Environment and Climate Change Canada
Environnement et Changement climatique Canada

Reducing Methane Emissions from Canada's Oil and Gas sector

Discussion Paper

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Canada

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Purpose

At the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change, Canada joined 110 countries in endorsing the Global Methane Pledge, which committed countries to take economy-wide action to reduce methane emissions by 30% by 2030. As part of its endorsement, Canada was the first country to signal an ambitious target to achieve at least a 75% reduction in oil and gas sector methane emissions relative to 2012 levels by 2030.

The purpose of this paper is to solicit comments from interested parties to help inform the development of new federal regulations and other measures needed to achieve at least a 75% reduction in methane emissions from the oil and gas sector from 2012 levels by 2030.

Environment and Climate Change Canada is seeking input on a number of key topics: emission reduction technologies and costs, design approaches for future regulations, as well as options for methane measurement, monitoring, reporting and verification. To guide the collection of input, several questions are included in the attached Annex. We also welcome perspectives and comments on other related issues of importance to you.

Oil and Gas Methane Emissions

Methane (CH_4) is the main component of natural gas. A colourless, odourless flammable gas, methane is a potent greenhouse gas (GHG) with a global warming potential that is more than 80 times greater than carbon dioxide (CO_2) over a 20-year period, and more than 25 times greater over a 100-year period.[1] It is listed as a toxic substance under Schedule 1 of the *Canadian Environmental Protection Act, 1999* (CEPA).

Methane makes up about 13% of Canada's total GHG emissions, and approximately 21% of the oil and gas sector's total GHG emissions in carbon-dioxide equivalent (CO_2e), as reported in Canada's 2021 National Inventory Report. Methane emissions remain in the atmosphere for a relatively short period of time, meaning that reducing them can have near-term benefits for reducing the impacts of climate change. IPCC research shows that methane is responsible for at least a quarter of today's global warming.

Oil and gas facilities are the largest industrial emitters of methane in Canada. Although many oil and gas activities emit methane, including exploration, drilling, production, field processing, gas gathering, refining, and transmission and distribution, most of the methane emissions from this

[1] As confirmed by the recent report from the Sixth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC).

sector are mostly from upstream activities: the production and field processing of light and heavy crude oils, bitumen, natural gas and natural gas liquids. Many activities emit methane, including exploration, drilling, production, field processing, gas gathering, refining, and transmission and distribution. Emissions can vary significantly depending on gas composition, access to gas gathering infrastructure, age and technical standard of equipment, operating conditions, and maintenance and other operational practices.

Methane emissions in the oil and gas sector are often categorized according to how they are released:

1. **Intentional equipment venting for operational or safety reasons**. Venting from equipment controllers and pumps occurs when natural gas is used to operate these devices. Compressors increase gas pressure to transport it, but typically vent small volumes. Tanks and other systems not designed for high pressure are directly vented, or incorporate safety systems that may vent gas to ensure the equipment does not fail due to pressure changes. At oil production facilities, when infrastructure to deliver gas off-site is not available and there is no immediate need for the gas on site as fuel, produced gas is typically flared or vented.

2. **Area sources.** Methane is emitted when non-recovered diluents, additives, and bitumen are mixed with water in tailings ponds as a result of oil sands mining.

3. **Fugitive emissions from accidental leaks or equipment failures** may result from deterioration of equipment, especially seals and fittings, or improper installation or operation of equipment. Such emissions occur at all stages of production, processing and transmission, across all equipment and facility types. In recent years, the issue of persistently leaking equipment and ‘super-emitters’ has been recognized as a major source of fugitive emissions.

Methane emissions can be continuous, intermittent or temporary, and vary significantly among sources. This variability creates challenges to reduce emissions. Where methane emissions are continuous and significant, measures to capture and use or manage methane are generally clearly identifiable and can be relatively low-cost. Where emission sources or releases are temporary, intermittent, low volume, diffuse or unexpected, mitigation can be more challenging.

Policy Context

Canada has committed to achieve net zero emissions by 2050 and to reduce total GHG emissions by 40% to 45% below 2005 levels by 2030. Reducing methane emissions from the oil and gas sector is one of the lowest-cost GHG reduction opportunities. The methane regulations published by Canada in 2018 were estimated to reduce methane emissions at an average cost of $17 per tonne of GHGs (CO2e) without accounting for the benefits of spurring clean technology development, which can be exported to other oil and gas producing countries. Lowering emissions of methane from the oil and gas sector can also have positive impacts on air quality and public health. Methane emission control measures can have substantial co-benefits for other air pollutants, including volatile organic compounds and black carbon.

