

CANADA'S METHANE GAS PROBLEM:

Why strong regulations can reduce pollution, protect health, and save money

Canada has a serious methane problem. Newly published research, including infrared camera footage, commissioned by the Alberta Energy Regulator and undertaken by Alberta-based energy services company GreenPath shows that methane emissions from Canada's oil and gas sector — due to both venting of methane as part of normal operations, and equipment leaks — are higher than previously thought.¹

Fortunately the problem can be fixed. Evidence shows that methane emissions can be cost-effectively reduced and eliminated by 2030. Smart federal regulations can help make that happen. This report makes recommendations about what those smart regulations should look like.

Methane is a potent climate pollutant, and responsible for 15 per cent of Canada's total greenhouse gas emissions, half of which are from the energy sector. Methane is a short-lived pollutant, and over 20 years, its global warming impact is 84 times greater than carbon dioxide.² Reducing methane emissions now will have a bigger short-term impact on global temperatures.

Leaks from oil and gas facilities could also have significant health impacts. In high concentrations, methane can cause oxygen deprivation, resulting in loss of consciousness and suffocation. Leaks and venting from oil and gas facilities often contain compounds other than methane that could impact human health because they are toxic, even carcinogenic, or lead to ground level ozone and respiratory diseases.

Active emission reductions would provide immediate climate and health benefits such as reducing greenhouse gas (GHG) levels and harmful air pollution. There will also be economic benefits of action through the creation of jobs to detect and repair methane leaks and the potential to use and sell the methane rather than letting it go to waste.



INFRARED CAMERAS REVEAL WHAT THE NAKED EYE CAN'T SEE: CONSTANT METHANE LEAKS FROM HEAVY OIL TANKS

Key Issues: Methane Emissions From Oil and Gas Operations

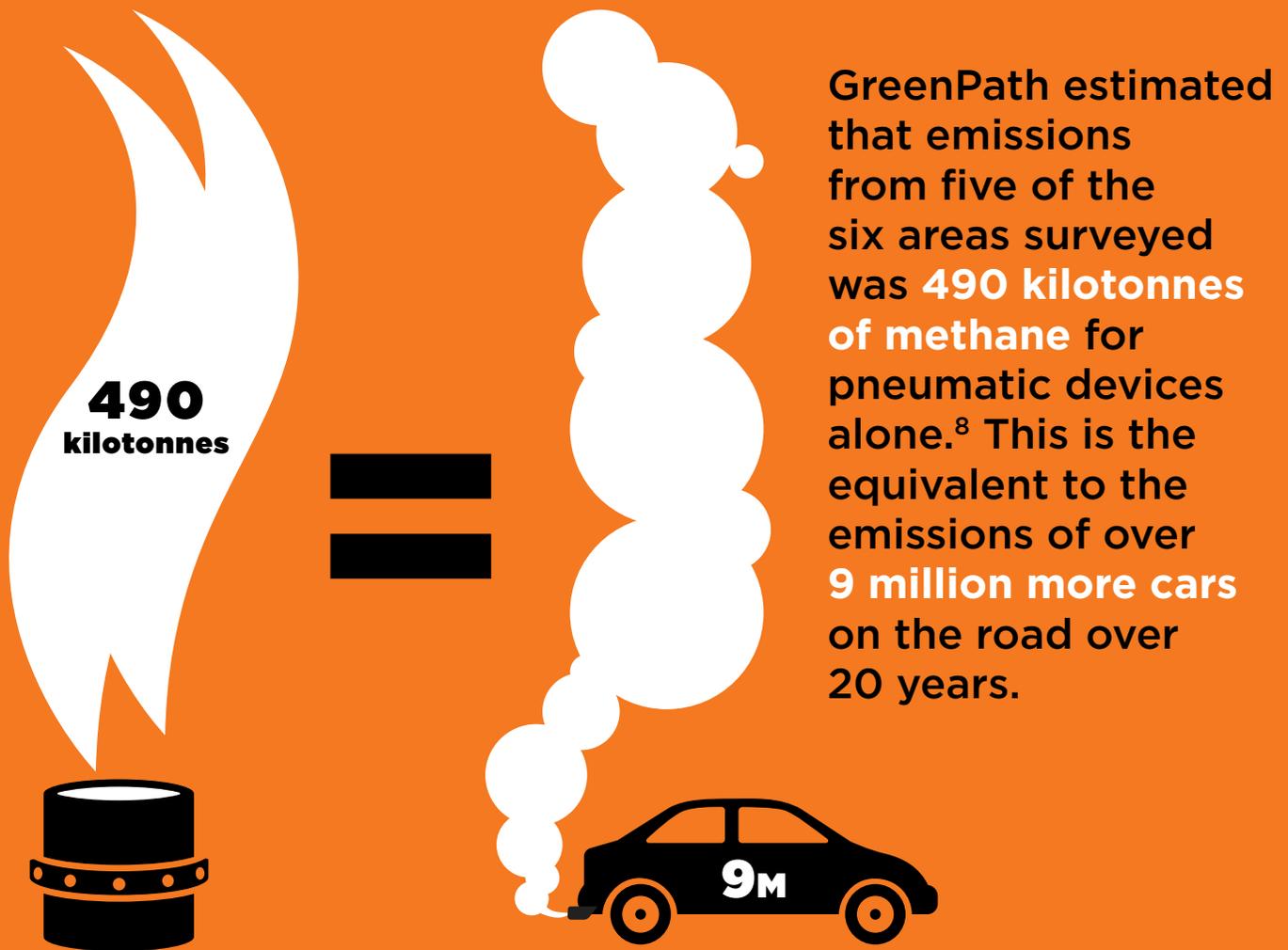
Our analysis of the GreenPath report, new infrared camera [video footage](#), and other research show that:

