Ivey Business School
WESTERN UNIVERSITY · CANADA
Energy Policy and Management Centre

POLICY BRIEF
JUNE 2020

Regulating Induced Emissions from Pipelines[1]

By Adam Fremeth and Brandon Schaufele

EXECUTIVE SUMMARY

- Recently enacted federal legislation, the *Canadian Energy Regulator Act*, explicitly links energy project approvals to Canada's climate change commitments through a "climate test." However, the Act stops short of prescribing specific regulations for pipeline approvals or for whether induced emissions—upstream emissions from oil and gas production, and downstream emissions from final consumption—should be included.

- We present a two-step process for the regulation of induced emissions caused by oil and gas pipelines, whereby regulators first specify a set of principles and then select a set of regulatory instruments that follow from those principles. Reasonable principles include: minimizing the *ex post* economic inefficiencies due to imperfect information, being administratively practical, maintaining consistent treatment across projects, and ensuring the project proponents bear the risk of new infrastructure projects.

- Three rules for regulating induced emissions from pipelines follow from these principles: applying a carbon tax, setting the tax at an appropriate level (we recommend the global social cost of carbon), and only regulating domestic emissions.

- Based on these principles and consequent instruments, Canada's existing backstop carbon pricing policy implies that new pipeline projects currently satisfy the climate test.

INTRODUCTION

Historically, pipeline impact assessments have focused on safety and the prospect of spills. The regulatory process did not require consideration of carbon dioxide (CO_2e) emissions, regardless of whether the emissions were upstream (i.e., produced as part of energy production), were downstream (i.e., resulting from energy consumption), or were induced (i.e., incremental emissions released due to new pipeline capacity). This changed with the passage of Bill C-69, *An Act to enact the Impact Assessment Act and the Canadian Energy Regulator Act, to amend the Navigation Protection Act and to make consequential amendments to other Acts (CER Act).* The *CER Act* explicitly links pipeline approvals to Canada's commitments to combatting climate change. Carbon dioxide emissions are now consequential for new energy infrastructure.

[1] This Policy Brief draws on a chapter by Brandon Schaufele included in the forthcoming volume: "Measuring the Contribution of Energy Infrastructure: A Practical Guide" edited by Trevor Tombe and Jennifer Winter.

Yet, while the *CER Act* is clear about connecting pipelines with fossil fuel emissions, it stops short of prescribing a regulatory system within which projects should be assessed. This Policy Brief outlines one potential framework for regulating induced emissions from future oil and gas pipelines. Given the unfamiliarity with the prospect of regulating such emissions, regulatory best practices have yet to emerge. Indeed, even determining the magnitude of induced emissions from pipelines presents significant challenges. The Policy Brief offers an analysis of the so-called "climate test" in the CER.[2] To be clear: it does not comment on the *Act's* merits or drawbacks; rather, it takes the legislation as given and considers how the regulator should operate within its provisions.

The *CER Act's* objectives are multi-fold, but above all it seeks to reduce what some considered to be perceived vagueness in key aspects of the *National Energy Board Act*. This includes ambiguous language such as "appeals to the public interest" and "just and reasonable" tolls. The *CER Act* also seeks to provide enhanced direction to both regulators and the courts on the "factors to consider" in the pipeline approval process (and other energy infrastructure projects). In particular, Section 183(2) of the proposed *CER Act* refers to approval of new pipeline infrastructure alongside Canada's commitment to address climate change. Specifically, clauses (a) and (j) state that pipeline approvals must consider:

> *(a) the environmental effects, including cumulative environmental effects;*
> *(j) the extent to which the effects of the pipeline hinder or contribute to the Government of Canada's ability to meet its environmental obligations and its commitments in respect of climate change;*

Clauses (a) and (j) are colloquially referred to as the "climate test": Regulators are required to address the issues of "cumulative environmental effects" and "Canada's ability to meet its environmental obligations and its commitments in respect to climate change." However, the legislation does not provide direction with respect to the regulatory instruments or stringencies that should factor into project assessment. It does not specifically define how "the effects of [a] pipeline hinder or contribute to" CO_2e emissions of any type and Canada's "commitments in respect of climate change." Clause (j) indicates that regulators may evaluate proposed projects according to induced emissions—i.e., up- and downstream emissions from Canada's entire fossil fuel sector that can be linked to the construction of new transportation capacity—and not just direct emissions associated with the pipeline's construction and operation.

