DON'T DELAY:

Methane Emission Restrictions Mean Immediate Jobs in Alberta

BLUEGREEN CANADA

BLUE GREEN CANADA is an alliance between Canadian labour unions, environmental and civil society organizations to advocate for working people and the environment by promoting solutions to environmental issues that have positive employment and economic impacts.

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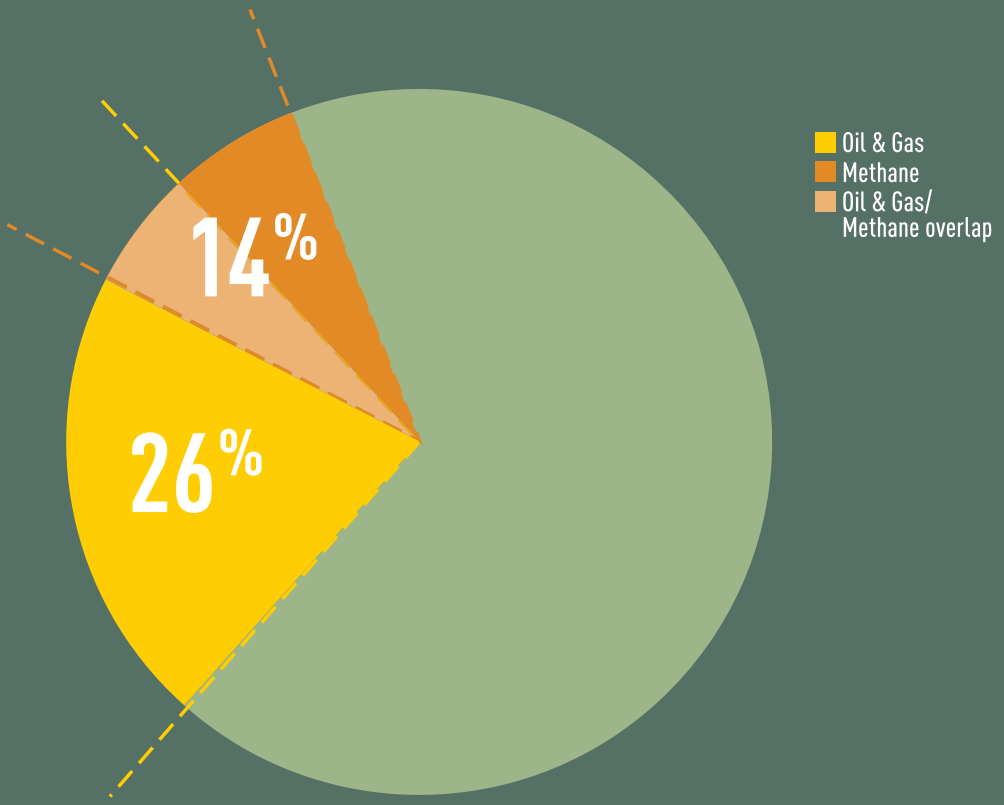
CANADA'S TOTAL GHG EMISSIONS



26% OF GHG EMISSIONS COME FROM THE OIL-AND-GAS SECTOR.
14% ARE METHANE WITH NEARLY HALF FROM THE OIL-AND-GAS SECTOR.

EXECUTIVE SUMMARY

Methane is a powerful greenhouse gas (GHG) with environmental and economic impacts that are often overlooked. Emissions of methane in Canada's oil-and-gas sector have traditionally been seen as simply a cost of doing business. However, continuing to waste methane means missing an opportunity to create good jobs. When regulation requires oil-and-gas companies to find and repair methane leaks and invest in equipment that eliminates the need to vent methane, less natural gas is wasted and more good jobs are created.

The methane mitigation business is a growth industry. Experience in American states where the oil-and-gas sector is required to reduce methane emissions is that regulations have led to the creation of new local jobs and economic opportunities. These jobs are well paid and include work in engineering, manufacturing, surveying and administration.

Canada needs to get started today to catch up with leading states such as California and Colorado. This will enable some of the more than 170 companies in the Canadian methane mitigation sector to scale up, help achieve the emissions reductions that are needed and employ people in good jobs across Alberta as well as in other provinces.

The draft regulations introduced in May by federal Environment and Climate Change Minister McKenna represent a significant improvement over the status quo treatment of methane in the oil-and-gas sector. **But rather than tackling our methane problem now -- with available made-in-Canada world-class solutions -- the draft regulations delay action on curbing emissions until 2023.**

For Alberta in particular there is no good reason to delay regulating methane. The province has the expertise to deal with methane and many of its companies have already had experience with acting to reduce methane emissions in U.S. states where regulations are further ahead. There are a number of innovative companies in Alberta ready to supply methane elimination technologies and services and a large majority of these companies report being poised for strong growth given the right regulatory signals. By acting now to implement a regulatory system that strengthens the draft federal regulations --using them as a floor and not a ceiling -- Alberta can lead the country's methane reduction efforts and keep good green job opportunities from going to waste.

Waiting will be costly – for job growth and the environment:

- The potential to create jobs in a growing methane mitigation industry – up to 15,000 years of work over a decade – could be delayed or lost to U.S.-based competitors that have already begun developing new equipment or approaches in leading U.S. markets.
- Pushing back the full implementation of methane regulations from the original target of having regulations in place by 2018 means the oil-and-gas sector will unnecessarily release an additional 55 million tonnes of carbon emissions.
- Delaying action will mean continued damage to our health, the climate, the environment, and lost economic and employment opportunities, despite government's recognition that allowing methane to leak and vent is no longer an acceptable cost of doing business.

Cleaner air with fewer harmful GHG emissions and more good jobs sooner ... why delay?