- 1** The oil and gas industry is underreporting methane emissions in Alberta. The GreenPath study found significantly more pneumatic devices present than currently reported. (These are pumps and controllers that control the flow or pressure of the hydrocarbons in the system.) Using this correct figure for the number of devices, the actual emissions at oil and gas facilities from pneumatic devices are 60 per cent higher than estimates used to compile Canada's GHG inventory. To put this in perspective, these devices alone have the same short-term climate impact as 9 million cars.
- 2** Equipment is routinely malfunctioning and leaking methane, and industry is venting methane — simply releasing it to the atmosphere — when it could be capturing it or using equipment that does not vent at all. The GreenPath data is clear that there is a problem and industry needs to start finding and fixing these leaks. On average, there is almost one piece of equipment leaking or venting methane at each well (with greater methane emissions at oil well sites compared to natural gas wells). This shows there are more emissions than industry acknowledges. Worryingly, some of these oil facilities are excluded from the potential federal methane regulations.
- 3** Industry is not currently required to look for methane leaks to see if they have a problem.
- 4** Leak detection and repair (LDAR) should be done on a quarterly basis to ensure proper leak detection.
- 5** Video footage shows that methane is also leaking from oil tanks found at wellheads. Some of these leaks are because of bad tank design, while other emissions are due to common industry practices, such as routing methane gas to oil tanks where it is allowed to escape out the top of the tank.
- 6** Methane emissions provide one of the lowest-cost emission reduction opportunities available in Canada. Research in other jurisdictions shows that plugging methane leaks and upgrading equipment can result in increased profits through the capture of methane for use or sale.
- 7** New access to information request findings show that as methane continues to leak from oil and gas facilities, the oil and gas industry is lobbying against proposed regulations that would reduce those emissions.

Analysis of new research shows that methane emissions are much higher than reported

Research completed in partnership with the Alberta Energy Regulator (AER) and published in March 2017 by GreenPath Energy Ltd., a Calgary-based energy services company, shows that methane is leaking and being deliberately released from many oil and gas facilities in Alberta.³ The researchers investigated 395 different oil and gas facilities in six

Research data and subsequent calculations reveal startling results and demonstrate that methane emissions in Alberta are higher than documented.



geographic areas in Alberta⁴ between August and December 2016, totaling 676 wells.⁵ The facilities were diverse in nature, producing natural gas, conventional oil, or heavy oil, (more specifically Cold Heavy Oil Production with Sand (CHOPS)). They were operated by 16 different companies, including industry majors and mid-sized companies.

GreenPath surveyed the majority of conventional oil and gas wells (and production) in each region. The survey undertook several activities, including:

- A survey of the number of pneumatic devices at each site: These are pumps and controllers that control the flow or pressure of the oil or natural gas in the system
- Counting the number of tanks and devices that were leaking or venting
- Using infrared cameras to document leaks from tanks and devices

These data and subsequent calculations reveal startling results and demonstrate that methane emissions in Alberta are higher than documented.