Several issues related to emissions that are *induced* by the construction of new pipelines are considered in this Policy Brief, beginning with a definition of induced emissions. This definition positions induced emissions from pipelines within the more general Canadian oil and gas transportation market. Specifically, we outline how a "but-for," or counterfactual, approach is the appropriate way to think about induced emissions. Second, an overarching procedure for developing new regulations related to induced emissions and pipelines is recommended. A two-step process is proposed, whereby regulators specify a set of principles and then choose the regulatory instruments that follow from those principles. Choices of both the principles and the instruments should be pragmatic and effective while acknowledging several high-level characteristics of the oil and gas sector. We then recommend four general principles that apply to pipeline regulation and a reasonable set of regulatory instruments that follow from these principles. Next, we present three simple rules to manage induced emissions from pipelines that follow from the regulatory principles. These rules involve specifying a regulatory instrument alongside a level of stringency and assessing the extent of coverage to which the regulation applies. Finally, we conclude that Canada's carbon pricing 'backstop' regulation, the federal carbon tax, already accords with the principles and

[2] The climate test refers to the provision that regulatory approvals for all new pipeline projects must consider Canada's commitments to combatting climate change.

instruments we recommend; hence, as long as the carbon tax continues, new pipelines have already passed the climate test.

UPSTREAM, DOWNSTREAM AND INDUCED PIPELINE EMISSIONS

Direct, or operational, CO_2e emissions from pipelines are minor. Still, CO_2e represents a significant reason why prominent environmental non-governmental organizations (ENGOs) and analysts have expressed concerns over the construction of major new projects (Israel et al., 2020). They contend that approving new pipelines might *induce* greater emissions from the stimulation, or inducement, of further production and consumption of fossil fuels. Pipelines have therefore become a touch point for controversy, even though emissions from the transportation of hydrocarbons are a small share of the energy supply chain. Because emissions along the entire supply chain are pertinent to regulating induced emissions, defining what is meant by upstream, downstream and, hence, induced emissions are critical to understanding the requirements of the *CER Act*.

'Upstream emissions' refer to CO_2e released in the *production* and, in the context of pipeline regulation, *transportation* of fossil fuels. Growth in Canadian fossil fuel production is forecast to be predominantly from bitumen and liquified natural gas (LNG). The *CER's* climate test could apply to upstream emissions, but only if they are induced by a new pipeline project, a concept we define below. Including upstream emissions in new pipeline approvals, as required in the *CER Act,* is thus effectively, if not strictly, tantamount to stating that pipeline regulators must account for the emissions profile of oil sands extraction methods. Even as the CO_2e-intensity of oil sands extraction has declined over the past decade (Natural Resources Canada, 2019), Western Canadian bitumen is on average among the more GHG-intensive sources of energy in the world. Production of a barrel of heavy Alberta crude generates 82 $kgCO_2e$ on average, two thirds of which is due to fugitive emissions and flaring (Natural Resources Canada, 2019). For comparison, the estimated per barrel emissions from Middle Eastern conventional equals 28 $kgCO_2e$ (Peters et al., 2015).

'Downstream emissions' refer to emissions released in the post-pipeline consumption phase of the product lifecycle. Downstream emissions can be divided into both domestic and foreign emissions. Fossil fuels consumed within Canada are counted as domestic emissions, while exported oil and gas is counted as foreign emissions. While the *CER Act* appears to only require that upstream emissions be factored into the regulatory process, there is some disagreement on this dimension. Several ENGOs have argued that downstream emissions should also be considered given the global environmental challenge of climate change (Flanagan and Demerse, 2014).

'Induced emissions' are *incremental* emissions that are released *relative to a counterfactual scenario* where proposed pipeline infrastructure is not developed. This definition is comprised of three relevant components—additionality, counterfactual, and timing. First, induced emissions must be additional. Additionality—a common criterion in the evaluation of environmental policy—refers to the net contribution of new and incremental emissions that are a direct consequence of the pipeline. That is, induced emissions from pipelines only refer to how many extra tonnes of CO_2e are emitted over and above the amount that would be released in the absence of the pipeline. This "absence of a pipeline" criterion is a counterfactual scenario, which means that comparisons need to be made. The definition

of induced emissions states that the relevant comparison is between scenarios with and without the new pipeline. Critically, a counterfactual scenario is not one where emissions are held constant at existing levels. Instead, in the absence of pipelines, decision-makers in the oil and gas industry will make different choices, which may include shipping products by rail or truck, or deciding not to develop new projects. Finally, the definition is restricted to new infrastructure. In effect, this assumes that all existing pipelines have been approved and are not subject to retroactive regulation on emissions.