DELAYED REGULATION WILL DELAY JOB CREATION

x1,500/yr

REGULATING REDUCTIONS IN METHANE LEAKS AND VENTING WILL CREATE 1,500 GOOD PAYING JOBS PER YEAR OR 15,000 JOB YEARS OF EMPLOYMENT OVER A DECADE.

INTRODUCTION

In jurisdictions where frequent leak detection and repair (or LDAR) is required by regulation, good green jobs are being created and oil-and-gas companies are finding frequent inspections to be a cost effective means to achieve significant methane emission reductions. This is a win-win for the economy and the environment.

In U.S. states where regulation has required frequent LDAR inspections, oil-and-gas companies have realized that reducing methane emissions is good business – revenue earned by selling previously wasted gas can often more than cover the costs of these preventative measures. However, in researching this report, we heard repeatedly from those in the methane mitigation industry that oil-and-gas companies often overestimate the costs of acting while also underestimating the benefits.

Because methane can powerfully accelerate climate change, we simply can't wait for all companies in the oil-and-gas industry to catch up with those that have already realized the bottom-line benefits of reducing waste. Instead, we need a level regulatory playing field that can make significant reductions in methane an immediate priority for the entire industry.

In November 2015, the Government of Alberta released its Climate Leadership Plan which committed the province, in collaboration with industry, environmental organizations, and First Nations, to implement a methane reduction strategy to reduce emissions by 45 per cent from 2014 levels by 2025.

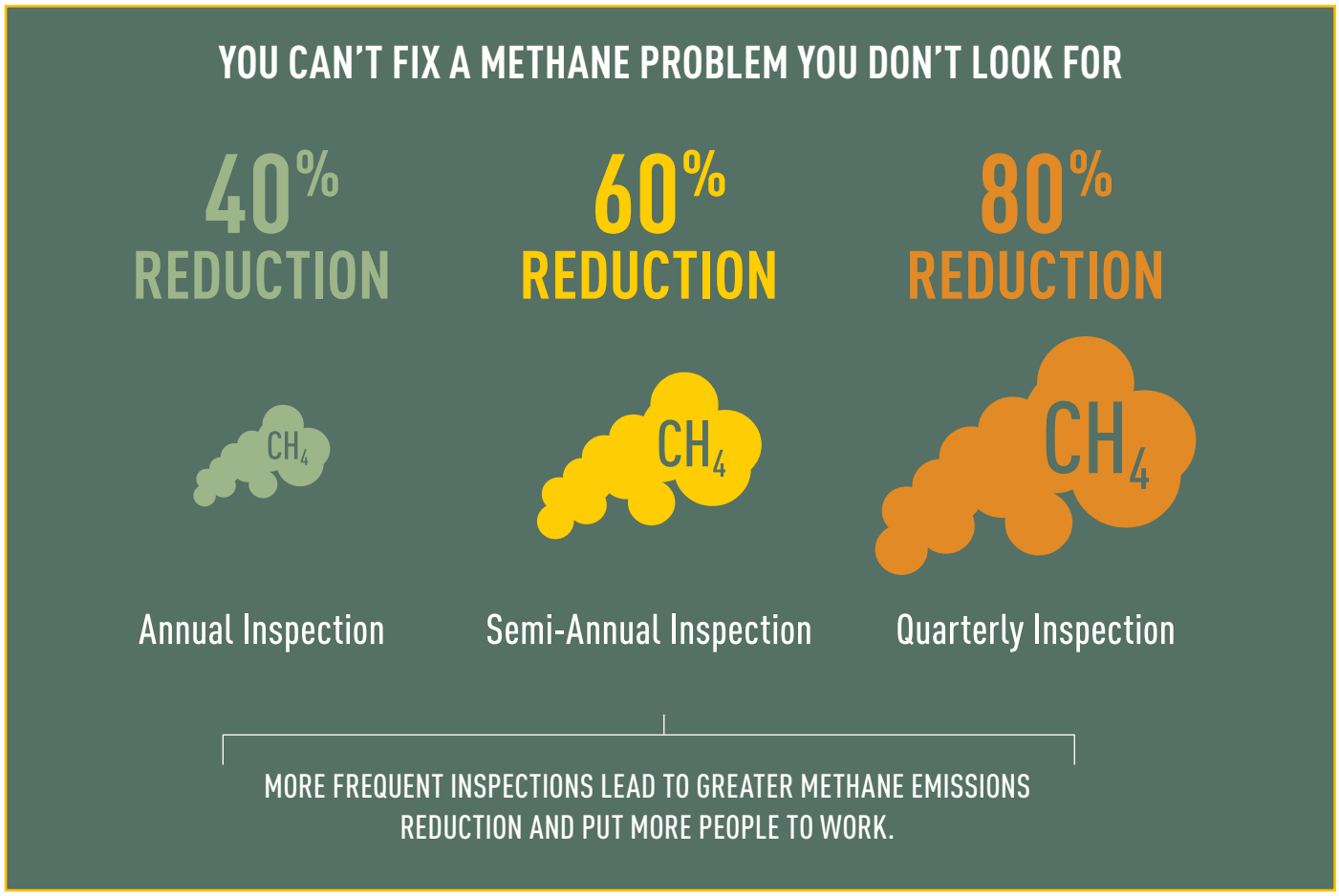
In May 2017, the federal government announced it will require the oil-and-gas industry to reduce methane emissions by 40 to 45 per cent below 2012 levels by 2023, but it will only require companies to begin phasing in regular leak inspection efforts in 2020. This represents a significant delay from initial plans to phase in rules to control methane starting in 2018, with new regulations in place by 2020.[1] It is not at all clear what the federal government's rationale is for waiting to adopt proven leak detection and equipment replacement efforts that can cost-effectively reduce oil-and-gas sector GHG emissions right now.