The infrared footage from both tanks and pneumatic devices is dramatic and telling.⁶

Underreporting methane emissions from pneumatic devices

The survey found there were, on average, 3.0 pneumatic controllers and 1.2 pumps per site and that each site emitted the GHG equivalent of 20 vehicles.⁷

Extrapolating from the collected data, GreenPath estimated that emissions from five of the six areas surveyed (excluding one area - Bonnyville - which was surveyed for tank emissions only) was 490 kilotonnes of methane for pneumatic devices alone.⁸ This is the equivalent to the emissions of over 9 million more cars on the road over 20 years as methane is a potent short lived greenhouse gas. This total is 60 per cent higher than the 306 kilotonnes of methane estimated for pneumatics in all of Alberta (not just the five regions) for 2010,⁹ data relied upon by the federal government when preparing its GHG emissions inventory.¹⁰ This suggests that either industry doesn't know



SOAP BUBBLES INDICATE A METHANE LEAK IN A PIPE

The researchers also used infrared cameras to detect additional sources of methane (predominantly wells and batteries) at oil or gas well sites.

how many of these devices they have, or they have allowed the data from this category to go underreported for years. Neither option inspires confidence that industry can fix this problem without strong regulations forcing them to reduce their waste.

A high number of leaks and vents for other devices

The researchers also used infrared cameras to detect additional sources of methane (predominantly wells and batteries) at oil or gas well sites. On average there was almost one (0.8) significant source of methane leaks per facility.¹¹ Oil facilities had a much greater number of methane sources compared to natural gas facilities, and heavy oil facilities had by far the highest number on average.¹² The prevalence of observable emissions casts doubt on existing industry emission control practices. The soon to be proposed federal methane regulations will be an important step to address these emissions. However, they may exclude many of these oil producing sites that were found in this study to be emitting a significant amount of methane.

Methane leaks are due to both regular practices and malfunctioning equipment

The GreenPath research revealed two separate issues related to methane emissions:

- Oil and gas facilities use equipment and devices that vent methane as part of their normal operation
- Facilities have equipment (both pneumatic devices and tanks) that are malfunctioning, inadvertently leaking methane to the surrounding environment

Devices that vent methane as part of normal operations

The researchers found that 95 per cent of the pneumatic devices at conventional oil and gas facilities vented methane and other gases.¹³ The vented gas is primarily methane but also includes volatile organic compounds (VOCs) such as benzene and other hydrocarbons.¹⁴ That means that venting hydrocarbons like methane to the atmosphere was a normal part of operation for the vast majority of devices.

It is possible to use electric controllers and pumps that don't vent hydrocarbons like methane. At least one site near Red Deer has been operating without incident for at least six years using only fully electric devices. However, researchers found that only four per cent of devices at the sites surveyed were electrically-driven. An additional one per cent of devices used instrument air, another way to eliminate gas venting.

Methane leaking from malfunctioning devices and tanks

The GreenPath research also found that there was a high number of controllers (a type of pneumatic device) that were malfunctioning. Most controllers were "snap-acting" devices, which when operating normally vent gas only as needed, for example when the system needs to be depressurized for safety or maintenance. However, roughly one-third of the controllers in the survey were found to be continuously venting methane.¹⁵ Frequent monitoring would detect these, and allow for repairs to stem emissions.

Also, the researchers noted that many of the methane sources at facilities were oil tanks.¹⁶ In the U.S. a majority of high emission sources detected at oil and gas facilities are from tank vents and hatches.

In this study, the amount of methane being emitted from these tanks was not estimated but

It is possible to use electric controllers and pumps that don't vent hydrocarbons like methane. At least one site near Red Deer has been operating without incident for at least six years using only fully electric devices.

the researchers noted that these emissions "often appear[ed] significant."¹⁷ Vapour recovery units could be used to limit or eliminate these emissions. However, the survey found that this type of unit was used at only one relatively new site, representing six per cent of all the tanks surveyed.¹⁸ Researchers also observed "excessive venting" from tanks at certain facilities due, the report speculates, to valves not operating as designed or the wrong-sized separation equipment being used.¹⁹

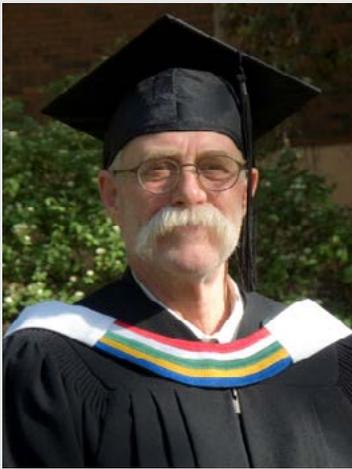
Emissions from oil and gas facilities can have significant health impacts