Several factors influence the magnitude of induced emissions:

1. *Global demand for hydrocarbons.* Many factors, including the state of the global economy, population growth, and the cost of low carbon energy sources influence global energy demand. Unknown future demand for Canadian energy implies that it is difficult to quantify the induced emissions from pipelines. A simple example highlights the analytical challenge. The Government of Canada's Trans Mountain Expansion pipeline project expands the capacity of the existing Trans Mountain pipeline to 590,000 barrels of oil per day. This does not imply, however, that the oil sands will necessarily produce an additional 590,000 barrels per day (and thus, induce the associated emissions). Oil sands production decisions depend on a multitude of factors. Weak global oil markets, for example, may yield excess capacity, yielding under-utilized assets. At the extreme, a new pipeline would induce no net additional emissions whatsoever if it were not utilized by oil shippers.[3] Alternatively, a more realistic example of weak markets could arise due to competition between multiple pipelines which, in total, could lead to surplus capacity.

2. *Displacement of foreign oil.* Energy markets are globally connected. Hence, expanded production of Western Canadian bitumen due to a new pipeline will influence production decisions elsewhere in the world. Typically, each new barrel of Canadian oil supplied displaces some portion of a foreign barrel. Substantial heterogeneity in the energy-intensity of oil extraction exists, however, which influences the magnitude of induced emissions. If Western Canadian bitumen displaced Middle Eastern light blends, each new barrel of production attributable to the pipeline would induce an additional 54 $kgCO_2e$ emissions. However, light oil blends from the Middle East are unlikely the source that will be displaced. This is because much of the US's refining capacity is engineered for particular blends, blends that include heavy crude (Energy Information Administration, 2019). Displacing Venezuelan extra heavy crude, for instance, implies notably fewer induced emissions. Venezuelan extra heavy crude is a resource with an emissions profile roughly comparable to the Alberta oil sands, implying virtually no net change in upstream emissions from production if barrels from Alberta were swapped for those from Venezuela.

3. *Alternative modes of transport.* Pipelines are not the only method for transporting oil and gas. To the extent that there are alternative modes of transport (e.g. rail or trucks), the definition of induced emissions, with its reference to a counterfactual state of the world where pipes are not approved, must account for these alternatives. New oil and gas development depends in part on the cost of rail and truck transportation relative to pipelines. The cost advantage of pipelines over rail is estimated to be in the range of $3 to $9 per barrel (Heyes et al., 2018). This additional cost influences production expansion decisions (i.e., how much more development will occur) and hence the overall upstream emissions profile of the Canadian oil sands. As with the uncertainties of future oil demand and which foreign oil source Canadian bitumen would displace, caution is required when estimating induced emissions vis-à-vis alternative modes of transportation as few reliable estimates of the scalability of rail or road transport exist (Leach, 2016).

[3] More controversially would be a new pipeline built to replace aging infrastructure, but of the same capacity. In this case, the regulator would need to precisely detail the counterfactual scenario, be it the continued operation of the old pipeline or the removal of a pipeline.

Taken together, these three factors—uncertain future demand, displaced foreign sources of oil, and alternative modes of transportation—make it difficult to precisely quantify the induced emissions from any given pipeline during the regulatory approval phase (prior to its construction).

Finally, downstream emissions, in contrast to upstream emissions, refers to emissions released in the post-pipeline, consumption phase of the product lifecycle. Downstream emissions can be divided into both domestic and foreign emissions. Fossil fuels consumed within Canada are referred to as domestic, while exported oil and gas is foreign. The *CER Act* only requires that upstream emissions be factored into the regulatory process, but there is disagreement on this dimension. Several ENGOs have argued that downstream emissions should be considered, given the global environmental challenge of climate change (Flanagan and Demerse, 2014).

A TWO-STEP PROCESS FOR REGULATING INDUCED EMISSIONS FROM PIPELINES

Given the uncertainty associated with the quantity of induced emissions from pipeline infrastructure, we offer a two-step approach for its regulation. Step one requires regulators to first establish a set of basic principles, which act as a foundation for the design of specific rules. Step two involves choosing a set of rules that follow from these principles. This two-step process ensures that regulation is responsive to the economic and political environments through the articulation of key tenets, while being consistent, pragmatic and effective via the selection of regulatory instruments that follow from the principles. This two-step process enables dialogue at the appropriate level. It is possible to disagree with the principles but accept that the proposed regulations are appropriate given these principles. Likewise, it may be reasonable to accept a set of precepts and then debate alternative regulatory tools that should be applied.