Improved methane performance by the Canadian oil and gas industry may enhance the Environment, Social and Governance (ESG) standards for companies, with the potential to differentiate energy products from Canada.

The Special Report on Global Warming from the IPCC concludes that achieving net-zero global emissions by 2050 is necessary to avoid the worst impacts of climate change, and the Sixth Assessment Report of the IPCC (released August 2021) highlights the need to significantly and urgently reduce both carbon dioxide and methane emissions this decade. Similarly, in its Net Zero Emissions by 2050 Scenario, the International Energy Agency concluded that methane emissions from global fossil fuel operations would need to fall by around 75% between 2020 and 2030 in order for the globe to attain net zero by 2050.

Various federal and provincial actions focus on reducing methane emissions from the oil and gas sector, including 2018 federal regulations under CEPA and various provincial regulations. By 2020, the Government of Canada had entered into Equivalency Agreements with the Governments of British Columbia, Alberta and Saskatchewan to enable regional tailored approaches to methane mitigation in their respective oil and gas sectors.

Building on this work, the Government is seeking stakeholders' views on how it should strengthen or modify its regulations to ensure that the oil and gas methane reductions decline by at least 75% by 2030 from 2012 levels.

Snapshot: Methane Policies in place in Canada

National:

- *Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector),*
- Emissions Reduction Fund
- Proposed Clean Fuel Regulations (final regulations targeted for Spring 2022)
- Clean Resource Innovation Network

Alberta:

- *Methane Emission Reduction Regulation*, incorporating:
  - Directive 060: Upstream Petroleum Industry Flaring, Incinerating, and Venting Directive *and*
  - Directive 017: Measurement Requirements for Oil and Gas Operations
- Emissions Reduction Alberta
- Methane Emissions Program
- Baseline and Reduction Opportunity Assessment Program

British Columbia:

- *Drilling and Production Regulation*
- Clean Infrastructure Royalty Credit Program and Clean Growth Infrastructure Royalty Program
- Oil and Gas Processing Facility Regulation
- Clean BC Industry Fund

Saskatchewan:

- *The Oil and Gas Emissions Management Regulations*
- Directive PNG036: Venting and Flaring Requirements
- Directive PNG017: Measurement Requirements for Oil and Gas Operations
- Methane Action Plan

As part its commitments under the Global Methane Pledge, the Government is developing a Methane Strategy that will outline measures it is taking to reduce methane emission across the economy. This will include actions in the oil and gas, waste and agricultural sectors. The Strategy will also elaborate on opportunities to improve measurement and reporting of methane emissions, which is foundational to driving greater emissions reductions across sectors. The Strategy is targeted for publication in mid-2022.

Methane Monitoring and Reporting

Canada provides an annual report on its greenhouse gas emissions, including methane, to the United Nations Framework Convention on Climate Change in the *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada* (NIR). The NIR provides estimates of all anthropogenic sources of methane within Canada and for each province and territory dating back to 1990.

Continuous improvement is a key principle for the NIR. The 2021 edition included significant improvements to the estimation of methane emissions from landfills. The 2022 edition will include a new fugitive emission model to estimate CO_2 and CH_4 emissions from pneumatic devices, compressor seals and equipment leaks in the upstream oil and gas industry. This will

result in upward revisions to methane emissions data in the 2022 NIR as compared to the previous year. The new model will replace the previous method that extrapolated data for specific years based on production. It will use Canadian-specific data, will facilitate the adoption of new scientific data, and will better capture the impact of improvements in technologies and industry practices on emissions. These revisions will help close the gap between NIR estimates and the results from recent scientific studies indicating methane emissions have been underestimated.

Total annual methane emissions in Canada are also reported in part through the Greenhouse Gas Reporting Program. The program collects self-reported information on GHG emissions from facilities across Canada that emit more than 10 kilotonnes CO_2e per year. While the program captures most GHG emissions, it does not include methane emissions from the large number of oil and gas facilities that emit below the threshold.

Provincial Regulators also have emission reporting requirements under provincial gas conservation requirements, production reporting systems, environmental air quality and GHG emission tracking, and through various offset and funding programs.

Canada's recent national review on methane from the oil and gas sector acknowledged that recent scientific studies indicate methane emissions have historically been underestimated in Canada.