Methane is harmful to human and animal health. In high concentrations, methane can cause oxygen deprivation, resulting in loss of consciousness and suffocation. Reducing methane emissions in the oil and gas sector will also mean a decrease in hydrocarbons more generally, which will carry health benefits. These hydrocarbons contain volatile organic compounds (VOCs) such as benzene, a known carcinogen.²⁰ VOCs also contribute to ground-level ozone and respiratory illnesses.²¹

There are many oil and gas facilities across Canada that operate very close to communities, farms, ranches, and local citizens. As such, there are numerous stories of Canadian citizens who are put at risk from methane emissions (and other hydrocarbons) from oil and gas production. In some cases, their health and lives are seriously impacted. A look at an individual citizen named Wayne Ungstad tells a story that is, unfortunately, not unique.



Yearly methane leaks from oil and gas operations could heat over 200,000 Alberta homes



WAYNE UNGSTAD

WAYNE UNGSTAD

is a 60-year old Alberta farmer and rancher who lives halfway between Red Deer and Edmonton, not far off Highway QEII that runs between them. Since 1991, half a dozen different companies—the current one being Canadian Natural Resources Limited (CNRL)—have

produced natural gas on his property, a mere 300 metres from his house. In those 26 years, the well has had four blowouts that have sent plumes of natural gas, including methane and other hydrocarbons, across his property. No matter whom he called—the company, the Alberta regulator, the Alberta environmental hotline—nobody seemed able or willing to take appropriate action.

During the third blowout, in 2009, Wayne had the misfortune to be working in his tractor so he didn't hear the gas release. The plume of gas enveloped him, ruining the tractor's diesel motor and provoking a serious illness in Wayne.

For months afterward, Wayne had vertigo, his equilibrium as he puts it was “thrown to hell,” and was not even able to sit in a tractor seat.

With a mix of anger and exhaustion, Wayne describes the impacts he and his community have suffered from natural gas leaks. Various people from the surrounding area, including a 21-year old, have been diagnosed with cancer. He lost three head of cattle when they drank from a wetland that had been contaminated with toxic runoff from the gas facility. After a battery of tests on the dead cattle, CNRL offered to reimburse Wayne for only two, at a price of their choosing. Wayne never cashed the cheque because of the conditions attached to the cheque.

Even when the natural gas facility is supposedly operating properly, Wayne checks which direction the wind is blowing before deciding what path to take on his property to check on his cattle. That's because he knows there is gas leaking from the facility almost continuously, and that gas can affect his health. Staying upwind is the only way to avoid those emissions.

Over a decade ago, Wayne went back to school, first to finish high school, and then to get a degree in native studies and environmental science. He wanted to better understand the impact the oil and gas industry has on human health and on the environment. He now

NATURAL GAS FACILITY ON WAYNE UNGSTAD'S FARM



Various people from the surrounding area, including a 21-year old, have been diagnosed with cancer.

participates in public and multi-stakeholder panels, giving input on how Alberta should be regulating the industry that has tragically become an integral part of his life.

He still awaits a satisfactory conclusion to all the damage he and his farm continue to experience from leaks and blowouts. The latest blowout at the natural gas facility on his ranch happened less than a year ago, in August 2016. He has yet to be contacted by the company or the regulator concerning any of these hydrocarbon releases.

Wayne checks which direction the wind is blowing before checking on his cattle. That's because he knows there is gas leaking from the facility almost continuously, and that gas can affect his health. Staying upwind is the only way to avoid those emissions.



GAS LEAKING FROM A VENT AS SEEN BY INFRARED CAMERAS

Fixing methane leaks has economic benefits

The methane gas that industry is letting disappear into thin air is enough gas to heat over 200,000 Alberta homes and has a market value of \$67.6 million. Research shows that eliminating these emissions represents some of the most cost-effective climate solutions in Canada.²²

Leaked methane is also wasted methane. Eliminating waste means that methane can be sold or used, creating higher revenue for oil and gas companies and potentially higher royalties for governments. For example, Colorado has similar regulations for methane emissions. A survey found that 8 of 10 representatives of Colorado oil and gas companies said that their company is “profiting, coming out even, or paying out just a little more than they are collecting in new revenue” because of activities stemming from the state’s regulations.²³

Regulated methane standards can also create a significant number of well-paying jobs. A study of the employment impacts for the U.S. found that similar regulations there could create 5,400 direct and indirect jobs in a variety of sectors, including in oil and gas and the energy services sector.²⁴

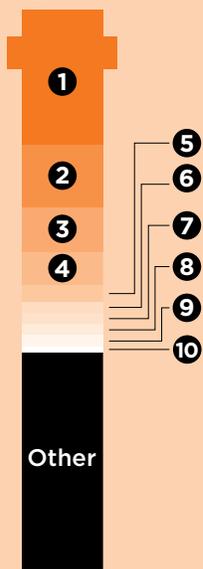
Eliminating waste means that methane can be sold or used, creating higher revenue for oil and gas companies and potentially higher royalties for governments.