I. Principles for Developing a Regulatory Framework

Most regulation seeks to protect the public interest. It is natural to suppose that protecting the public interest should be a basic principle stipulated by the regulator, yet it provides only a vague guide for regulators' actions. Principles require sufficient specificity to be operationally meaningful. To provide greater specificity, four minimal principles are suggested on which to base the regulation of induced emissions from pipelines:

1. Minimize economic inefficiencies due to imperfect information, including both market effects and environmental damage.
2. Be administratively practical.
3. Maintain consistent treatment across different projects.
4. Allocate project risks to proponents (to the extent possible).

The objective of minimizing economic inefficiencies entails selecting regulatory instruments that make after-the-fact inefficiencies as small as possible. Similarly, arguments for administrative practicality follow from three rationales. First, regulations should try to avoid onerous transactions costs for either firms or the regulator. Often this means that the regulations may deviate from a feasible ideal. Provided they

tolerably approximate these ideals, but at a notably lower administrative cost for firms (or the regulator), then simplicity implied by this deviation is interpreted as a virtue. Second, transparency typically accompanies administratively reasonable regulations. Transparency means that all parties can understand the costs and benefits of a set of tools without requiring burdensome investments in specialized knowledge. Finally, as policy can be difficult to change, reasonably straightforward rules for modification reduce the costs of adjustment.

Maintaining consistent treatment across projects means that the regulator should not pick winners or losers. Instruments should be sought that do not differentiate between projects or proponents, except with respect to the characteristic—induced emissions in this case—that they are trying to regulate. Private capital funds the construction of most Canadian pipeline projects and the financial benefits of these projects accrue to those who provide the capital; but pipelines are risky projects and returns are subject to changes in global energy markets, public opposition, and changes in technology. As a general principle, when returns accrue privately, risks should be borne privately. Thus, the risks associated with pipeline projects should be borne by proponents.[4]

II. Three Rules for Regulating Induced Emissions from Pipelines

Based on the suggested principles, a specific regulatory framework is presented. The framework involves selecting the regulatory instrument, choosing the level of stringency, and setting the extent of coverage. The proposed regulations can be simplified to three rules to manage induced emissions from pipelines.

Rule 1: Use a Carbon Tax

As induced emissions could be included in the pipeline approval process, the issue for regulators is how to effectively incorporate them into regulation. The preferred regulatory instrument for managing induced emissions, given the four principles discussed, is a carbon tax. Carbon taxes minimize economic inefficiencies. They are also administratively simple, treat emissions equivalently and, if set at the correct rate with the appropriate coverage (Rules 2 and 3), do not transfer risks to government or society.

CO_2e is a long-lived "stock" pollutant. It remains in the atmosphere for a very long time after it is emitted. Further, the future is uncertain, and policy can be difficult to change. As a result, the choice of appropriate regulatory instrument for managing induced emissions from pipelines can be reduced to two options: carbon taxes or quantity restrictions (i.e., rules governing the maximum number of tonnes that can be emitted). Quantity restrictions are implicit if projects are rejected on the basis of inducing too many emissions and accepted if they induce fewer emissions. In a world where the future is predicted with certainty, carbon taxes and quantity regulations produce identical outcomes. In a setting of induced emissions from pipelines, however, large differences between price and quantity regulations exist.

The argument for a carbon tax for regulating induced emissions relies on a comparison of the varying costs to society from making an economically inefficient choice. This is the forgone economic benefit that no one—consumers, producers, or the environment—receives. If government misses a policy target, for instance, due to uncertainty in market conditions, there is an economic cost. The first principle of regulating induced emissions from pipelines states that the regulator should minimize after-the-fact economic losses. The Ivey Energy Policy and Management Centre Policy Brief, "An Economic Analysis of New Upstream Emissions Requirements for Pipeline Approvals" (July 2016) outlines the argument

[4] There are limits to this principle. Pipelines share some characteristics with natural monopolies and, to a lesser extent, public goods. Firms owning and operating pipelines may also be unable to bear all potential liability and be considered judgement-proof in the case of major accidents, such as rupture. Thus, it is improbable that all risk can be privately assigned but, to the extent possible, project proponents should bear the risk of pipeline infrastructure.

supporting a carbon tax over an emissions constraint for pipelines. The rationale outlined in that Policy Brief focused on the ability for a carbon tax to outperform a quantity restriction due to the fundamental uncertainty about the level of emissions that a pipeline project could produce.