This delay is especially problematic given that the benefits of moving forward more quickly with regulations would extend well beyond our climate. Acting now will create good jobs and new businesses in everything from detecting and fixing leaks to replacing conventional equipment with leak-proof devices. These good jobs are needed now in the oil-and-gas sector.

Companies in the methane mitigation sector anticipate fast growth and rapid hiring as soon as best practice methane regulations are put in place. They point to opportunities in leak detection and repair and in the development and deployment of new technology. Skilled, well-paying jobs are assured if governments require industry to change outdated practices and replace leak-prone equipment sooner rather than later. These trends have been borne out in jurisdictions such as Colorado where oil-and-gas companies are required to quickly find and fix leaks and have had an incentive to reduce venting.

Delaying these job gains makes little sense in a Canadian oil patch where employment opportunities have fallen dramatically and where rapid progress is needed on emission reductions. This report outlines the economic potential of the methane mitigation industry in Canada and profiles some of the companies that are already leading the way in this growth industry.

METHANE (CH_4) IS A POWERFUL GREENHOUSE GAS (GHG) WITH 84 TIMES MORE CLIMATE IMPACT OVER A 20-YEAR PERIOD THAN CARBON DIOXIDE (CO_2).



ADDRESSING METHANE JUST MAKES SENSE

Methane is a powerful greenhouse gas, packing 84 times more climate impact than carbon dioxide over a 20-year period. The oil-and-gas industry is the number one industrial source of methane emissions in Canada, and Canada is the fourth largest emitter of methane in the world.[2]

The good news is that we can dramatically reduce methane emissions from the oil-and-gas sector by updating industry practices, replacing old equipment and better maintaining everything from storage tanks and pumps to valves and compressors.

The even better news is that these actions will lead to job growth in the industry, with skilled workers employed to detect leaks, replace and repair equipment, and design new equipment and processes. Many of these tasks will lead to the recovery of natural gas that is currently being wasted. That means more revenue for industry and government (through additional royalty payments). According to one U.S. study "A single faulty pressure release valve can leak nearly $110,000 worth of gas annually."[3]

Survey data provided to the Alberta Energy Regulator (AER) revealed the troubling news that the oil-and-gas industry is actually releasing far more methane than has previously expected or reported.[4] Emissions from pumps and controllers are 60 per cent higher than reported because industry has been underestimating the number of such devices in use. Analysis of this data reveals that "these devices alone have the same short-term climate impact as 9 million cars."[5]

Methane leaks are also often accompanied by leaks of volatile organic compounds and other air pollutants, meaning that acting to reduce emissions will have significant health benefits as well. Brian Campbell, Energy Sector Director with Unifor, Canada's largest oil, gas, and chemical sector union, is concerned for workers well-being as he believes there are leaks throughout the oil-and-gas system. Mr. Campbell says that "regular detection and repair should be a no-brainer" for the oil-and-gas industry. Campbell believes that "we need a plan to create good jobs while helping our environment by plugging leaks and ending wasteful practices in the oil-and-gas industry."

THE OPPORTUNITY

There are three main ways to reduce oil-and-gas sector methane emissions:

- **Require frequent leak detection and repair**
- **Reduce venting of gas from wells and storage tanks**
- **Replace equipment that has high methane release rates**

A U.S. study calculated that tackling these tasks would create the equivalent of 5,400 good paying jobs in the United States per year.[6] Based on our calculation that the Canadian oil-and-gas sector releases about one-quarter of the methane released by the U.S. industry, this suggests that there is an opportunity to create more than 1,500 similar jobs in Canada each year. Over a decade, that is more than 15,000 badly needed years of employment for the oil-and-gas sector.[7]

More than 40 per cent of the companies in the Canadian methane mitigation industry anticipate doubling their workforce to handle the clean-up work that would be generated by new methane emission limits.[8] In fact, 80 per cent of the companies surveyed said they expect to see job growth in the next 12 to 18 months.[9] Of course, the pace of this job growth will largely depend on when requirements for reducing emissions kick in. The federal government's decision to delay action on methane and to water down regulatory requirements could seriously dampen job and industry growth right when we need it most.

There are more than 170 companies in Canada involved in reducing methane emissions, with half providing technology and half providing services, such as leak detection and repair. The majority of these companies are Canadian-based small businesses with fewer than 50 employees, a sector that is widely acknowledged to be a key job creator.[10]

Jobs reducing methane emissions pay on average $30.88 (U.S.) an hour, compared to the U.S. average hourly rate of $19.60 (U.S.), or 57 per cent above average wages. These good jobs are spread across at least 30 key job types.[11] Work in the leak detection and repair sector, in particular, is also more labour intensive than for the oil-and-gas industry on average, while employing many of the same skill sets.[12]

One of the keys to addressing and preventing leaks, which are responsible for half of the methane emissions from the oil-and-gas sector,[13] is regular inspection. Studies and industry experience have shown that quarterly inspections of pumps, seals and other equipment is the most effective way to identify and address methane leaks.[14]

There are a few reasons why quarterly surveys are the most sensible approach to reducing damaging methane emissions from leaks. First, leaks are not predictable – they can occur anywhere at any time. Frequent inspection means these random leaks will be detected and addressed more quickly. Second, it has been documented that a small number of large-scale leaks add disproportionately to the industry's climate and air quality impact. Left undetected for months, these large but unpredictable leaks can seriously drive up emissions.

