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POLICY BRIEF

Regulating Carbon in Canada

Flexibility and Federal Oil and Gas Greenhouse Gas Regulations: Containing costs while increasing ambition

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Abstract

The Canadian federal government is developing regulations for greenhouse gas (GHG) emissions from Canada's oil and gas sector. This is a necessary and important policy step, given the sector's substantial contribution to national emissions, rapid production and emissions growth projections. Yet our analysis and modelling suggests that the oil and gas sector has a limited ability to deliver emission intensity improvements between now and 2020.

To ensure cost-effective policy and increase the level of ambition for achieving deeper emissions reductions, federal sector-by-sector GHG regulations should consider including compliance flexibility both within and beyond the sector. Federal light- and heavy-duty vehicle GHG regulations, as well as Alberta's Specified Gas Emitters Regulation (SGER), provide compliance flexibility blueprints from which to inform the emerging federal oil and gas GHG regulations. But stringency will need to be higher in order to move Canada towards achieving its 2020 GHG target of 607 megatonnes carbon dioxide equivalent (Mt CO_2e).

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Pragmatic Regulatory Design for Oil and Gas GHGs

A regulatory approach to driving GHG reductions does not need to be rigid and costly. Careful design can lead to more cost-effective—and more ambitious—regulations for reducing Canadian GHG emissions. While the lack of federal carbon pricing policy has been much lamented, we are now seeing federal GHG regulations move forward that include the most important element of carbon pricing—flexibility. Both the light-duty vehicle regulations and the proposed heavy-duty vehicle regulations include elements of compliance transfers such as crediting and banking.

This movement to hybrid performance regulations with elements of compliance flexibility is positive, as regulators seek to strike a balance between emissions reductions and competitiveness. While the current political reality has moved policy away from the economist's preferred "first best" carbon pricing, the sector-by-sector regulations do seem to be evolving toward increased flexibility, partially tempering the risks from rigid, prescriptive and potentially high-cost policy.

Such pragmatic policy design is the focus of this policy brief. Building on the federal GHG sector-by-sector approach to regulating carbon, we explore the implications of developing flexible performance-based regulations for the oil and gas sector. We ask three simple questions to help inform the design of new performance-based regulations:

1. What flexibility mechanisms in existing GHG regulations might inform new oil and gas regulations?
2. How important is compliance flexibility to the oil and gas sector?
3. What flexibility mechanisms can be added to the oil and gas performance regulations to keep costs low while achieving emission reductions?

Our approach to addressing these questions builds on IISD's previous work in the Regulating Carbon Emissions in Canada initiative.[3] Specifically, in *Mind the Gap* (Sawyer, 2011), we identified five principles that should inform the design of performance-based regulations:

1. Establish certainty through a regulatory schedule that makes expected effort clear
2. Enable flexibility while achieving emissions reductions
3. Avoid disproportionate costs across emissions in Canada
4. Seek reductions throughout the entire emission inventory
5. Accommodate a transition to carbon pricing in the longer term

These principles still hold, and our recommendations on the design of new federal oil and gas regulations are solidly embedded in this framework. We find that the movement in federal sector-by-sector GHG regulations to include more compliance flexibility is particularly important for the oil and gas sector, with an opportunity both to design cost-effective regulations and to increase the level of ambition for achieving deeper emissions reductions.

This policy brief focuses mainly on the 2020 time horizon and on emissions reductions that can contribute to Canada's 2020 target of 17 per cent below 2005 emissions levels. However, we recognize that longer-term emissions reductions also matter for Canada, given the long-lived capital stock now being deployed by the oil and gas sector, and so must

[3] See www.iisd.org/climate/north_american/regulating_carbon.aspx

also be considered in policy design. Finally, the oil and gas sector is defined in this report as both conventional and unconventional oil extraction, upgrading, natural gas extraction and petroleum refining. These sectors will likely be regulated under emerging federal oil and gas regulations.

Flexibility Mechanisms in Existing GHG Regulations

Regulatory policies for mitigating GHG emissions are a key part of Canada's current climate change policy landscape. The federal government in particular has begun to implement a sector-by-sector approach to GHG regulation. It has announced or enacted regulations in three sectors—light-duty vehicles, coal-fired electricity generation and heavy-duty vehicles—and plans to announce regulations for the oil and gas extraction sector by 2013. Alberta has similarly relied on a regulatory framework, having had its SGER for industrial emitters in place since 2007.

Yet a brief review of some of the details of each of these regulations illustrates that there isn't necessarily a clear-cut division between regulatory and market-based policy approaches. Existing regulations are already relying on flexibility mechanisms to contain costs.

Federal Light-Duty Vehicle Regulations[4]

Canada's light-duty vehicle regulations require that for each model year 2011 and forward, the average GHG emissions from a given automobile manufacturer's fleet of new passenger vehicles and light-duty trucks meet—on average—a given standard for emissions per mile travelled.