Rule 2: Set the Carbon Tax Rate Equal to the Global Social Cost of Carbon

Once a carbon tax is selected as the regulatory instrument, determining the stringency of the regulation is the next step. The carbon tax should be set equal to a value known as the social cost of carbon (SCC). Environmental economists define the SCC as: "Monetized damages associated with an incremental increase in carbon emissions … intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services" (Greenstone et al. 2013, pgs. 23-24). In other words, the SCC represents the social benefits from reducing CO_2e emissions by one tonne.

The appropriate stringency for Canada's carbon tax should account for the global nature of the externality. While there is debate around the appropriate SCC to select, we recommend that regulators opt to apply a global SCC as opposed to a national or regional SCC. Setting a carbon tax equal to the global SCC has two broad implications. First, this is the appropriate value assigned to the externality as climate change is a global phenomenon, and emissions in one jurisdiction affect all other regions. Second, the SCC measures the trade-off between costs and benefits from CO_2e emissions. Setting the tax rate at the global SCC, a rate that is likely greater than the damage from climate change that will occur in Canada, entails placing value on the benefits from mitigation that accrue to non-Canadians. The global SCC means that Canadians will 'overpay' for their contribution to mitigating climate change based on expected domestic damage, but they will not overpay for their contributions to global damages.

Adopting this global perspective involves a slight deviation from the standard practice of regulatory impact assessments in Canada. Canadian academics highlight how the cost-benefit guidelines provided by Canada's Treasury Board typically require only considering the benefits and costs that accrue to Canadians (Heyes et al., 2013). Special accommodations are made when the regulations influence Canada's global commitments, and induced emissions from pipelines clearly qualify.

Rule 3: Regulate Only Domestic Emissions

The first two rules identify a regulatory instrument and level of stringency. The final rule considers the important and sometimes controversial dimension of the scope of coverage: whether foreign emissions associated with downstream consumption of Canadian hydrocarbon exports should be included. While instrument selection and stringency rate are guided by economic theory, the coverage of the regulation depends on factors that are more difficult to control. We recommend exclusively considering domestic emissions in the regulatory process.

There are several arguments in favour of solely regulating domestic emissions. First, the global SCC already factors in the damage accruing to the rest of the world from domestic emissions. By using the global SCC, Canada is investing in domestic abatement in order to benefit foreign jurisdictions while only regulating domestic emissions.

Second, international agreements on GHG emissions stipulate that countries are only responsible for domestic emissions. Specifically, "Under United Nations accounting rules, countries are only responsible

for emissions that occur within a country's national borders (IPCC, 2006b: 1.4; UNKFCCC, 2006: para.9)" (Purdon and Breton, 2016). Restricting coverage to domestic emissions means that, under the *CER Act,* Canada complies with its commitments to international climate change agreements.[5]

Third, restricting attention to emissions released within Canada's borders avoids double counting if the purchaser of Canadian fossil fuels resides in a jurisdiction which also has a climate policy. If the jurisdiction of both the seller and the buyer have climate policies, then including foreign emissions within the scope of induced emissions from pipelines would mean that foreign downstream emissions would be counted twice—once in Canada and once in the purchaser's country.

Finally, regulators must be cognizant of the risk of emissions leakage, whereby domestic regulation creates incentives for firms to relocate production to jurisdictions with weaker environmental controls. Over-regulating emissions produces larger incentives for leakage and may cause Canada to lose competitiveness, reducing the efficacy of its climate change regulation.

CONCLUSION

Economists have estimated that failure to add new pipeline capacity in Canada will reduce oil sands output by between 8% and 12% (Heyes et al., 2018). The Government of Canada has simultaneously required that international commitments with respect to climate change must factor into future pipeline approvals. This Policy Brief outlines how regulations can be designed to account for induced emissions from pipeline infrastructure. It argues for a straightforward two-step approach, establishing a set of principles and creating a consistent set of regulations. The proposed regulations are consistent with the principles and are pragmatic and effective ways to achieve the federal government's objectives.[6] The three rules are also consistent with the Federal Government's Pan-Canadian Framework on Clean Growth and Climate Change, which is commonly referred to as the federal carbon pricing 'backstop'. Based on our arguments, Canada's backstop carbon price implies that induced emissions from pipelines are already accounted for when determining whether to approve a pipeline and issue a Certificate of Public Convenience and Necessity, negating the need for further regulatory action. Importantly, Canada's federal carbon pricing policy already treats most emissions equivalently, is expected to rise over the years to a level consistent with a global SCC, and exclusively applies to domestic emissions. Thus, new pipeline projects already pass the *CER's* climate test.