Unfortunately, studies have shown that there is no reliable pattern for determining where or when leaks will occur, making frequent inspection the only viable solution to nipping the problem in the bud.[15] In fact, one U.S. company found that regular inspections reduced leaks by 75 per cent over a five-year period.[16]

Colorado,[17] Wyoming,[18] California,[19] Pennsylvania,[20] Ohio,[21] the U.S. Environmental Protection Administration[22] and Bureau of Land Management[23] all require quarterly inspections of compressor stations. Colorado,[24] Wyoming,[25] and California also require operators to conduct quarterly inspections of production facilities.[26] By comparison, the Canadian federal government's new standards will require inspections only three times per year and no inspections during winter.[27]

The oil-and-gas industry's successful efforts to convince the federal government to delay regulations when it comes to improving practices and fixing leaks is bad for our health, the environment, and our wallets. The problem is not just the heavy climate impact. Vented gas and leaks also emit volatile organic compounds as well as cancer-causing pollutants such as benzene that pollute our air. They also have the potential to reduce government revenues by wasting gas that companies would otherwise pay royalties on. One American study

suggests that the gas wasted by methane leaks and venting represents the loss of "tens of millions of dollars in royalty revenue each year."[28]

The methane gas that industry is currently releasing in Alberta is estimated to be worth $67.6 million on the energy market and could heat more than 200,000 Alberta homes.[29] This methane is coming from both system leaks and deliberate venting at well heads, storage tanks, etc.

Many of the pumps and controllers used by the industry currently routinely release methane. But better technology is now available that uses electricity rather than pressurized gas to operate these devices, thereby avoiding methane release altogether.

However, a recent study found that only 5 per cent of pneumatic devices at conventional oil-and-gas facilities have been switched to such non-venting devices.[30] Site inspectors discovered that, on average, there was almost one significant methane leak per facility visited. They calculated that each site emitted the GHG equivalent of 20 vehicles.

Fortunately, in Alberta there is an excellent opportunity to use the gas recovered by fixing leaks and preventing venting. Alberta took action in the 1990s to better control sour gas pollution, which resulted in an extensive network of pipelines that can also be used to collect recovered methane which can then be processed for sale as natural gas.[31]

Various studies have found that a large percentage of methane reduction actions would pay for themselves and that the net cost of driving down methane emissions by 45 per cent would add as little as one to two cents per thousand cubic feet (MCF) to the cost of natural gas (North American gas prices are currently in the range of $3.25 per MCF). It has been estimated that in 95 per cent of cases, action to reduce leaks would represent a net financial gain for companies.[32]

Meanwhile, in jurisdictions that have adopted strict methane regulations, companies are seeing bottom-line benefits. In a recent survey in Colorado, seven out of ten oil-and-gas producers said the benefits of regularly checking equipment for leaks outweigh costs.[33]

"... there is an opportunity to create more than 1,500 similar [good-paying-methane-busting] jobs in Canada each year. Over a decade, that is more than 15,000 badly needed years of employment for the oil-and-gas sector."

ALBERTA POISED TO LEAD

Delaying methane regulations in Alberta means delaying much needed job opportunities. Introducing clear new regulations will provide the certainty the oil-and-gas industry needs and will boost the methane mitigation sector, generating immediate employment opportunities for Albertans. Technology is available today that makes LDAR more affordable and made-in-Alberta components are already in the product pipeline.

For example, optical gas imaging (OGI) technology, which uses infrared camera equipment, can be deployed to quickly detect leaks of this invisible gas. This equipment is widely available and cost effective – often paying for itself in avoided gas loses in one or two years.[34]

Target Emission Services is using this technology and it is proving to be a highly efficient way to find leaks. As the company's CEO Terence Trefiak explains, it is like finding a needle in a haystack by deploying a strong magnet instead of by inspecting each piece of hay by hand. (See four companies profiled below.)

Another opportunity lies in deploying new equipment, such as electric controllers and pumps, that don't vent methane. Changing out old equipment for newer electric equipment could create jobs while eliminating emissions. And with Alberta shifting to greener sources of electricity, there is also the opportunity to build the province's renewable power industry at the same time by providing opportunities to supply power to remote sites. Two Alberta companies, General Magnetic International Inc. and Calscan Solutions, have developed systems using Canadian expertise and components that can be used at remote well sites.

Another weakness of the draft federal regulation is that they will not apply to all oil-and-gas facilities. The draft federal regulations will essentially require the replacement of compressors that leak methane, but not until 2023 at the earliest. Pumps will either have to have some sort of pollution control technology installed or must be of a type that does not leak methane by the same date. However, both of these measures will only apply to facilities that meet certain operating thresholds.[35]

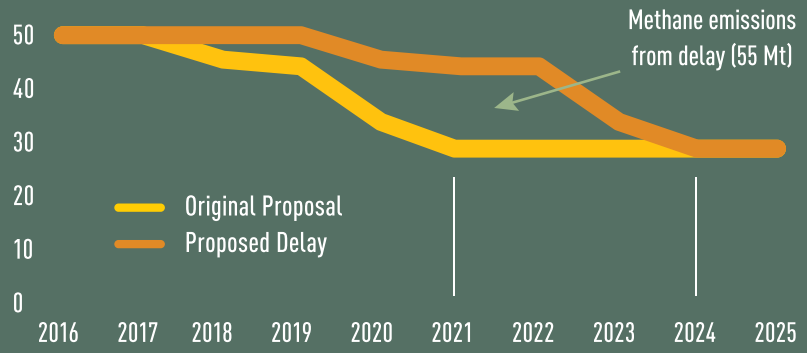
The proposed federal regulations are a definite improvement over the status quo handling of methane emissions. However, the unnecessary delay in activating these proposed regulations will lead to the release of 55 million tonnes of additional methane compared to the original plan of starting the job of reducing emissions in 2018.[36]

The costs for methane reduction activities are a fraction of the cost of implementing carbon capture and storage (CCS) operations, which are often favoured by the fossil fuel industry. Methane reductions would cost just $2.76 for every tonne of CO_{2e} emissions eliminated, comparing very favourably to the cost of Shell Oil's Quest CCS project in Alberta, where costs are currently $72 for every tonne of CO_{2e} captured.[37]

Cost effectiveness has also been the real world experience of Josh Anhalt, whose company, GreenPath Energy Inc., helps companies detect leaks and measure emissions. According to Anhalt optical technology for detecting leaks is "proven," and there should be a broader effort to find and repair leaks, especially given that 80 per cent of methane emissions result from just 20 per cent of leaks.[38] Mr. Anhalt says his company will easily double in size when regular leak detection is required, creating good jobs for workers with oil-and-gas sector experience.