Alberta’s top methane emitters

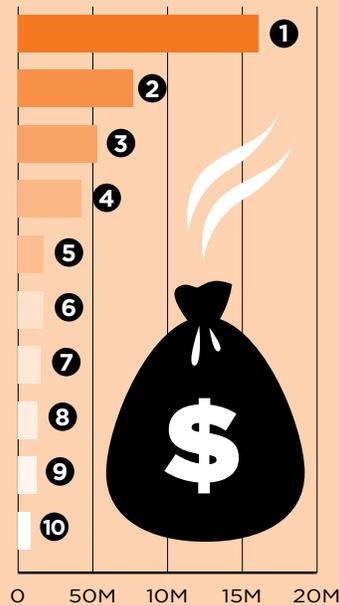
The Alberta Energy Regulator has collected data on methane emissions across the province. The vast majority of these emissions – 86 per cent – can be attributed to a named company, while the remaining 14 per cent cannot. Using the emissions that can be associated with a company, below is the list of Alberta’s Top 10 methane polluters. Since methane is emitted in both conventional oil and gas production and bitumen production, the Top 10 list includes producers of both.²⁵

List of top methane emitters in Alberta oil and gas sector

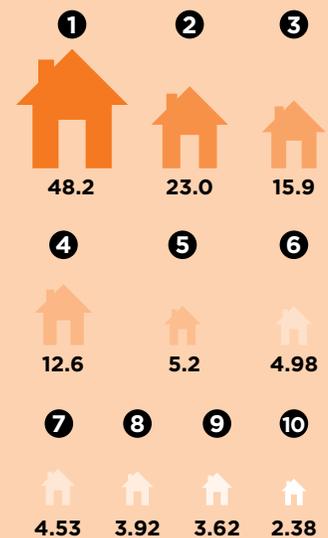
% of AB Methane Emissions



Value of wasted gas (\$CAN)



of AB homes that could be heated (x1000)



- 1 Canadian Natural Resources Ltd. 2 Husky Oil Operations Ltd. 3 Syncrude 4 Devon (all entities)
- 5 Suncor Energy Inc. 6 Twin Butte Energy Ltd. 7 Cenovus (all entities) 8 Penn West Petroleum Ltd.
- 9 Gear Energy Ltd. 10 Cardinal Energy Ltd.

The oil and gas industry is trying to avoid fully addressing methane emissions

Canada's oil and gas industry is far from monolithic, but the activities and public comments from the industry association, the Canadian Association of Petroleum Producers (CAPP), is instructive. Similar to other issues related to climate change, CAPP has been disingenuous on the regulation of methane emissions. It appears the industry association is engaging in activities that includes behind the scenes lobbying to undermine government efforts to address methane emissions.

In March 2016, U.S. President Barack Obama and Canadian Prime Minister Justin Trudeau were set to meet to discuss what kind of cooperative action the two countries could take with respect to methane

emissions. CAPP vice-president Alex Ferguson sounded supportive of joint action, but also signalled that a voluntary approach should be used for existing facilities.²⁶ That attempt to influence the outcome failed two days later when the U.S. and Canada agreed in a joint statement that they would regulate new and existing oil and gas sources, and that the U.S. would adopt the same methane target as Canada (40 per cent to 45 per cent reductions by 2025).²⁷ In June 2016, Mexico joined its North American partners with a commitment to reduce methane emissions, again with the same target.²⁸

This joint statement certainly didn't dissuade CAPP from trying to water down Canada's approach to methane regulations. In documents obtained through Saskatchewan's Freedom of Information Act, CAPP continued to lobby federal and provincial governments through the summer and fall of 2016.²⁹

CAPP continues to advocate for a voluntary approach for existing facilities, meaning that

regulations would apply to new facilities only as they come online. This, despite the GreenPath research showing that voluntary standards have been unsuccessful at addressing significant problems related to methane emissions. According to the documents, the industry association was also lobbying for a delay in implementing any measures and advocating for inspections to be made less frequently.³⁰ Not surprisingly, CAPP's approach would lead to fewer methane emission reductions. (Incidentally, the documents show that CAPP was also lobbying to weaken the government's approach to carbon pricing and pending clean fuel standards).³¹