[5] In light of Article 6 of the Paris Accord, the requirements and expectations around this provision are currently being negotiated and new provisions may apply in the future.

[6] Other regulatory tools are also consistent with the principles. For instance, incorporating emissions into oil lease auctions is another method to align the costs and benefits of CO_2e emissions and oil development.

REFERENCES

Canada. 2016. "Government of Canada Moves to Restore Trust in Environmental Assessment," press release available at http://news.gc.ca/web/article-en.do?mthd=index&crtr.page=1&nid=1029999 (accessed March 26, 2020).

Energy Information Administration. 2019. "Refinery Capacity Report." https://www.eia.gov/petroleum/refinerycapacity/ (accessed June 9, 2020).

Flanagan, Erin and Clare Demerse, 2014. "Climate Implications of the Proposed Energy East Pipeline: A Preliminary Assessment." The Pembina Institute, 2014.

Greenstone, Michael, Elizabeth Kopits and Ann Wolverton, 2013. "Developing a Social Cost of Carbon for US Regulatory Analysis: A Methodology and Interpretation." *Review of Environmental Economics and Policy,* 7(1): 23–46.

Heyes, Anthony, Andrew Leach and Charles F. Mason. 2018. "The Economics of Canadian Oil Sands." *Review of Environmental Economics and Policy,* 12(2): 242-263.

Heyes, Anthony, Dylan Morgan and Nicholas Rivers. 2013. "The Use of a Social Cost of Carbon in Canadian Cost-Benefit Analysis." Canadian Public Policy 39, no.2: s67-s79.

Israel, Benjamin, Jan Gorski, Nina Lothian, Chris Severson-Baker, and Nikki Way. 2020. "The oilsands in a carbon-constrained Canada." The Pembina Institute, 2020.

Leach, Andrew, 2016. "Why the debate over Keystone and emissions comes down to rail." http://www.macleans.ca/economy/economicanalysis/kxl-econ-101-lecture-2/ (accessed April 28, 2016).

Natural Resources Canada, 2019. Energy and Greenhouse Gas Emissions. https://www.nrcan.gc.ca/science-data/data-analysis/energy-data-analysis/energy-facts/energy-and-greenhouse-gas-emissions-ghgs/20063#L2 (accessed May 21, 2020).

Peters, Jotham, Nicholas Rivers and Michael Wollinetz, 2015. "Linking pipelines infrastructure and global GHG emissions."

Purdon, Mark and Simon-Philippe Breton. 2016. "The Downstream Emissions Resulting from the Energy East Pipeline: An Evaluation Considering Economics, Technical and Political Risk Factors." IQCarbone Climate Policy Working Paper No.2. Institut Quebecois du carbone (IQCarbone): Montreal.

ABOUT THE IVEY ENERGY POLICY AND MANGEMENT CENTRE

The Ivey Energy Policy and Management Centre is the centre of expertise at the Ivey Business School focused on national energy business issues and public policies. It conducts and disseminates first class research on energy policy; and promotes informed debate on public policy in the sector through supporting conferences and workshops that bring together industry, government, academia and other stakeholders in a neutral forum. The Centre draws on leading edge research by Ivey faculty as well as by faculty within Western University.

More information is available at
www.ivey.ca/energy

Ivey Business School
WESTERN UNIVERSITY · CANADA

Energy Policy and Management Centre

AUTHORS

Adam Fremeth, Associate Professor
Business, Economics and Public Policy
E.J. Kernaghan Chair in Energy Policy
Ivey Business School

Brandon Schaufele, Assistant Professor
Business, Economics and Public Policy
Ivey Business School

The findings and opinions contained in this report reflect solely those of the author. The Ivey Energy Policy and Management Centre submits reports for external review by academic and policy experts and energy sector stakeholders. The Centre gratefully acknowledges support from organizations and individuals listed on the Centre's website:
https://www.ivey.uwo.ca/energycentre/about-us/supporters