OIL-AND-GAS METHANE EMISSIONS IN CANADA (MT)

DELAYED FEDERAL REGULATION MEANS AN ADDITIONAL 55 MT CO_{2E} OF METHANE WILL BE EMITTED FROM 2018 TO 2025.



NO REASON FOR DELAY

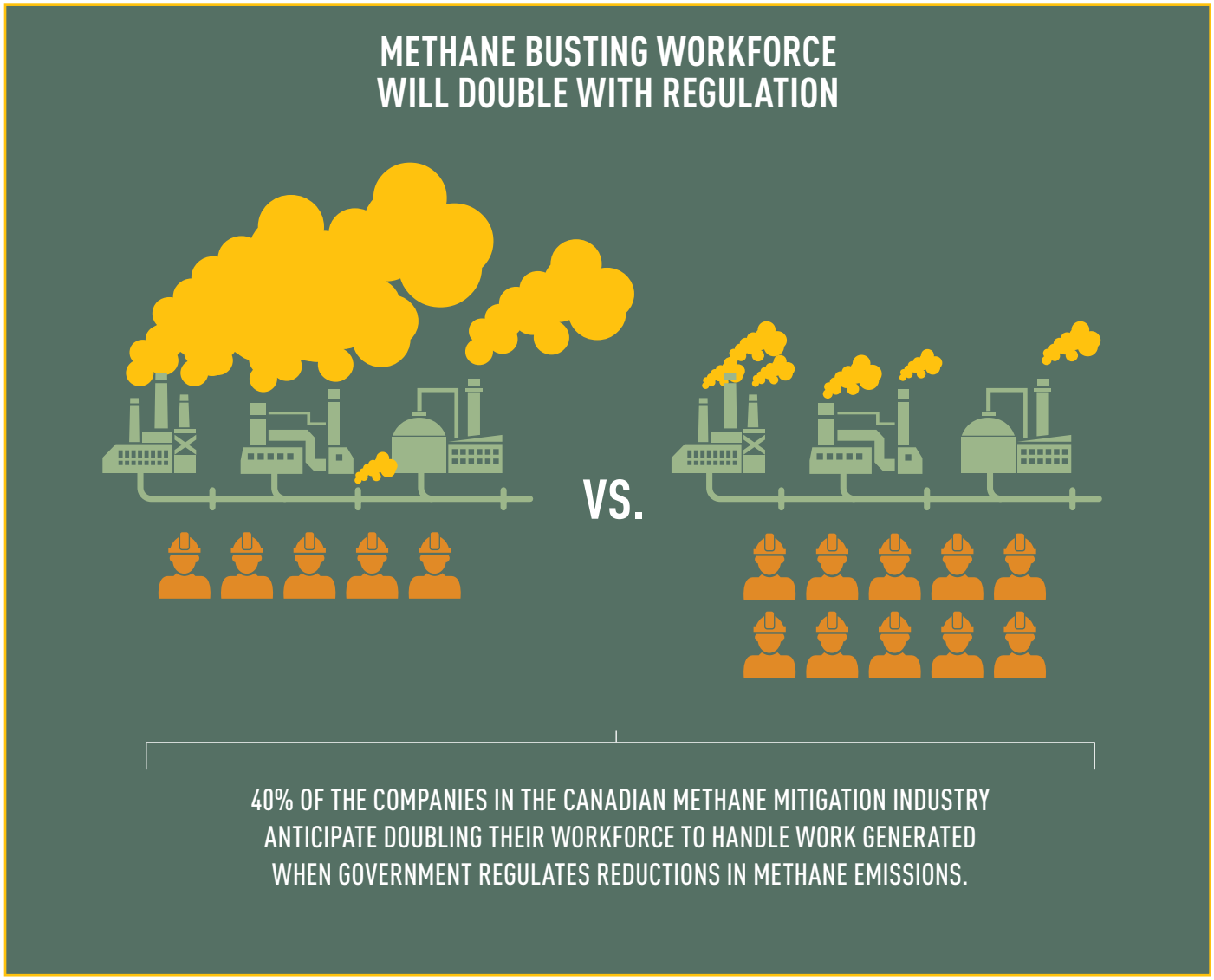
The Alberta and Canadian governments have made it clear that methane emissions need to be dramatically reduced. The two governments have recognized that current wasteful practices are environmentally unsustainable and economically wasteful.

But instead of putting people to work achieving much needed emission reductions as soon as possible, our governments have so far chosen to delay action.

One justification offered for this delay is the need to match U.S. actions. But while the U.S. federal administration may be willing to walk away from global climate commitments, including possibly methane reduction commitments, it is clear that many state governments are not. In fact, many are already taking strong action to reduce methane emissions. The result is that it is by waiting to act that we actually put Canada at a competitive and jobs disadvantage.