The regulatory standard does, however, include a number of flexibility mechanisms, because a company can obtain credits if its fleet's average emissions are lower than the regulated threshold. These credits can be used within the next five years of compliance with the regulation. Essentially, this is a *banking mechanism*. Manufacturers can choose to improve vehicle efficiency earlier, rather than later, if it is more cost-effective for them to do so. Companies can also transfer credits to other manufacturers. This *trading mechanism* allows the manufacturers that can most cost-effectively improve efficiency to do so, and those less equipped to purchase additional credits. Both of these flexibility mechanisms serve to decrease the total cost of compliance for the regulation, without affecting its impact on emissions reductions. These mechanisms align with our second and third principles for regulation. Banking allows flexibility across time, and trading allows flexibility across the regulated emissions, allowing firms to seek out the lowest cost options for emissions reductions.

Federal Heavy-Duty Vehicle Regulations[5]

The proposed regulations for emissions from heavy-duty vehicles require progressively more stringent GHG emission standards for new on-road heavy-duty vehicles and engines for model years starting in 2014. The regulations apply to companies manufacturing and importing new on-road heavy-duty vehicles and engines for the purpose of sale in Canada.

However, this proposed regulation also lays out a credit system. Similar to the light-duty vehicle regulations, manufacturers with vehicle fleets that fall below the required average level of emissions can obtain credits. These credits can be *banked* (used for compliance with subsequent model-year standards) or *traded* (sold to other manufacturers for

[4] Information for this section is drawn from Government of Canada (2010).
[5] Information for this section is drawn from Department of the Environment (2012).

the purposes of their own compliance). Again, these mechanisms provide flexibility across time and across regulated emissions, providing firms with choice in how they can achieve the required emissions reductions at a lower cost.

Federal Electricity Performance Standard

The regulation for coal-fired generation of electricity sets a performance standard for new coal-fired units and those that have reached the end of their useful life (Government of Canada, 2012). It will phase out high-emitting coal-fired generation, requiring new capacity to be high-efficiency natural gas, renewable energy or fossil fuel-fired power with carbon capture and storage.

Again, while clearly a regulatory approach—it sets a minimum standard all new projects must meet—the policy also includes some flexibility in how emitters can comply with the policy. Temporal flexibility underscores the regulations, with units having up to 50 years to comply. This flexibility allows the full book value of the asset to be depreciated prior the regulation binding, thus avoiding stranding assets. As well, an existing plant that shuts down or meets the performance standard prior to when it would be required to do so under the regulation could take on the performance standard obligation of an alternate facility. The existing unit has to have equal or greater capacity than the end-of-life unit, both units have to have a common owner who has 50 per cent or more ownership in each of the units and they must be in the same province.

Other flexibility includes:

- **Carbon capture and storage (CCS) provisions**: New and old units can apply for a deferral if they incorporate CCS, while existing units with CCS prior to their requirement to meet the performance standard can transfer two years of compliance to older units.
- **Fleet transfers or substitutions:** Utilities can swap in-service years between two facilities, as long as one meets the performance standard or is set to close.
- **Standby provisions and emergency use:** A small share of total generation can be designated as "standby" to be used in case of emergency.
- **Equivalency:** Provinces can opt for equivalency agreements to avoid pre-emption by federal regulation.

Alberta Specified Gas Emitters Regulation[6]

Finally, Alberta's policy for industrial GHG emissions is also a regulatory policy in which market-based mechanisms are firmly embedded. The SGER requires major emitters in Alberta to incrementally improve their emissions intensity in each subsequent year of production. It also provides a range of options for complying with the regulation. Firms can choose to improve their emissions performance, to purchase credits from other firms that have reduced their emissions below the required threshold, to purchase offsets that represent emissions reductions elsewhere in the Alberta economy or to purchase compliance credits at a price of $15[7] per tonne CO_2e. These compliance options establish a market for emissions reductions, which in turn sends a clear price signal for emitters.

[6] Information for this section is drawn from Government of Alberta (2012).
[7] All currency is denoted in 2011 Canadian dollars.

The Importance of Flexibility in Oil and Gas GHG Regulations

The oil and gas sector, including oil and gas extraction and petroleum refining, is a large source of GHG emissions in Canada. In 2010 it contributed 22 per cent of national emissions, second only to the transportation sector (Environment Canada, 2012). Yet even more importantly, this sector's emissions growth is significant (see Figure 1). Oil and gas production emissions increased by around 54 per cent—or 54 Mt—between 1990 and 2010 (Government of Canada, 2012). IISD forecasts the sector's GHG emissions will continue to grow, likely increasing in the order of 15 per cent, or 20 Mt, between now and 2020.