The election of Donald Trump as U.S. President gave CAPP another argument to make in public: Canada moving ahead with methane regulations would make Canadian industry uncompetitive. CAPP was using this line even before President Trump was inaugurated³² and continued with any new move by Congress, regardless of its significance.³³

The reality is that the Canadian oil industry needs to play catch up on methane emissions since many U.S. states have methane regulations already in place. In fact, more oil and gas production is already facing methane regulations in the U.S. than total conventional oil and gas production in Canada.³⁴ Also, 20 other countries, including major oil and gas producers like Norway, the UK, Australia, and Mexico, have joined Canada in committing to reduce methane emissions from the oil and gas sector.³⁵

Thankfully, Canadian leaders are continuing to move forward. In the immediate aftermath of the U.S. election, Alberta Premier Rachel Notley reaffirmed her commitment to climate action, including methane regulations. Premier Notley made the point that Alberta finalized its climate plan in advance of any decisions by the federal government or the previous U.S. administration.³⁶ Any reversal in the U.S. meant nothing to the

province's plans and ambitions, according to the Premier.³⁷

A similar message came from Prime Minister Trudeau. He said it was "full steam ahead" for his climate plan after the American presidential election.³⁸ More recently, the Prime Minister even suggested it would be an "extraordinary opportunity" for Canada to step up on climate change if President Trump pulled back on U.S. climate commitments.³⁹

It is surprising that the oil and gas industry is fervently resisting the one measure in Canada's climate framework that focuses on the oil and

gas sector. Every other sector is facing ambitious policies to reduce GHG emissions. From full coal phase-out in electricity, a net-zero energy home standard for buildings and a zero emission vehicle strategy in the transportation sector, other sectors are expected to reduce GHG emissions significantly on the way to phasing out fossil fuel use.⁴⁰ Meanwhile, according to the pan-Canadian climate framework, Canada's oil and gas sector, already the highest carbon-emitting sector in Canada, is expected to increase

production and emissions until 2030. And yet, the industry is fighting one of the lowest cost, highest return measures in the framework, and the only one that is focused on its emissions.

According to the pan-Canadian climate framework, Canada's oil and gas sector, already the highest carbon-emitting sector in Canada, is expected to increase production and emissions until 2030.

Recommendations for strong regulations

Activities that reduce methane emissions are some of the cheapest and easiest methods to reduce greenhouse gases.⁴¹ Regulations that stipulate regular monitoring of oil and gas facilities can ensure that leaks are detected and eliminated before they leak for months on end. Equipment that vents hydrocarbons should be replaced with equipment that doesn't. And simple technologies

can reduce waste from tanks, such as installing vapour recovery towers or stabilizers to reduce the vapor pressure of liquids entering tanks, properly sizing control equipment, and maintaining pressure relief valves and tank hatches to prevent leaks.

The Canadian government's commitment to regulate methane emissions is laudatory. However, the proposed approach is not the most effective, with a focus on achieving a pre-determined emissions reduction target of 40 per cent - to 45 per cent by 2025. Though achieving that target would represent significant progress, smart regulations that would tackle the emissions

problems to the full extent that technology provides cost-effective solutions could lead to greater emission reductions than the pre-determined target. We know what the problems are:

- 1 **Deliberate venting of methane**
- 2 **Equipment designed to vent methane**
- 3 **Fugitive emissions from a variety of sources**
- 4 **Malfunctioning equipment that goes undetected due to lack of frequent monitoring**

Recommendations For Federal Methane Regulations

The ultimate goal should be to eliminate methane emissions by 2030, especially in cases of intentional venting and flaring other than when required for reasons of safety. Federal regulations with clear requirements would lead to the greatest amount of emission reductions, which would be beyond the 40 per cent to 45 per cent target. Such regulations at a minimum should:

- 1 **Undertake quarterly inspections for leak detection and repair (LDAR)** at all oil and gas facilities. The data is clear that frequent leak detection is effective in reducing emissions and provides the only backstop to ensure that other regulated reductions are happening.
- 2 **Eliminate routine venting**, which has already largely been eliminated in the US. Do not permit new routine flaring, and phase-out existing flaring practices. An economic test should not be applied to determine whether venting and flaring are allowed. When the price of natural gas is relatively healthy, it will be economic to capture and either use or sell that gas. But even when the price of natural gas is low, involving a net cost to reuse that gas, the cost of that emission reduction is low compared to most other GHG reductions and the waste of that gas is significant.
- 3 **Set requirements that solution gas at oil wells not be wasted**, since utilization opportunities exist at these facilities.
- 4 **Electrify pneumatic pumps and controllers** wherever grid energy or renewable energy is available.
- 5 **Set requirements for the green completion for both new and existing wells** that are re-fracked, meaning capturing excess gas when wells are tapped.
- 6 **Address legacy issues**, especially from fracked, abandoned wells, and set highest standards for well abandonment and reclamation to prevent methane leakage from these wells, and future liabilities being passed to taxpayers.
- 7 There is enough data to know there is a methane problem in Canada that frequent LDAR, eliminating venting and flaring, electrifying pneumatics will solve. However, better data is helpful to improve the policies. That would include using geospatial information so that areas with oil and gas facilities known to have higher emissions face more stringent regulations. **Governments should identify and target high-emitting facilities as quickly as possible.**



Methane gas leaked by industry in a one year period has a market value of **\$67.6 million**



EQUIPMENT LEAKING METHANE GAS, CAPTURED BY INFRARED CAMERAS

Conclusion

It is clear that not only are methane emissions from oil and gas facilities a problem in Canada, they are a bigger problem than the industry acknowledges. Extensive site surveys and infrared cameras both reveal that the problem is widespread. These methane emissions contribute to climate change, create air pollution, pose risks to human health, waste valuable resources and deprive the economy of economic activity.

And yet, cheap and easy solutions to phase out emissions are available and have already been proposed. Federal regulations that apply across the country can spur investment in routine and ongoing maintenance, and the deployment of simple technological solutions. U.S. states that have moved forward with this regulatory approach are showing the dividends. Those are the jurisdictions that Canada should be using as a model.

Gradually eliminating methane emissions from the oil and gas industry is imperative for the environment and human health. It also makes economic sense, creating new jobs in the energy sector.

Canada should be seeing the 45 per cent methane reduction target as a first step only. Achieving that reduction target by 2025 or before should be a signpost on the way to phasing out methane emissions entirely.

REFERENCES

1. GreenPath Energy Ltd. (2017). "GreenPath 2016 Alberta Fugitive and Vented Emissions Inventory Study." Commissioned by the Alberta Energy Regulator. Online at: http://www.greenpathenergy.com/wp-content/uploads/2017/03/GreenPath-AER-Field-Survey-Results_March8_Final_JG.pdf.
2. *Ibid.*
3. GreenPath Energy Ltd. (2017).
4. The six geographic areas surveyed by GreenPath Energy Ltd. are: Red Deer; Drayton Valley, Grande Prairie; Medicine Hat; Midnapore; and Bonnyville.
5. These six areas account for 86% of the operating wells in the province as well as 91% of Alberta's natural gas production and 77% of non-bitumen oil and gas production. GreenPath Energy Ltd. (2017). pp. ii-iii.
6. See video footage online at: www.methaneproblems.ca
7. GreenPath Energy Ltd. (2017). p. vi.
8. U.S. Environmental Protection Agency. (2016). "Greenhouse Gas Equivalencies Calculator." Online at: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator%20>
9. According to Canada's GHG inventory, energy-related methane emissions increased slightly between 2010 and 2014 (from 47 to 53 Mt CO₂e), much less than the discrepancy between Clearstone data and the GreenPath estimates. Environment and Climate Change Canada. 2016. "National Inventory Report 1990-2014." Table A9-3 and A9-7.
10. GreenPath Energy Ltd. (2017). p. vii.
11. GreenPath Energy Ltd. (2017). p. iv.
12. On average there were 0.67 sources of methane per facility for conventional oil, 2.21 per facility for heavy oil, and 0.26 per facility for natural gas. GreenPath Energy Ltd. (2017). p. iv.
13. There were 1688 devices inventoried (1,218 controllers and 469 pumps). GreenPath Energy Ltd. (2017). p. v.
14. GreenPath Energy Ltd. (2017). p. v.
15. *Ibid.* p. vi.
16. *Ibid.* p. iv.
17. *Ibid.* p. vii.
18. *Ibid.* p. viii.
19. *Ibid.* p. iv.
20. Colborn, T.; Kwiatkowski, C.; Schultz, K.; Bachran, M. (2011). Natural Gas Operations from a Public Health Perspective. *Hum. Ecol. Risk Assess.* 17 (5), pp. 1039-1056.
21. *Ibid.*
22. ICF International. (2015). "Economic Analysis of Methane Emission Reduction Opportunities in the Canadian Oil and Natural Gas Industries." Online at: https://www.edf.org/sites/default/files/content/canada_methane_cost_curve_report.pdf
23. Keating Research, Inc. (2016). "The Colorado Case Study on Methane Emissions: Conversations with the Oil and Gas Industry." Online at: <http://www.methanefacts.org/files/2016/07/MethaneStudy.pdf>
24. BlueGreen Alliance. 2016. "Plugging the Leaks: Protecting Workers, Reducing Pollution, and Creating Quality Jobs by Reducing Methane Waste in the U.S. Oil and Gas Industry." Online at <https://www.bluegreenalliance.org/resources/plugging-the-leaks/>.
25. Pembina. (Forthcoming). "The Who's Who of Methane Pollution in the Alberta's Oil & Gas Sector: 2015 Edition."
26. <https://beta.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/canada-us-aim-to-reduce-methane-emissions-by-40/article29080108/?ref=http://www.theglobeandmail.com&service=mobile>
27. Prime Minister's Office. (2016a). "U.S.-Canada Joint Statement on Climate, Energy, and Arctic Leadership." Online at: <http://pm.gc.ca/eng/news/2016/03/10/us-canada-joint-statement-climate-energy-and-arctic-leadership>.

