Survey Results: OBPS impacts on large emitters

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June 2025

Summary

Heavy industrial facilities say carbon markets (specifically output-based pricing systems) are working but could be far more effective. Provincial carbon markets are improving business and environmental performance for most heavy industries across Canada. This is the key finding from a new survey of 60 operators that participate in these carbon markets — also known as output-based pricing systems (OBPSs).

Responses also indicate several key areas where OBPS design could be improved. Market uncertainty is high and facilities have low confidence that carbon credit prices will be stable and predictable in the future.

Key takeaway #1: OBPS is working

Over half of facilities said OBPS improves their environmental performance.

Carbon pricing is having a positive impact at facilities and it is affecting their environmental decision-making. Many companies pledge environmental or emissions reduction targets regardless of carbon pricing regulations. However, carbon pricing helps contribute to advancing these targets, with 63% of respondents noted a positive impact from carbon pricing on emissions reductions on-site.

Most facilities say OBPS has a positive or no impact on their profitability, capital spend, and competitiveness.

Overall, most facilities said that OBPS has a positive or no impact on various aspects of their business performance. A majority of facilities said that OBPS has a positive impact on their process efficiency. Many said it has a positive impact on overall capital investments, no impact on their competitiveness, and positive or no impact on profitability.

Almost half of regulated facilities said OBPS has had a positive impact on their overall capital investments.

In fact, carbon pricing even as designed today helps attract domestic investments. Carbon pricing has contributed to most facilities' low-carbon investments, including energy efficiency measures (73% with a positive impact) and alternative energy sources (49% with a positive impact). Carbon pricing alone may not be the deciding factor for an investment, but it helps push the decision over the edge. One company noted that carbon pricing helps to elevate projects and initiatives by offering stronger financial paybacks.

This presents an opportunity for carbon pricing to play an increasingly important role in attracting domestic capital investments, in light of international competition and tariffs.

Half of facilities have a goal to stay below their emissions benchmarks.

Facilities are driven by the financial impact of carbon pricing. Carrots (the financial incentive for staying below emissions benchmarks and being able to sell credits back into the market) can be effective tools to incentivize emissions reductions and capital investments. However, sticks (the cost of emitting over a facility's allotted benchmark) are also powerful incentives. We can see this from almost 50% of facilities targeting reducing emissions intensity below their benchmarks to avoid the carbon price.

Key takeaway #2: OBPS could be much more effective

Only two in five facilities are confident that the carbon price will reach $170/tCO2e by 2030.

Business decision-makers cannot rely on carbon pricing over the long-term in their investment decisions. While we can see the short-term impacts of carbon pricing on environmental and business performance, companies are not confident in the long-term outlook for carbon prices. Uncertainty about the future of carbon pricing makes it harder for businesses to make decisions. One respondent said pointedly, "**Uncertainty is impacting long term investment.**"

Only 39% of facilities incorporate the future $170/tonne carbon price in long-term investment decisions, with a quarter incorporating a lower carbon price (i.e. current carbon price of $95/tCO2e). Evidently, decision-makers at facilities want to use carbon pricing as support to make capital investments, but the lack of regulatory stability within their decision-making gets in the way.

Different facilities are using different carbon prices in financial planning.

Facilities are uncertain on what price of carbon to incorporate into decision-making. Respondents are split almost equally between using the benchmark carbon price and the average carbon price within financial analysis of projects.

Less than half of facilities are using carbon pricing in financial analyses.

This is also largely attributed to a lack of confidence in the design or longevity of the programs. One respondent explained they weren't incorporating carbon pricing into their financial analysis because both the value of carbon credits and the timing to realize their value are too uncertain. The risk of a program being scaled back or scrapped creates political uncertainty. This makes it less worthwhile to factor potential benefits into investment planning, if facilities are not confident in achieving the required results.

Most facilities are holding onto their carbon credits.

Carbon pricing relies on a strong market signal to incentivize investments in emissions reductions. Facilities are able to reduce carbon costs through purchasing credits at a discount to the annual carbon price, while sellers are able to achieve a revenue stream for performing well under the program and selling credits.

But just37% of facilities generating credits are selling to other companies. Depending on the jurisdiction, facilities are unsure how to engage within the market, or they have insufficient market liquidity to make transactions. Further, only a quarter of facilities are retiring credits to reduce compliance costs.

Introduction

Large-emitter trading systems cover about 42% of Canada's emissions and are the single most impactful climate policy driving emissions reductions in Canada (Beugin et al., 2024; Sawyer, 2024). Batu and Rivers administered a first-of-its-kind survey to Canadian industrial facilities that participate in output-based pricing system (OBPS) carbon markets.

Carbon markets 101

Industrial carbon markets are regulatory systems that place a price on greenhouse gas emissions produced by large industrial facilities (oil and gas, steel and aluminum, cement, chemicals and fertilizers, pulp and paper, etc.).

With the exception of Quebec, which uses a cap-and-trade system, federal, provincial, and territorial governments in Canada use output-based pricing systems to price industrial emissions. Governments assign a performance benchmark to each facility that sets a maximum emissions intensity for its operations, in terms of emissions per unit of production (e.g. per barrel of oil or tonne of cement). Each facility therefore has a total emissions limit based on its total production output. These performance benchmarks typically fall every year, to provide facilities with an ongoing incentive to reduce their emissions. This method balances environmental and economic objectives and ensures that facilities do not automatically face higher costs for expanding production.