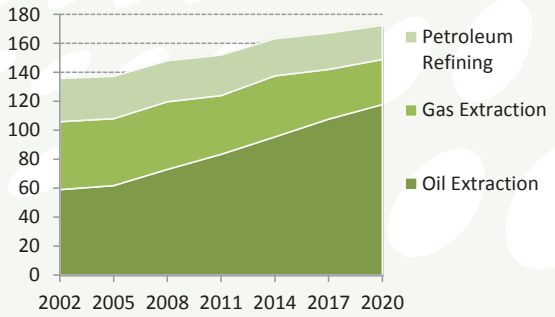

FIGURE 1. OIL AND GAS EMISSIONS TO 2020: Mt CO_2E
Source: IISD modelling (all figures and tables)

Given the likely growth in GHG emissions, regulations for this sector are a central piece of Canada's mitigation ambition. The federal government agrees, having indicated that oil and gas will be the next sector to be regulated under its sector-by-sector approach.[8]

Approach

To assess options for regulating the oil and gas sector, we are interested in both in *effectiveness* (that is, to what extent a regulation will improve emissions-intensity and resulting emissions reductions) as well as *cost-effectiveness* (that is, to what extent emissions reductions are achieved at least cost). We quantitatively assess these factors considering *emissions-intensity improvement marginal abatement cost curves* for the oil and gas sectors: the GHG emissions produced per barrel of oil, refined product or cubic metre of natural gas. These curves relate decreases in emissions intensity in 2020 (producing fewer GHG emissions per barrel of oil or per cubic metre of gas) to the cost of achieving those improvements (measured in terms of the marginal cost per tonne of CO_2e reduced). With the cost curves, we then can explore the likely response of the sector to regulatory policy and map a range of potential regulatory scenarios with different levels of stringency, illustrating the marginal cost and expected emissions intensity improvements expected under each.

We generate emissions-intensity cost curves for the oil and gas sector and for the individual subsectors (Figure 2) within the broader oil and gas sector using the GEEM model, a computable general equilibrium (CGE) model of Canada's economy. Because the curves are built using a CGE model, they include general equilibrium effects such as demand and supply changes related to price changes attributable to increased regulatory costs.

[8] Draft regulations for oil and gas are expected in 2013; see http://unfccc.int/files/bodies/awg-lca/application/pdf/20120517_canada_1749.pdf

Scenarios to Highlight the Importance of Policy Flexibility

The stringency of the intensity standard is the most important regulatory design choice. It drives the magnitude of the required improvements in emissions intensity, and so affects both the level of emissions reduced under the policy, as well as its total costs. To highlight a range of environmental and economic outcomes, our scenarios "bookend" a range of policy stringency relative to a business-as-usual forecast for 2020:

- A low level of policy stringency requires an improvement in emissions intensity in 2020 of 20 per cent or 30 Mt CO_2e below the 2020 forecast.[9]
- A high level of policy stringency requires an improvement in emissions intensity in 2020 of 50 per cent or 84 Mt CO_2e below the 2020 forecast.

The second most critical design decision is the choice of compliance pathways enabled by the regulations. Our analysis considers three main policy scenarios, each with different levels of flexibility:

1. **A rigid scenario** requires firms to hit each intensity standard with their own actions.
2. **A compliance flexibly within the sector scenario** allows firms to transfer intensity improvement credits, where some firms over-comply and some under-comply, but on average the intensity standard is met for all.
3. **A compliance flexibility beyond the sector scenario** where firms can use emission reductions from other emission sources but a price ceiling sets a maximum compliance price to contain costs (price safety valve).

Table 1 provides an overview of the scenarios.

Note that these scenarios are illustrative. They are designed to provide a range of the potential trade-offs between effectiveness and cost-effectiveness through our modelling analysis. They are not intended to represent recommendations for optimal regulatory design.

TABLE 1: SCENARIOS FOR OIL AND GAS REGULATIONS

SCENARIO	COMPLIANCE IN 2020	COMPLIANCE FLEXIBILITY WITHIN THE SECTOR	COMPLIANCE FLEXIBILITY BEYOND THE SECTOR
Rigid Scenario: No flexibility			
No flexibility, 20% intensity improvement	30 Mt	—	—
No flexibility, 50% intensity improvement	84 Mt	—	—
Compliance flexibility within sector: Firm transfers			
Transfers within sector, 20% intensity improvement	30 Mt	Firm transfers	—
Transfers within sector, 20% intensity improvement	84 Mt	Firm transfers	—
Compliance flexibility within and outside sector: Firm transfers and a price ceiling			
Transfers, maximum price, 20% improvement	30 Mt	Firm transfers	Max price of $50 per tonne CO_2e
Transfers, maximum price, 50% improvement	84 Mt	Firm transfers	Max price of $100 per tonne CO_2e

[9] While we focus on intensity improvements, with a production forecast in hand, we are able to translate the intensity improvements into the equivalent GHG reductions.

The Importance of Regulatory Flexibility within the Sector

Figure 2 shows emissions intensity cost curves for subsectors within the broader oil and gas sector in 2020. The subsectors shown highlight the diverse range of abatement potentials and costs available in the oil and gas sector. In reality, the variety in abatement costs in the sector will be even more widespread; individual facilities within the same subsector will have unique characteristics that will make abatement more or less expensive. As the figure shows, the costs of improving the emissions intensity of each of these subsectors by 2020 are very different. These variations are largely a function of differences in extraction processes, but also reflect the fact that Alberta emitters are already making improvements in response to the Alberta GHG regulations, and so have fewer low-cost abatement options available.