With dozens of companies ready to create good jobs right now, delaying action makes no sense. **The evidence is clear that methane reduction is a low cost way to take long overdue action on reducing oil-and-gas sector emissions.** Canadian companies have developed excellent technology and practices for tackling the problem. Four of Alberta's methane busting companies are profiled in the next section. They are ready to train and employ workers in skilled jobs today.

Delay will simply waste jobs and resources.

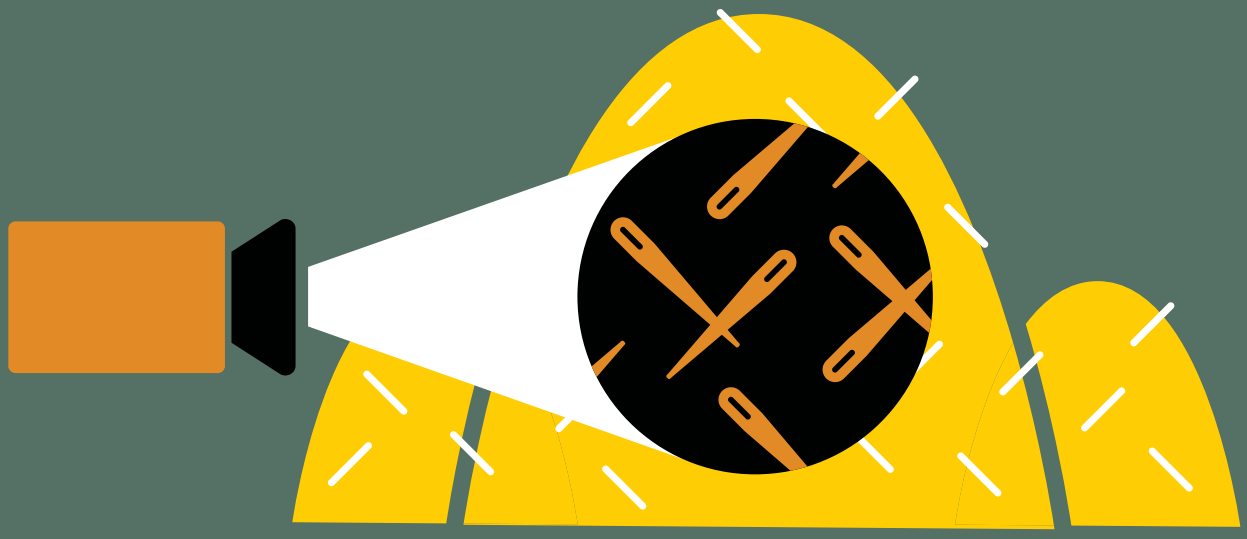


NEW TECH LEADS TO NEW JOBS AND FEWER EMISSIONS

Terence Trefiak, Founder
"massive leaks are regularly found during inspections"

TARGET EMISSION SERVICES specializes in the use of Optical Gas Imaging (OGI) to detect hydrocarbon gas leaks and vents. Their experience and innovative technology provides accurate, safe, and cost-effective detection & measurement of hydrocarbon fugitive emissions. They have approximately 20 employees in total (4 in Canada and 16 in U.S.) with locations in Houston, TX, Calgary and Edmonton, AB.

FAST AND EFFICIENT



MODERN LEAK DETECTION AND REPAIR (LDAR), INCLUDING OPTICAL GAS IMAGING (OGI) TECHNOLOGY, IS LIKE USING A GIANT MAGNET TO FIND NEEDLES IN A HAYSTACK INSTEAD OF CHECKING EVERY PIECE OF HAY ONE AT A TIME.

Companies often over-estimate the cost of leak detection and repair

Target Emission Services started in 2007 when founder Terence Trefiak was introduced to infrared camera technology or optical gas imaging while working for a major oil company. The technology made it possible to efficiently detect and repair methane leaks. Mr. Trefiak estimates that "one camera technician can do in one day what two people would have had to do over a week" using old manual inspection methods. He likens OGI to a giant magnet finding needles in a haystack, saying that with this technology "you don't need to check every piece of hay one at a time."

Target was well positioned when the U.S. Environmental Protection Agency brought in greenhouse gas emissions compliance regulations in 2010 and has since grown to 20 employees. Most of these employees are based in the U.S. because the tougher regulatory environment there has made U.S. companies more serious about finding and fixing leaks.

The U.S. regulations, for example, require frequent inspections and frequent inspections, in turn, lead to more leaks being found and repaired, in Mr. Trefiak's experience. U.S. regulations are also much more prescriptive, meaning that inspection requirements are spelt out in much more detail. Generally, camera inspections occur six times a year with conventional inspections for smaller leaks once a year.

Mr. Trefiak notes that "massive leaks are found regularly" during inspections, meaning that there is a high value for oil and gas companies in finding and plugging leaks. In fact, Mr. Trefiak estimates that on average for every $10,000 spent on detection and repair, $30,000 worth of useable gas is recovered.

But while the economics are positive, Mr. Trefiak points out that companies will not undertake regular inspections without it being required by regulation. "They only realize the benefits after doing it," he explains. Companies often overestimate the cost of doing leak detection and repair, he notes, while in truth most repairs can be undertaken under routine maintenance budgets.

By adopting stronger leak detection and repair regulations, Canada could build the LDAR industry here while also showing oil-and-gas companies that regular inspections and repairs are cost effective, he believes.

READY TO POWER UP

Al Duerr, Founder
"In my opinion, you throw everything you have today at today's emissions as the goal"

GENERAL MAGNETIC INTERNATIONAL INC. was incorporated in Calgary, Alberta in 2008. The company has concentrated its business on the development and manufacture of electric motors for applications that optimize the advantages of its technology. Production of their GMII MagnoDrive and Solar Powered Injection Pumps with Trido Industries Inc. started in 2012.