Industry, government and universities have been working to improve and expand methane measurements. In particular, the increased use of satellite, aircraft and mobile sensors is allowing governments and industry to measure methane emissions directly from industrial sites.

New technologies and systems to measure fugitive emissions are also emerging. Methods such as continuous monitoring systems, aerial surveillance and high-resolution satellite instruments are being developed and deployed, allowing more complete monitoring and faster reaction to address unexpected failures.

Snapshot: Methane Emission Monitoring Options

• Satellites can offer wide-area scans to identify very large leaks, with variable temporal coverage, providing snapshots of emissions.

• Piloted aircraft with mounted sensors provide wide area coverage and higher capacity for site measurements compared to ground-based systems.

• Unpiloted aerial vehicles (drones) can carry sensors on fixed-wing and rotary-propelled systems to detect methane emissions at short and medium ranges.

• Mobile ground labs (for example, a truck or van) can be equipped with a variety of sensors and a global positioning system to enable a survey approach including methane concentration mapping.

• Optical gas imaging cameras are used by inspectors and operators walking production sites to detect emissions.

• Continuous emission monitoring instruments, using optical methods, laser-based sensors, and methane concentration detectors can be permanently installed at production sites.

With the right infrastructure, monitoring through advanced ground, aerial and satellite technology could identify a wide range of oil and gas methane emission sources at a reasonably low cost. Collecting and analysing data from these integrated systems will help inform the design of methane policy for the oil and gas sector in Canada. In particular, the Government is considering the opportunities these emerging technologies and methods present for developing the 2030 regulations as performance-based regulations. Continuous improvement of measurement and monitoring approaches will involve government, industry, academia and civil society.

Emission Reduction Technology Solutions

Canada's 2018 regulations and corresponding provincial systems have already set industry in motion to reduce emissions.

Further reductions of methane emissions will require current technology to be deployed on a much greater scale along with new solutions that may be at an earlier stage of technical readiness. This may require government support to complement regulated reduction requirements.

New and enhanced technologies have been developed that reduce methane emissions through electrification, fuel switching, efficiency improvement, and mitigating fugitive emissions. For example, vapour recovery units can be installed to capture gas that would otherwise be vented.

This gas can be diverted to sales or it can be used to supply energy needs of the facility, such as heating or electricity generation, which can reduce on-site facility costs.

Snapshot: Potential for additional action

- **Coverage**: Expand facility coverage to all facilities that handle hydrocarbon gas within the oil and gas sector, including the expansion to the distribution sector
- **Pneumatic Devices:** Require non-emitting solutions for pumps and controllers
- **Fugitive Emissions and Abnormal Operations**: Enhancing emission monitoring and frequency to reduce the time to repair leaks
- **Routine Venting**: Limit or eliminate routine flaring and venting
- **Temporary Venting (like Blowdowns)**: Require capture and conservation or destruction of emissions during planned maintenance operations
- **Combustion Systems:** Optimize combustion of hydrocarbon gas

Designing an Approach

Canada intends to expand coverage and increase the stringency of the methane reduction obligations in the existing federal oil and gas methane regulations. This could include new approaches to address incidental releases of super-emitters and expanded fugitive emissions management requirements. Recognizing that emissions have historically been underreported in the sector, the Government will also consider ways for the regulations to increase measuring and reporting to better inform decision making.

Building Upon the Current Approach

The new regulations could continue the approach in the existing regulations of specifying the technical solutions that must be implemented to reduce emissions from specific sources. This approach would be well suited to dealing with situations where there remains a lack of data on emissions, allowing differentiated actions across equipment and facility types.

Command-and-control regulations provide predictable results and clear compliance requirements. They can drive specific actions, for example by banning the use of certain equipment for new operations, and requiring the phase-out of that equipment at existing operations. This type of regulation can also prescribe operational practices, such as frequency of inspection and other maintenance activities. However, this approach risks missing emissions from undefined sources and from temporary activities such as unintentional venting. It can also limit the flexibility for regulated parties to determine the most cost-effective approach to achieve

a desired outcome and may lock in certain technologies and approaches that limit adoption of advances in technology.

Moving to a Performance-Based Approach

ECCC is also considering an alternative approach that would place greater emphasis on performance-based objectives. The corollary to specifying performance based objectives (like maximum emission levels or emission reduction targets) would be the need to include recordkeeping and reporting requirements as well as standardized monitoring methods. This approach would provide more flexibility for innovation by specifying the emissions outcome required while leaving compliance solutions to regulated parties.