The **rigid scenario** is represented in Figure 2, where firms must attain the intensity standard alone as illustrated by the vertical dotted lines. Figure 2 highlights the significant variability or heterogeneity in emissions-intensity improvements between sectors. Some sectors, such as petroleum refining, British Columbia tight gas, and Newfoundland and Labrador offshore have limited improvement potential, whereas others have much greater potential, notably Saskatchewan heavy oil due to enhanced oil recovery. Indeed, only two of the seven subsectors in the model can achieve the 20 per cent intensity standard in the rigid, or no flexibility, scenario. This observation is significant for regulatory design, indicating that a rigid, "one-size-fits-all" emissions standard would benefit from compliance flexibility.

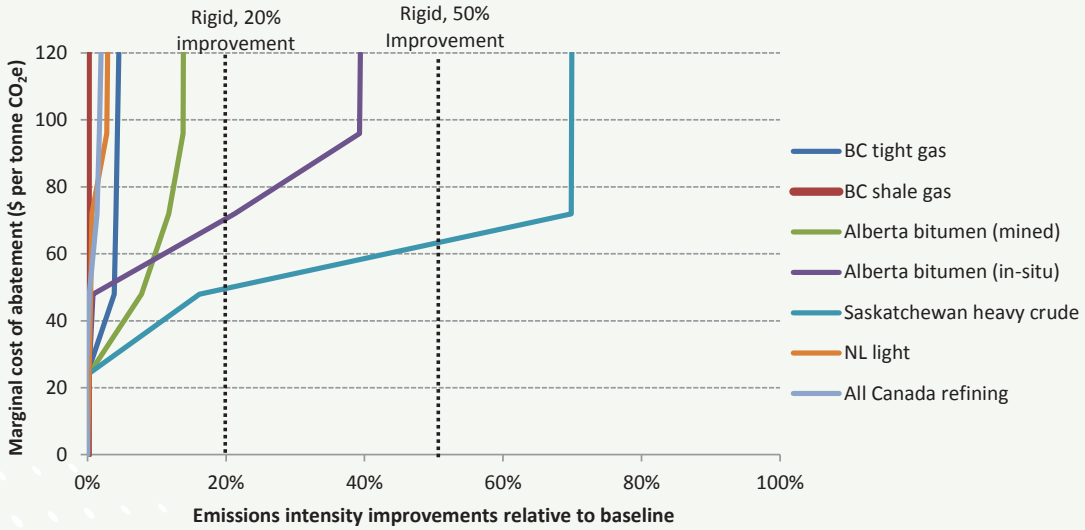

FIGURE 2. EMISSIONS-INTENSITY MARGINAL COST CURVES FOR REPRESENTATIVE OIL AND GAS SUBSECTORS IN 2020

Additional flexibility could address this risk of non-attainment under the rigid scenario, while improving the cost-effectiveness of the regulation. In the **flexibility within the sector scenario**, emitters generate credits through emissions-intensity improvements *above* the required standard, and exchange these credits with other emitters, who find it more cost-effective to trade rather than improve some portion of their own intensity standard. Given the significant heterogeneity in intensity improvement costs and potentials in the sector, both effectiveness and cost-effectiveness are improved with credit transfers relative to the **rigid scenario**.

At a 20 per cent intensity improvement, the sector can likely comply at marginal costs of $88 per tonne CO_2e (Figure 2), achieving the necessary compliance of 30 Mt CO_2e in 2020. But our analysis suggests that for standards requiring more than 24 per cent improvement, non-compliance is a real risk, with a 50 per cent improvement totally out of reach even with in-sector transfers. After 24 per cent, sectors essentially have rising costs but a limited potential to deliver further intensity improvements. This finding suggests that, in the absence of compliance flexibility, only a limited level of ambition can be placed directly on the sector by 2020.

Table 2 shows the expected marginal cost per tonne of abatement for oil and gas regulations with and without a credit transfer flexibility mechanism. As the table illustrates, flexibility within the oil and gas sector is an improvement relative to the rigid scenario, but only to a point. While some subsectors cannot individually achieve the 20 per cent intensity improvement, the oil and gas sector as a whole can reduce emissions by 30 Mt CO_2e, achieving the required emissions reductions. Flexibility within the sector improves policy effectiveness, increasing the total emissions reduced by 7 Mt beyond the rigid scenario, effectively achieving compliance. In-sector flexibility also improves the cost-effectiveness, reducing the average cost of abatement by 16 per cent.

Yet in-sector flexibility is insufficient to drive deeper intensity improvements. By 2020 about 30 Mt of reductions are available at costs approaching $88 per tonne (marginal cost), after which costs rise with few additional reductions. With in-sector flexibility, the 50 per cent intensity standard is likely out of reach.