Gas wells that are not connected to the power grid still need systems to inject chemicals such as methanol and de-waxing agents into wells. This has led to the widespread use of pneumatic injection pumps that are inexpensive from a capital perspective, but increase operating costs and, more importantly, are major sources of methane gas emissions.

Replacing pneumatic devices with solar-powered chemical injection pumps creates an opportunity to dramatically reduce CO_{2e} emissions, notes former Calgary Mayor and now founder and CEO of General Magnetic International Inc. Al Duerr. **"This is low hanging fruit,"** he notes comparing the modest cost of converting to solar-powered electric injection pumps to high cost solutions like carbon capture and storage.

Mr. Duerr believes companies need a clear incentive to replace GHG producing equipment with zero emission pumps and controllers. Given the cost of retrofitting highly dispersed infrastructure over thousands of wells throughout Alberta, access to funds to help finance the cost of retrofitting emission reduction equipment is essential, he says. **He adds that using funds generated through the province's carbon pricing system to support this work will result in substantial, real, and measurable emissions reductions now,** rather than using this money to focus on potential future innovations to reduce emissions sometime down the road.

On the regulatory front, Mr. Duerr sees a need to encourage early action. "In my opinion, you throw everything you have today at today's emissions as the goal" he states.

Industry needs to be able to plan with certainty, and it is important that a clear indication of policy direction be given early to enable that planning and to make emission reduction part of current and future budget decisions. This includes phased in regulation at both the federal and provincial levels, and the continued availability of funding incentives in Alberta. This, he says, is important if early adopters are to be both encouraged and rewarded for their early action to reduce emissions.

TRACKING AND QUANTIFYING EMISSIONS

Josh Anhalt, President
"We're happy to be creating jobs and hiring people in Alberta"

GREENPATH ENERGY LTD. is an emission management service provider for the oil and gas industry. They specialize in methane emission detection, measurement and reduction solutions including equipment inventory collection, leak detection and repair (LDAR) for fugitive emissions, and methane emission reduction project development. They have a seven-person team in Canada headquartered in Calgary, Alberta.

Company president Josh Anhalt is a big believer in Optical Gas Imaging (OGI) technology, which he says is one of the most efficient ways to detect leaks. The technology is approved for use in Colorado, he points out, a state with some of the strictest methane regulations.

Anhalt believes GreenPath will have its work cut out for it when Canada finally begins to catch up with places like Colorado. He says leak detection and repair activity could increase close to a hundred fold once companies are required to conduct regular inspections and begin to see the value of acting to stop leaks and improving equipment.

Currently, GreenPath is active around the world in helping companies measure emissions and develop plans to reduce them. It's a growth business in a world where action on climate change is increasingly seen as urgent.

Canadian regulations could lead to at least doubling of GreenPath's workforce "in short order" he says, particularly if the Canadian government demonstrates a greater sense of urgency about the need to reduce these powerful climate destabilizing emissions.

Mr. Anhalt sees his company adding value by providing companies with "real numbers" on emissions drawn from on-the-ground monitoring. These numbers can help companies see the value of repairing old equipment or using better state-of-the-art equipment for newer installations, he points out.

Anhalt notes that he needs people who have experience working with oil and gas equipment and that he can offer well paying jobs. "We're happy to be creating jobs and hiring people in Alberta," he concludes.

ELIMINATING EMISSIONS JUST GOOD BUSINESS

Henri Tessier, Operations Manager
"Calscan's BEAR control system can replace all wellsite pneumatic devices and emits zero emissions."

CALSCAN SOLUTIONS started in 1995 as an instrumentation and control company. They are headquartered in Edmonton and have 25 employees over their locations in Edmonton, Calgary and Houston. Calscan develops products for the oil-and-gas industry to reliably measure and reduce air emissions.

One of the more hidden aspects of the oil and gas methane problem is the extent to which a lot of this problem results from deliberate choices rather than leaks.

Henri Tessier of Calscan Solutions notes that venting of gas from pneumatic devices used at well sites produces the equivalent of more than 15 million tonnes of carbon dioxide each year in Alberta. He points out that according to the Petroleum Technology Alliance of Canada, there are approximately 70,000 well sites where process control devices use high-pressure natural gas to operate valves that regulate system pressure.

Calscan offers a better solution:

It has developed an all-electric control system to replace pneumatic devices that vent gas. Calscan's BEAR control system can replace all wellsite pneumatic devices and emits zero emissions. According to the U.S. Environmental Protection Agency "Instrument air systems substitute compressed air for the pressurized natural gas, eliminating methane emissions and providing additional safety benefits" and can save companies "up to $490,000 per facility."[39] The catch is that many well sites are far from power lines, but the advantage of the BEAR system is that it can be run with solar panels and batteries.

Right now, the system is particularly attractive for new well sites, but also well suited for replacing high-emitting devices. However, Mr. Tessier hopes to see it become more common on existing sites if governments move to more tightly regulate methane emissions.

With offices in Calgary, Edmonton and Houston, Calscan is focused on growth, and Mr. Tessier believes

the company could be five times its current size if the industry is required to better control climate damaging emissions.

In fact, he is keen to kick his component manufacturing operations into high gear in anticipation of "big changes" coming to the oil patch through stricter emissions limits.

ENDNOTES

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6 BlueGreen Alliance (U.S.) (2016) Plugging the Leaks: Protecting Workers, Reducing Pollution, and Creating Quality Jobs by Reducing Methane Waste in the U.S. Oil and Gas Industry Available at: https://www.bluegreenalliance.org/wp-content/uploads/2016/09/PluggingtheLeaks-vFINAL.pdf "Note that the jobs estimates reported here are more appropriately called "job year equivalents." Each "job" represents an increase in demand for employment sufficient to employ one-person full time for one year."

