“Economic Analysis of Methane Emission Reduction Opportunities in the Mexican Oil and Natural Gas Industries”](#)

OIL AND GAS METHANE PARTNERSHIP (OGMP)– Learn more about the [Oil and Gas Methane Partnership](#), a voluntary industry initiative, run by the Climate & Clean Air Coalition (CCAC).

PRI (FORTHCOMING) ENGAGING WITH OIL AND GAS COMPANIES ON FRACKING: AN INVESTOR GUIDE - This guide provides investors with an overview of how to effectively engage with companies on their fracking operations across four focus areas: governance, water, air and community impact. Taking the lessons learned from a two-year PRI-coordinated investor engagement on the issue, this document provides investors with tested questions to encourage companies in their portfolio to minimize risks related to fracking. Methane is identified as one of the areas that need to be addressed moving forward and the EDF/PRI methane engagement guide provides the detailed approach to holding dialogue with companies on methane.



PRI INVESTOR EXPECTATIONS ON CORPORATE CLIMATE LOBBYING – Global investors signed this statement to make clear that company lobbying on climate change related policy and regulation must be in line with the universally accepted goal of limiting global temperature rises to two degrees Celsius. The investors call for improvements in practice and transparency from investee companies on aspects such as their governance processes for climate policy engagement and their membership of or support for all third-party organizations that lobby on climate change (not just those where the company is on the board or provides financial support).

[Investor Expectations on Corporate Climate Lobbying](#)

RHODIUM REPORT – A report detailing the extent of global methane emissions from the oil and gas sector. A key finding is that the industry is losing \$30b a year from methane emissions.

[Untapped Potential: Reducing Global Methane Emissions from Oil and Gas Systems](#)

APPENDIX 3

EMISSIONS QUANTIFICATION TECHNIQUES

There are two broad ways for companies to create an emission inventory for methane: the use of estimates and direct measurement. Although estimates are more common, direct measurement is more effective in providing accurate emissions information.

Companies can *estimate* their inventory using a series of emissions factors and activity factors in a desktop analysis. In this method, a company calculates that they have X number of a type of source (e.g. valve, tanks, etc.) and then assumes each source emits Y emissions per year. Multiplying the two will provide an estimate of total emissions for a particular source. While this method is better than not estimating emissions at all, it is less accurate than directly measuring emissions. Companies often rely on general emission factors (e.g. a valve emits Y emissions per year) rather than company-specific factors which are more accurate. Estimating emissions using this methodology also likely undercounts emissions, particularly from leaks, or fugitive emissions, since emission factors often neglect the largest leaks, known as “super-emitters,” which account for a significant portion of overall emissions. Engineering equations are another approach that estimates emissions with physics-based equations using measured or estimated parameters such as gas pressure as inputs. Engineering equations can be more accurate than emission factors, but only if the input data are accurate.

For these reasons, companies should incorporate *direct measurement* into their process of developing an emissions inventory. Direct measurement is the process of going out into the field and taking measurements of actual emissions using a variety of “bottom-up” (e.g. on the ground, source-specific measurements) and “top-down” (e.g. site-level or field-level measurements generally done by aircraft) methodologies. While taking actual measurements can require more time and cost, it will yield more accurate information that will better enable a company to understand its actual emissions, track and monitor emissions over time, improve decision-making and prioritize the largest, most cost-effective emissions sources.

The EDF methane science studies have yielded one insight with a great impact on risk: **the distribution of emissions is heavy tailed.** Among sources of fugitive emissions are what are referred to as “super-emitters”, which release an excessive amount of methane and build the heavy tail. In other words, there are a small number of disproportionately large leaks.

When assessing methane emissions, companies tend to sample measurements. These samples are then scaled-up, and the resulting company-wide figures often wrongly assume that the leak distribution follows a normal distribution. However, this practice does not account for the super-emitter caused heavy-tailed distribution, and thus underestimates the actual emissions. Therefore, investors should query companies on the assumptions they make when generalizing from sample measurements to total emissions.