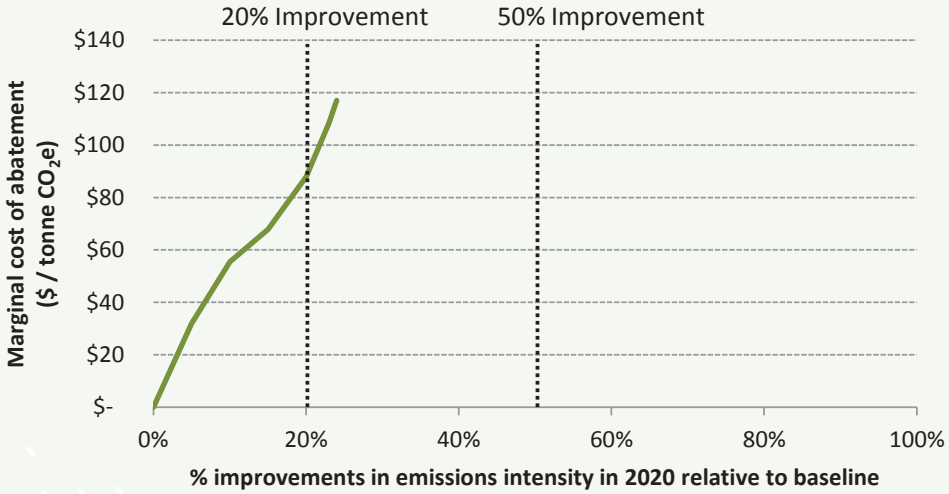

FIGURE 3. IN-SECTOR FLEXIBILITY SCENARIO: EMISSIONS INTENSITY COST CURVE OIL AND GAS SECTOR IN 2020

TABLE 2: RIGID VERSUS IN-SECTOR FLEXIBILITY: ECONOMIC AND ENVIRONMENTAL IMPLICATIONS IN 2020

	GOAL: 20% INTENSITY IMPROVEMENT				GOAL: 50% INTENSITY IMPROVEMENT			
	INTENSITY TARGET ACHIEVABLE?	COMPLIANCE*	AVERAGE ABATEMENT COST	MARGINAL ABATEMENT COST	INTENSITY TARGET ACHIEVABLE?	COMPLIANCE	AVERAGE ABATEMENT COST	MARGINAL ABATEMENT COST
Rigid regulations no flexibility	No	23 Mt	$56 per tonne	Varies across emitters	No	36 Mt	$64 per tonne	Varies across emitters
Flexible regulations with credit transfers within sector	Yes	30 Mt	$47 per tonne	$88 per tonne	No	Cannot deliver reductions from oil and gas		
Gains from in-sector flexibility	Target becomes achievable	Plus 7 Mt	16% cost reduction					

** When the intensity target is not achievable under the rigid scenario, each subsector achieves the reductions as are technically feasible; reductions and average costs are calculated assuming these reductions are maximized.*

The Importance of Regulatory Flexibility beyond the Sector

Flexibility beyond the sector would help policy effectiveness and cost-effectiveness by enabling access to lower-cost compliance outside the oil and gas sector. Two main approaches could introduce flexibility beyond the sector:

- **A maximum compliance price ceiling**. This mechanism could limit the maximum cost exposure of emitters. Firms could choose to pay a compliance fee at a fixed price per tonne CO_2e in place of achieving their most expensive emissions. The best known use of such a mechanism is in the Alberta SGER Climate Change and Emissions Management Fund (or technology fund), where revenue is invested in technology research and development (R&D) projects to reduce the long-term costs of emission reductions. While R&D investments support long-term climate change objectives, it will not necessarily reduce emissions prior to 2020. Proceeds could therefore be used to fund additional emissions reductions through land set asides that also seek to deliver bundled benefits such as biodiversity and conservation. Land set-asides with bundled benefits would be outside of a formalized compliance mechanism such as low cost domestic reductions (see below).
- **Low-cost domestic reductions (LCDRs).**[10] LCDRs are essentially GHG reductions from sectors not covered by the regulation. They could be domestic (typically from sectors like waste, agriculture or forestry) or international. In order for LCDRs to represent real reductions, they require some kind of guarantee to quality, being verifiable and additional (which would not have happened absent the regulation). IISD explored the potential usefulness of LCDRs in a policy brief called *Offsets and Canada's GHG Regulations: Reducing Costs, Improving Competitiveness and Lowering Emissions* (Sawyer, Stiebert & Beugin, 2011).

We consider two variants of **flexibility beyond the sector for the two intensity standards:** maximum compliance prices of $50 and $100 per tonne CO_2e for 20 per cent and 50 per cent intensity improvements, respectively. For the emitter, accessing the price ceiling effectively represents a credit towards compliance, and then places decisions on government about whether or not additional emission reductions or research and development investments will be sought with the proceeds. Thus, compliance and emission reductions are not necessarily the same to the extent that the price ceiling is utilized.