7 Methane emissions for the oil and gas sector in Canada were 50.8 Mt per year as of 2012. (However, recent survey data suggests this is a low estimate.) According to the U.S. EPA, similar emissions in the U.S. were 182.5 Mt as of 2013. This means the Canadian oil-and-gas sector emits the equivalent of 27 per cent of U.S. emissions. We have therefore adjusted the potential jobs calculated for the U.S. market to find a Canadian equivalent level of 1,500 jobs (5,400 x 27%). Job number sources: ICF International (2014, March) Economic Analysis of Methane Emission Reduction Opportunities in the U.S. Onshore Oil and Natural Gas Industries (Prepared for Environmental Defense Fund) Available at: https://www.edf.org/sites/default/files/methane_cost_curve_report.pdf, ICF International (2015, April) Economic Analysis of Methane Emission Reduction Opportunities in the Canadian Oil and Natural Gas Industries (Prepared for Environmental Defense Fund and the Pembina Institute) Available at: https://www.pembina.org/reports/edf-icf-methane-opportunities.pdf, and BlueGreen Alliance (U.S.) (2016).

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16 Environmental Defense Fund (U.S.) (2016, May)

17 5 C.C.R. 1001-9, CO Reg. 7, § XVII F (Feb. 24, 2014), (Quarterly inspections are required at gathering sector compressor facilities with uncontrolled emissions between 12 and 50 tons of VOCs).

18 Wyoming Department of Environmental Quality, Air Quality Division Standards and Regulations, Nonattainment Area Regulations, Ch. 8, Sec. 6; Individual permits for compressor stations, on file with EDF.

19 California Final Regulation Order, March 25, 2017 ("CARB"), 17 C.C.R. § 95669(g), Available at: https://www.arb.ca.gov/regact/2016/oilandgas2016/oilgasfro.pdf.

20 Pennsylvania. Department of Environmental Protection, General Permit for Natural Gas Compression and/or Processing Facilities (GP-5), Section G, Available at: http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-94153/2700-FS-DEP4403.pdf; see also Proposed Pa. Dep't of Envtl. Prot., Proposed General Plan Approval And/or General Operating Permit BAQ-GPA/GP5, Section K ("Pennsylvania General Permit 5"), (extending quarterly inspection requirement to new compressor stations in the transmission segment), Available at: http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-116053/2700-PM-BAQ0267_GP-5%20.pdf

21 Ohio General Permit 18.1.C.1.c., Available at: http://epa.ohio.gov/dapc/genpermit/ngcs/GP_181.aspx

22 EPA, 40 C.F.R. § 60.5397a.

23 Bureau of Land Management, Final Rule, Waste Prevention, Production Subject to Royalties, and Resource Conservation ("BLM"), 81 FR 83008, Nov. 18, 2016, 43 C.F.R. § 3179.304 Available at: https://www.federalregister.gov/documents/2016/11/18/2016-27637/waste-prevention-production-subject-to-royalties-and-resource-conservation.

24 5 C.C.R. 1001-9, CO Reg. 7, § XVII F.4.c. (Feb. 24, 2014). Quarterly inspections required for well sites and tank batteries with uncontrolled emissions between 20 and 50 tons of VOCs from the largest condensate or oil storage tank onsite.

25 WY Permitting Guidance; Wyoming Department of Environmental Quality, Air Quality Division Standards and Regulations, Nonattainment Area Regulations, Ch. 8, Sec. 6.

26 California Final Regulation Order, March 25, 2017 ("CARB"), 17 C.C.R. § 95669(g). Available at: https://www.arb.ca.gov/regact/2016/oilandgas2016/oilgasfro.pdf.

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28 Morton, Ph.D., Pete (The Hill) (2016, June 17) Capturing Methane: Turning environmental costs into revenues. Available at: http://www.methanefacts.org/files/2016/07/Capturing-Methane-06.17.16.pdf

29 Environmental Defence (2017, April 26)

30 GreenPath Energy Limited (2016, March)

31 Noakes, Susan CBC News (2016, July 12)

32 BlueGreen Alliance (U.S.) (2016)

33 Environmental Defense Fund (U.S.) (2016, May)

34 Environmental Entrepreneurs (E2) (2017, February)

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36 McDiarmid, Margo – CBC News (2017, Apr 20) Federal government seeks to push back methane reduction regulations by up to 3 years Available at: http://www.cbc.ca/news/politics/methane-emissions-regulations-changes-1.4078468
Canada's National Inventory Report (NIR) lists 50.8 Mt as the 2012 methane emissions baseline. While we expect these volumes to be underestimated, it is the primary source available currently. With this as the baseline, in 2025 methane is supposed to be reduced by ~23Mt CO2e. When looking at the cumulative emissions, the delay of implementation effectively puts off making reductions until closer to 2025 rather than getting started now. We've calculated that this equates to an additional 55 Mt CO2e of methane being emitted over the period 2018 to 2025. (Canada's NIR is available for download from the UNFCCC at: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php)

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38 GreenPath Energy Limited (2017, January 30) Historical Canadian Fugitive Emissions Management Program Assessment. Available at: http://auprf.ptac.org/wp-content/uploads/2017/02/Report-FUGITIVE-EMISSIONS-16-ARPC-02.pdf

39 U.S. Environmental Protection Agency (2006, October) Lessons Learned from Natural Gas STAR Partners: Convert Gas Pneumatic Controls to Instrument Air. Available at: https://www.epa.gov/sites/production/files/2016-06/documents/ll_instrument_air.pdf.