NOTES

¹ According to EDF calculations based on IPCC AR5 CH 8. Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

² Birol, Faith. "World Energy Outlook Special Report: Energy and Climate Change." International Energy Agency. IEA, 15 June 2015. Web. <<https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf>>

³ Ibid

⁴ Wright, Sean and Carlos Villacis. "Rising Risk: Improving Disclosure in the Oil and Gas Industry." (n.d.): n. pag. Environmental Defense Fund, Jan. 2016. Web. <https://www.edf.org/sites/default/files/content/rising_risk_full_report.pdf>.

⁵ [IEA expects natural gas consumption to grow 1.5% per year through 2021.](#)

⁶ Larsen, Kate, Michael Delgado, and Peter Marsters. "Untapped Potential: Reducing Global Methane Emissions from Oil and Natural Gas Systems." Rhodium Group, Apr. 2015. Web. <http://rhg.com/wp-content/uploads/2015/04/RHG_UntappedPotential_April2015.pdf>.

⁷ Ibid.

⁸ Op. Cit., 2

⁹ ICF International. "Economic Analysis of Methane Emission Reduction Opportunities in the U.S. Onshore Oil and Natural Gas Industries." (2011): Mar. 2014. Web. <https://www.edf.org/sites/default/files/methane_cost_curve_report.pdf>

¹⁰ "Proposed Methane and Waste Prevention Rule." Bureau of Land Management, 25 Apr. 2016. Web. <http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/methane_and_waste.html>.

¹¹ Op. Cit., 2

¹² "U.S.-Nordic Leaders' Summit Joint Statement." The White House. Office of the Press Secretary, 13 May 2016. Web. <<https://www.whitehouse.gov/the-press-office/2016/05/13/us-nordic-leaders-summit-joint-statement>>.

NOTES

¹³ Please see appendix for additional resources.

¹⁴ Companies respond to the [CDP](#) survey on climate change; Société Générale research (2016) U.S. & Canada crackdown on methane from oil and gas; [Disclosing the Facts](#) benchmarks the public disclosure of companies on hydraulic fracturing with performance indicators on methane.

¹⁵ For more information on collaborative engagement, please see [Introductory guide to collaborative engagement: how institutional investors can effectively collaborate in dialogue with companies](#)

¹⁶ Other methane-related investor initiatives in the U.S. are convened by [ICCR](#) and [Ceres](#).

¹⁷ OGMP has identified nine key sources of methane: <http://www.ccacoalition.org/en/content/ccac-oil-gas-methane-partnership>

¹⁸ A table comparing compliance and investor-focused reporting can be found on page 24 of Rising Risk.

¹⁹ Methane emissions/total energy production is an alternative means of reporting a rate for companies that produce predominantly oil.

²⁰ In CC2.3a of Statoil's 2015 CDP response

²¹ Op., Cit., 6

²² Ibid.

²³ "Economic Analysis of Methane Emission Reduction Opportunities in the Canadian Oil and Natural Gas Industries." ICF International, Sept. 2015. Web. <https://www.edf.org/sites/default/files/content/canada_methane_cost_curve_report.pdf>.

²⁴ "Economic Analysis of Methane Emission Reduction Opportunities in the Mexican Oil and Natural Gas Industries." ICF International, Oct. 2015. Web. <https://www.edf.org/sites/default/files/content/mexico_methane_cost_curve_report.pdf>.

²⁵ See Reduce section for an overview of OGMP

²⁶ See ["Investor Expectations on Corporate Climate Lobbying"](#)

FOR MORE INFORMATION, PLEASE CONTACT:

Sean Wright

Senior Manager, Corporate Partnerships Program,
Environmental Defense Fund
1 202-572-3303
swright@edf.org

Gemma James

Manager, Environmental Issues,
Principles for Responsible Investment
+44 (0) 20 3714 3207
Gemma.james@unpri.org

Paul Chandler

Manager, Environmental Issues,
Principles for Responsible Investment
+44 (0) 20 3714 3180
Paul.chandler@unpri.org



Environmental Defense Fund

1875 Connecticut Ave NW,
Suite 600
Washington, DC 20009
T: 1 (202) 387 3500
www.edf.org



Principles for Responsible Investment

5th Floor, Camperdown Street,
London, E1 8DZ, UK
+44 (0) 20 3714 3141
www.unpri.org