[10] Also known as domestic offsets.

Note the scenario also includes flexibility within the sector, with compliance coming from an emitter's own reductions, credits bought or sold, and access to the compliance price ceiling.

Table 3 illustrates the impact of the price ceiling on the emissions reduced and the average costs of compliance for the 20 per cent and 50 per cent intensity standards. For a 20 per cent improvement in intensity, the price ceiling eliminates the highest cost emissions reductions from the sector, resulting in decreased costs by 8 per cent. For a 50 per cent improvement, out-of-sector compliance flexibility allows the intensity standard to be met, unlike the scenario with flexibility only within the sector (credit transfers between entities).

TABLE 3: REGULATORY IMPACTS IN 2020 WITH AND WITHOUT FLEXIBILITY BEYOND THE OIL AND GAS SECTOR

	GOAL: 20% INTENSITY IMPROVEMENT				GOAL: 50% INTENSITY IMPROVEMENT			
	COMPLIANCE ACHIEVABLE	COMPLIANCE	MAXIMUM COMPLIANCE PRICE PAID	AVERAGE COMPLIANCE COST	INTENSITY TARGET ACHIEVABLE? (INCLUDING COMPLIANCE)	COMPLIANCE	MAXIMUM COMPLIANCE PRICE PAID	AVERAGE COMPLIANCE COST
Flexible with transfers within sector	Yes	30 Mt reductions in sector	$88 (marginal)	$47 (average)	No	Sectors cannot deliver required reductions as a whole		
More flexible with in-sector and out-of-sector flexibility	Yes	9 Mt reductions in sector 21 Mt out of sector	$50* (marginal) Set by price ceiling	$43 (average)	Yes	34 Mt reductions in sector 50 Mt out of sector	$100* (marginal) Set by price ceiling	$83 (average)
Gains from out-of-sector flexibility				8% cost reduction	Target becomes achievable			

**Marginal cost is the cost of the last unit of emissions reduced, whereas average cost is total cost divided by total reductions.*

Summary of Scenario Results

Table 4 provides an overview of the scenarios we have explored. It provides a summary of metrics that illustrate both the *effectiveness* (emissions intensity improvements and GHG emissions reductions) as well as the *cost-effectiveness* (average cost of compliance per tonne CO_2e). Together, the scenarios illustrate that flexibility in regulations can improve cost-effectiveness but also enable more ambitious, stringent regulations. Adding flexibility *within* the sector through a credit-trading system decreases costs relative to a rigid scenario, but also enables compliance. Adding even more flexibility through reductions *beyond* the oil and gas sector decreases costs further and enables compliance with more stringent regulations.

TABLE 4: SUMMARY METRICS FOR OIL AND GAS REGULATION SCENARIOS

SCENARIO	EMISSIONS INTENSITY IMPROVEMENT GOAL	IS COMPLIANCE ACHIEVABLE IN 2020?	COMPLIANCE			AVERAGE COMPLIANCE COST IN 2020 ($ PER TONNE CO_2E)
			REDUCTIONS WITHIN THE SECTOR	COST-CONTAINMENT (OUT-OF-SECTOR FLEXIBILITY)	TOTAL	
Rigid regulations no flexibility	-20%	No	24 Mt	—	24 Mt	$ 56
Flexible with transfers within sector		Yes	30 Mt	—	30 Mt	$ 47
More flexible with in-sector and out-of-sector flexibility		Yes	9 Mt	21 Mt	30 Mt	$ 43
Rigid regulations no flexibility	-50%	No	36 Mt	—	—	$ 64
Flexible with transfers within sector		No	Sector cannot deliver required reductions. Maximum intensity improvement is -24%, or 38 Mt at an average cost of $ 57			
More flexible with in-sector and out-of-sector flexibility		Yes	34 Mt	50 Mt	84 Mt	$ 80

Related Issues for Operationalizing Performance-Based Regulations

Three additional questions emerge from our benefits analysis of flexibility in regulations for the oil and gas sector. These issues are outside the scope of our modelling scenarios, but should be taken into consideration when designing practical regulations for the oil and gas sector.

Are Sufficient LCDRs Available?

If LCDRs are to be used to provide out-of-sector flexibility, can enough credible LCDRs be generated from unregulated sectors to meet demand? If a flexible regulation is to drive deep emissions reductions in the oil and gas sector, emitters would likely need to rely heavily on LCDRs. Figure 4 illustrates the distribution of compliance under the two full flexibility options. Under full flexibility with a performance standard mandating 20 per cent improvement in emissions intensity (or 30 Mt CO_2e), emissions reductions are available under $50 per tonne in the oil and gas sector to drive about one third of the required emissions reductions in 2020 (equivalent to 9 Mt CO_2e). Out-of-sector compliance options then need to supply 70 per cent of compliance, or about 21 Mt CO_2e. Under a 50 per cent emissions-intensity improvement standard, emitters must rely heavily on out-of-sector compliance, with 59 per cent, or about 49 Mt CO_2e, of compliance.