28. Prime Minister's Office. (2016b). "Leaders' Statement on a North American Climate, Clean Energy, and Environment Partnership." Online at: <http://pm.gc.ca/eng/news/2016/06/29/leaders-statement-north-american-climate-clean-energy-and-environment-partnership>
 29. Stewart, Keith. (2016). "Could Trump derail Canada's climate and energy plan?" Policy Options. Online at: <http://policyoptions.irpp.org/magazines/february-2017/could-trump-derail-canadas-climate-and-energy-plan/>
 30. *Ibid.*
 31. *Ibid.*
 32. McCarthy, S. (2017). "Bracing for Trump: Energy sector fears competitive disadvantage." The Globe and Mail. January 10. Online at: <http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/ottawa-provinces-will-face-pressure-to-backtrack-on-emission-targets-under-trump/article33569076/>
 33. See for example Global News. (2017). "U.S. rejection of methane limit spooks Canadian oilpatch." From files from Canadian Press. Online at: <http://globalnews.ca/news/3226537/u-s-rejection-of-methane-limit-spooks-canadian-oilpatch/>
 34. Greenpeace Canada. (2017). "US States with Oil and Gas Emissions Rules Cover More Production than ECCC Rules." Backgrounder. Online at: http://www.greenpeace.org/canada/Global/canada/report/2017/03/BACKGROUND_US_States_with_Oil_and_Gas_Emissions_Rules_Cover_More_Production_than_ECCC_Rules.pdf.
 35. Climate and Clean Air Coalition. (2016). "Marrakech Communiqué." Online at: <http://www.ccacoalition.org/en/resources/marrakech-communication>
 36. Southwick, R. (2016). "Trump presidency presents double-edged sword to Alberta's oilpatch." Calgary Herald. November 9. Online at: <http://calgaryherald.com/business/energy/trump-presidency-presents-double-edged-sword-to-albertas-oilpatch>.
 37. *Ibid.*
 38. Global News. (2016). "Donald Trump's win doesn't change Canada's carbon pricing plan: Trudeau." From files from Canadian Press. Online at: <http://globalnews.ca/news/3059741/donald-trumps-win-doesnt-change-carbon-pricing-plan-trudeau/>
 39. Ross, E. (2016). "'Extraordinary opportunity' for Canada if U.S. steps back from climate plans: Trudeau." JWN Energy. Online at: <http://www.jwnenergy.com/article/2016/12/extraordinary-opportunity-canada-if-us-steps-back-climate-plans-trudeau/>
 40. Government of Canada. (2016a). "The Pan-Canadian Framework on Clean Growth and Climate Change." Online at: <https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework.html>
 41. Government of Canada. (2016b). "Frequently Asked Questions: Canada-U.S. Joint Action to Reduce Methane Emissions." Backgrounder. Online at: <http://news.gc.ca/web/article-en.do?nid=1039319>
-

Canada's Methane Gas Problem: Why strong regulations can reduce pollution, protect health, and save money

A REPORT BY:



environmental
defence

© Copyright April 2017 by ENVIRONMENTAL DEFENCE CANADA.

Permission is granted to the public to reproduce or disseminate this report, in part, or in whole, free of charge, in any format or medium without requiring specific permission. Any errors or omissions are the responsibility of ENVIRONMENTAL DEFENCE.

Download the report at: methaneproblems.ca