In general, performance-based regulations offer flexibility to industry to solve emission problems using locally appropriate solutions. The key to performance-based regulation is accurate measurement. For oil and gas methane, this would need to cover venting and fugitive emissions from on-going and temporary activities.

The difficulty in accurately measuring methane emissions from leaks poses a challenge for operators and regulators to ensure specific outcomes. However, if this challenge is managed, this approach could allow for ongoing improvements in technology and create incentives for companies to seek innovative solutions, enabling operators to choose their preferred path to compliance.

Another approach could allow facilities to choose which set of obligations to which they will be subject.

A key factor that will influence the design of the regulations is the availability of monitoring technologies and the ability to set standardized monitoring, measurement and reporting methodologies for some or all of the methane sources to be covered, including super-emitters.

Additional action to manage costs and accelerate technological readiness could be provided through programs to support clean technology deployment and required infrastructure. For example, funding projects which accelerate regulatory compliance, especially regarding shared infrastructure access that could support the elimination of venting and flaring of methane.

Consideration will also be given to the nature of compliance flexibilities.

Next Steps

Environment and Climate Change Canada will be engaging stakeholders, including industry, non-governmental organizations, Indigenous organizations and research organizations on potential regulatory options and possible complementary measures. The Government will initiate structured sessions to gather information and showcase mitigation technology applications and costs, measurement and monitoring technologies and systems, and Canadian producer plans and priorities to manage methane emissions.

Based on feedback received through this process, proposed regulations are expected to follow in early 2023.

Parties wishing to comment on any aspect of this paper, including responding to questions posed in the attached Annex, are invited to provide written comments by May 25, 2022, to:

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Annex I: Discussion Questions

Context

1. What opportunities exist for regulatory cooperation and alignment, domestically and abroad?

2. What lessons from Federal and Provincial regulatory development and Equivalency experiences should be considered?

3. What best practices or lessons from international jurisdictions should be considered?

Regulatory design to achieve at least a 75% reduction by 2030

4. Should Canada retain the approach in its current oil and gas methane regulations, and expand their coverage and increase their stringency?

5. Should Canada develop new, performance-based regulations?

6. Are there some sources of methane emissions that are not well suited to a performance-based requirement?

7. What monitoring and reporting requirements should support performance based requirements?

8. What barriers exist related to methane monitoring? How can they be overcome?

9. How can real-time measurement technologies be incorporated into the regulations?

10. Should the regulations allow a facility to select which regime to be subject to?

11. Should it allow this for different methane sources or only on a facility-wide basis?

12. How should methane be treated in other oil and gas policies?
    a. Carbon pricing
    b. The oil and gas sector emissions cap (in development)

Net zero by 2050

13. From the perspective of achieving net-zero GHG emissions by 2050, should any reductions for methane emissions be considered “dead ends” and avoided in the regulations?

Supportive measures

14. What activities should the science and research community prioritize to support methane reduction?

15. What measures would accelerate deployment of methane reduction technology?

16. What limits the deployment of methane reduction technology?

17. How should a centre for excellence on methane detection and elimination be leveraged to support strengthened methane regulations?

Annex II: Methane Policy Context

The Special Report on Global Warming from the IPCC concludes that achieving net-zero global emissions by 2050 is necessary to avoid the worst impacts of climate change, and the Sixth Assessment Report of the IPCC (released August 2021) highlights the need to significantly and urgently reduce both carbon dioxide and methane emissions this decade. Similarly, in its Net Zero Emissions by 2050 Scenario, the International Energy Agency concluded that methane emissions from global fossil fuel operations would need to fall by around 75% between 2020 and 2030.

The United Nations Environment Program's Global Methane Assessment demonstrates that the levels of methane mitigation needed to keep warming to 1.5° C will not be achieved by broader decarbonization strategies alone. Focused strategies specifically targeting methane need to be implemented to achieve sufficient methane mitigation.

In 2016, Canada and the U.S. issued a Joint Statement on Climate, Energy, and Arctic Leadership, where both countries committed to reduce methane emissions by 40 to 45% below 2012 levels by 2025 from the oil and gas sector, and explore new opportunities for additional methane reductions. To achieve this target, both countries committed to regulate methane emissions in the oil and gas sector. Mexico later joined this commitment.