This ability of LCDRs to act as a main compliance pathway at increasing levels of policy stringency is an open question, and therefore requires more analysis to determine what quantity of LCDRs is available, and at what cost. In particular, very little in Canada is known about the potential for LCDRs from forestry, agriculture and land-use changes, and the costs of these reductions.

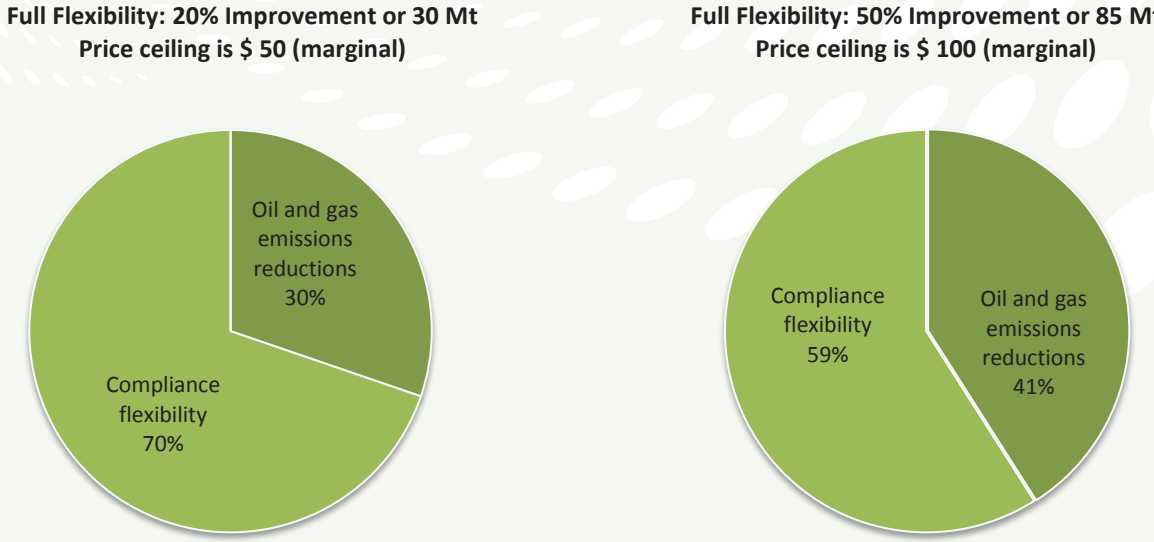

FIGURE 4: COMPLIANCE WITH OIL AND GAS REGULATIONS WITH FULL FLEXIBILITY COST-CONTAINMENT

How Can Policy Drive Innovation?

Regulations may be limited in that they do not necessarily incent innovation. Firms have incentive to comply with the performance standard, but under rigid regulations, do not have incentive to reduce emissions *beyond* the standard. The incentive to innovate new, revolutionary technologies is therefore reduced. In the longer term, innovation is critical. Canada must not seek only to achieve its 2020 targets at lowest cost, but also to keep deeper, longer-term reduction targets in its sights as well.

Three potential mechanisms could be considered to support innovation:

- Using a technology fund as the mechanism for out-of-sector compliance flexibility would generate revenue that could be used to support technology and innovation directly. Government could distribute the revenue as subsidies for research, development and deployment with an eye to supporting lowering the costs of long-term reductions.
- A flexible—but sufficiently stringent—regulation would provide incentive for innovation on its own. As long as regulation includes flexibility within the sector, firms can generate revenue by reducing more emissions than required to comply with the regulation and selling credits to other firms. Incentives for innovation therefore only exist when the market price for permits is sufficiently high.
- Distinct technology and innovation policies can be used to complement regulations. These policies can be designed to close the gap between public and private returns on investments in research and development.

Distributing Price Ceiling Proceeds a Challenge

From an economic perspective, the financial transfers from the flexibility mechanisms for compliance result in increased policy efficiency since overall policy costs are decreased. But the financial transfers have distributive implications, with financial transfers between competitors and regions. Interregional financial transfers are an extremely important policy barrier for provinces under any flexibility mechanism. These transfers can be large and regionally concentrated both positively and negatively, and therefore any policy regime must address this fundamental issue.

Under a price ceiling, with payments for compliance, a recycling mechanism could be designed to spend the revenue in the province from which it originated. This could occur under an equivalency agreement, where, for example, Alberta's SGER is set at a level equivalent with a federal performance standard, and existing governance arrangements are used to keep the compliance payments in Alberta. Alternatively, a jointly federally and provincially managed fund could be established with a mandate to recycle the compliance payments back to the originating province, with governance oversight by provincial and federal representatives.