Later in 2016, the Government of Canada released the Pan-Canadian Framework on Clean Growth and Climate Change. The PCF affirmed Canada's commitment to reduce methane emissions from the oil and gas sector by 40% to 45% below 2012 levels by 2025.

The Government of Canada launched the Emissions Reduction Fund (ERF) in Fall 2020, as a COVID-19 response measure to support oil and gas workers by supporting investments that reduce or eliminate methane and other GHG emissions from oil and gas operations. The ERF has 3 streams:

- The Onshore Deployment Program supports the deployment of infrastructure and solutions to reduce methane and other GHG emissions from venting and flaring in upstream and midstream oil and gas operations.
- The Offshore Deployment Program supports the deployment of technologies to reduce GHG emissions from Newfoundland and Labrador's offshore oil and gas industry and to improve the environmental performance of oil spill-related activities.
- The Offshore RD&D Program supports research, development and demonstration of technologies and solutions that reduce GHG emissions in Newfoundland and Labrador's offshore oil and gas industry.

In the December 2020 A Healthy Environment and a Healthy Economy, the Government of Canada framed its existing 2025 target as laying the foundation for additional reductions by 2030 and 2035, and reiterated that it will continue to work with provincial partners, Indigenous

organizations, civil society, and industry to reduce methane emissions. The Government also committed to publicly report on the efficacy of the suite of federal actions to achieve the 2025 methane target in late 2021.

In June 2021, a federal review of Canada's approach to reducing oil and gas methane was launched in consultation with provincial governments, industry, environmental non-governmental organizations, and Indigenous organizations. This report, released in December 2021, concluded that Canada is on track to meet its 2025 target for methane reductions from the oil and gas sector.

In December 2021, the Prime Minister issued mandate letters with commitments to address methane emissions through key Departments:

- The Minister of Environment and Climate Change was asked to develop "a plan to reduce emissions across the broader Canadian economy consistent with the Global Methane Pledge" and "require through regulations the reduction of oil and gas methane emissions in Canada by at least 75% below 2012 levels by 2030."
- ECCC published a discussion paper on reducing landfill methane emissions in Canada in January 2022.
- The Minister of Natural Resources and the Minister of Innovation, Science and Industry were asked to "establish a global Centre for Excellence on methane detection and elimination."
- The Minister of Agriculture and Agri-Food Canada was asked to "work with farmers and stakeholders to reduce methane and fertilizer emissions in the agricultural sector" as part of a green agricultural plan for Canada.

Several important methane-related initiatives are in place and under development in other jurisdictions. Understanding the direction of action across jurisdictions enhances opportunities for policy synergies and complementary programs.

The European Commission published a Methane Strategy and has proposed legislation for reducing methane in the energy sector. The Commission is consulting on a proposal that includes:

- Measurement, reporting and verification requirements
- Leak detection and repair surveys every 3 months
- Prohibitions on venting and flaring
- Requirements on importers to provide measurement, reporting and verification and abatement measures undertaken by exporters

With a view to building on its 2012 and 2016 national regulations for oil and gas methane, in November 2021 the United States Environmental Protection Agency announced a proposed new regulation that would reduce methane from new and existing oil and gas sources by 74% from 2005 levels by 2030. The proposal would expand and strengthen emissions reduction

requirements currently in place for new, modified and reconstructed oil and natural gas sources. It would also introduce – for the first time – a requirement that American states reduce methane emissions from hundreds of thousands of existing sources. Key features of the proposed US approach include:

- a monitoring program for new and existing well sites and compressor stations
- flexible compliance options for identifying major methane leaks and requirements for oil and gas facilities to check for leaks from 4 to 6 times per year depending on facility-type
- a zero-emissions standard for new and existing pneumatic controllers
- standards to eliminate venting of associated gas, and require capture and sale of gas where a sales line is available, at new and existing oil wells
- presumptive standards for other new and existing sources, including storage tanks, pneumatic pumps, and compressors
- a commitment to receive comments and consider supplementary rulemaking in 2022 to address additional sources not covered under the proposed rulemaking

In March 2022, the Oil and Gas Climate Initiative (OGCI), a group that includes many of the world's largest oil companies, launched the Aiming for Zero Methane Emissions Initiative. The OGCI committed to strive to reach near zero methane emissions from oil and gas assets by 2030, to put in place all reasonable means to avoid methane venting and flaring, and to repair detected leaks, and to support the implementation of sound regulations to tackle methane emissions and encourage governments to include methane emissions reduction targets as part of their climate strategies.