LCDRs are a separate case; economic efficiency is likely adversely impacted to the extent LCDR supply is limited geographically. For example, firms in Saskatchewan can only use LCDRs in that province. Still, some provinces will likely take issue with financial transfers out of the province for LCDR compliance purchases elsewhere. Given the efficiency gains associated with LCDRs, limiting the geographic scope of LCDR supply for distributive reasons would come at a high price.

Designing Flexible Regulations for Oil and Gas

The federal government is developing regulations for GHG emissions from Canada's oil and gas sector. This is a necessary and important policy step, given the sector's substantial contribution to national emissions and its rapid expected growth in production and emissions. Our analysis provides insight that could be relevant in designing these regulations as cost-effectively as possible.

A few main conclusions emerge in answer to the questions we posed in the beginning of this brief.

1. What flexibility mechanisms currently in GHG regulations might inform new oil and gas regulations?

Environment Canada's sector-by-sector GHG regulations so far can provide a blueprint for designing flexibility in emerging oil and gas regulations. Federal regulations for light-duty vehicles and proposed regulations for heavy-duty vehicles set a performance standard. They enable compliance flexibility through credit transfers both within and between regulated entities. Alberta's SGER enables compliance flexibility with performance standards through multiple compliance pathways: trading between entities, LCDR purchases from unregulated emitters and a cost-safety value in the form of a technology fund. The SGER is a useful blueprint for new federal oil and gas regulations, but stringency will need to be increased in order to make a meaningful contribution to Canada's 2020 targets.

2. How important is compliance flexibility to the oil and gas sector?

Compliance flexibility for the oil and gas sector can significantly increase the cost-effectiveness of performance regulations in three ways.

First, in the absence of flexibility, the sector cannot achieve emissions reductions consistent with a 20 per cent improvement in emission intensity between now and 2020. Some firms simply cannot comply by 2020. By introducing in-sector flexibility, with transfers between regulated entities, a 20 per cent intensity standard is achievable. Expanding flexibility outside the sector increases the potential level of ambition, with a 50 per cent intensity improvement then achievable.

Second, compliance flexibility lowers costs by smoothing the significant heterogeneity in abatement potentials and costs. Our analysis suggests that a uniform performance standard with compliance flexibility significantly lowers costs relative to a rigid standard with no compliance flexibility. While, in theory, differentiated benchmarks could be set for groups in the sector, the time required to do so would likely limit the reductions possible prior to 2020. Such a process would be both analytically challenging and vulnerable to political lobbying.

Finally, a rapidly growing sector means absolute reductions are expensive, especially against a fixed baseline (i.e., 2005). While the emission reduction potential of the sector is large, reflecting its large share of national emissions, the cost of reductions is high. As a result, the oil and gas sector looks unlikely to be able to achieve reductions at levels consistent with Canada's 2020 target of 17 per cent below 2005 levels. The expected growth of the sector to 2020 dominates any improvements in emissions intensity as a result of policy. Cost containment mechanisms that provide in-sector and out-of-sector flexibility in complying with policy could reduce costs of compliance.

Based on our analysis and modelling, mechanisms for flexibility both within and beyond the sector could decrease costs, at least in our hypothetical scenarios, by 23 per cent relative to rigid regulations and increase emission reductions if compliance payments are used for LCDRs.

3. What flexibility mechanisms can be added to the oil and gas performance regulations to keep costs low while achieving emission reductions?

Multiple compliance options can deliver cost-effective emission reductions. First, allowing emission reduction transfers between emitters—similar to the mechanisms in the light- and heavy-duty vehicle regulations and the Alberta SGER—ensures that the lowest cost emissions reductions are achieved. Transfers, therefore, ensure consistency with our first principle for cost-effective regulation by allowing emitters with particularly high costs to purchase emissions reductions from other emitters with lower costs of abatement. This would not raise the level of ambition or produce reductions beyond compliance, but would lower average compliance costs.

Additional flexibility is likely required to further contain costs and increase policy ambition, especially at higher levels of reduction stringency. Without additional compliance options from outside the sector, emitters can only improve their emissions performance so much before reducing production is the last compliance option—something we see borne out in our modelling.

LCDRs are a viable out-of-sector compliance option. LCDRs as a compliance mechanism could build on the Alberta's operational SGER, but obviously equivalency provisions would need to be sorted out. Developing an LCDR system with the associated rules now would then create the architecture for additional flexibility, once other industrial sectors are targeted for regulations by the federal government.

A compliance mechanism like Alberta's option to purchase compliance credits at a fixed price ceiling could contain costs while seeking low-cost reductions outside the oil and gas sector. The Alberta SGER enables compliance payments into the technology fund. Compliance payments to a technology fund could lower longer-term technology costs, but in the short term would not be effective in contributing to Canada's 2020 target. Compliance payments could also be used to develop an LCDR purchasing facility that is governed by a private sector board or administered by the federal government. This facility would essentially shop for low-cost and verified reductions outside of the regulated emitters.

Flexibility could both reduce overall costs for compliance and increase the level of ambition as reductions are sought outside of the regulated oil and gas sector.

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