Facilities that beat their performance benchmarks generate credits, which have monetary value in the open market. Facilities that overshoot their benchmarks pay for their excess emissions and can do so in a number of ways, including buying credits from other facilities. For facilities considering large-scale decarbonization investments, credits can offer revenue streams that make projects financially viable. Different carbon markets allow for different types of credits, depending on the facility and the specific project.

Design and methodology

This research involved conducting a survey of industrial facilities operating under output-based pricing systems in various provinces and industrial sectors in Canada. The

questionnaire was designed to unveil how firm behaviour, decision-making, financial investment, and performance is influenced by OBPS.

The initial survey yielded 126 responses; respondents who did not complete any questions after question 8 (type of carbon pricing system) were omitted (20). In total, 106 facilities were included in the analysis. Of these, 60 facilities identified themselves as operating under OBPS. Twenty facilities identified themselves as operating under the full federal fuel charge. Nine facilities operated under Quebec's cap-and-trade system, and six were operating under B.C.'s provincial carbon tax at the time they responded to the survey.[1]

We evaluated the impact of OBPS on facilities' environmental and business performance, how the current OBPS carbon credit market is functioning, which price incentives industrial facilities are responding to in practice, and the degree to which OBPS performance benchmarks are integrated in financial analysis. Written surveys were prioritized over verbal surveys (i.e. interview or focus group). Glasgow's (2005) survey research methodology informed this survey design and the structure of this section.

The information collected in the study is cross-sectional, representing each facilities' experience under OBPS at a point in time. The study used a convergent parallel mixed-methods approach, collecting qualitative and quantitative data simultaneously to provide a comprehensive understanding of facilities' responses. Some closed-ended questions asked respondents to select yes/no (binary choice), and some asked respondents to select from multiple choices or a Likert scale, yielding quantitative results. Some open-ended questions asked for explanations in text, yielding qualitative results. Some questions were partially closed-ended and combined both approaches by adding "Other (please explain)" with a textbox field to multiple choice questions, yielding both quantitative and qualitative results.

[1] Five facilities indicated they were unsure of which carbon pricing system they are subject to, and six were unclear in their qualitative response and thus were uncategorizable.

Study sample characteristics

Table 1: Type of carbon pricing system of surveyed facilities				
Question 8: Which of the following describes your facility?	**# of responses**	**Label**	***Label assigned**	**Sample total**
Incomplete or redundant response (omitted)	20	/	/	/
My facility operates under a provincial carbon tax (B.C.)	6	"CTBC"	0	6
My facility operates under a provincial emissions trading system (QC)	9	"QCT"	0	9
My facility operates under an output-based pricing system (OBPS). It has a GHG emissions performance benchmark assigned by the government. If my facility emits more GHG than the performance benchmark, my facility must remit carbon credits to the government. If my facility emits less GHG than the benchmark, my facility is granted carbon credits that we can save or sell to another facility.	44	"OBPS"	16	60
My facility operates under the federal fuel charge (carbon tax). It must pay a fixed fee to the government for each unit of GHG produced. This covers all facilities who emit less than 10,000 tonnes of GHG annually, and those that have not opted in to OBPS.	16	"FFC"	4	20
Other (please explain)	23	*	/	/
Unsure	5	"UNSURE"	0	5
Blank	3	"UNCLEAR"	3	6
Grand Total	**126**		**23**	**106**

Data collection

The Greenhouse Gas Reporting Program (GHGRP) was identified as a source of contacts for industrial facilities and formed the basis of the distribution list. The GHGRP Facility Greenhouse Gas (GHG) Data includes facility-level emissions from 2004 to 2022 and lists a contact email for each facility. The dataset was accessed in February 2024. To capture employees likely to still be working with the listed company, data was filtered to only display data for companies that have reported since 2017. Filtering yielded a potential sample of 1575 contacts, though this included facilities under OBPS (the target sample) as well as facilities operating under other carbon pricing systems.

Surveys were created and hosted on SurveyMonkey and distributed to listed contact emails from May to December 2024, using a letter sent through a University of Ottawa email address. This letter contained a unique pre-generated survey link, specific to respondents' listed public contact email. Letters were sent to each potential respondent once, followed by two reminder emails in following months for non-responses. To mitigate the risk of the emails being automatically flagged or rejected by spam filters, a maximum of 60 emails were sent out per day. Of those contacted, 1147 total emails were sent for a final delivery rate of 71.73%. In total, this survey distribution yielded 126 responses, representing a survey response rate of 10.98% given the sample of 1147 contacts where the email was successfully delivered.

Because of these different thresholds for voluntary participation, not all facilities covered by provincial OBPS are captured in our GHGRP dataset. Therefore, the survey distribution list did not include all voluntary OBPS facilities covered by provincial systems. However, mandatory OBPS participants in Canada were captured in the GHGRP database, and all facilities that voluntarily participate from every province other than Alberta and Saskatchewan were also captured. These facilities represent Canada's largest industrial emitters, accounting for 42% of national emissions (ECCC, 2025c). The potential survey sample was therefore industrial firms with a public contact email for a designated

employee attached to their GHGRP emissions reports, and the study sample were those facilities who responded voluntarily to the survey.[2]

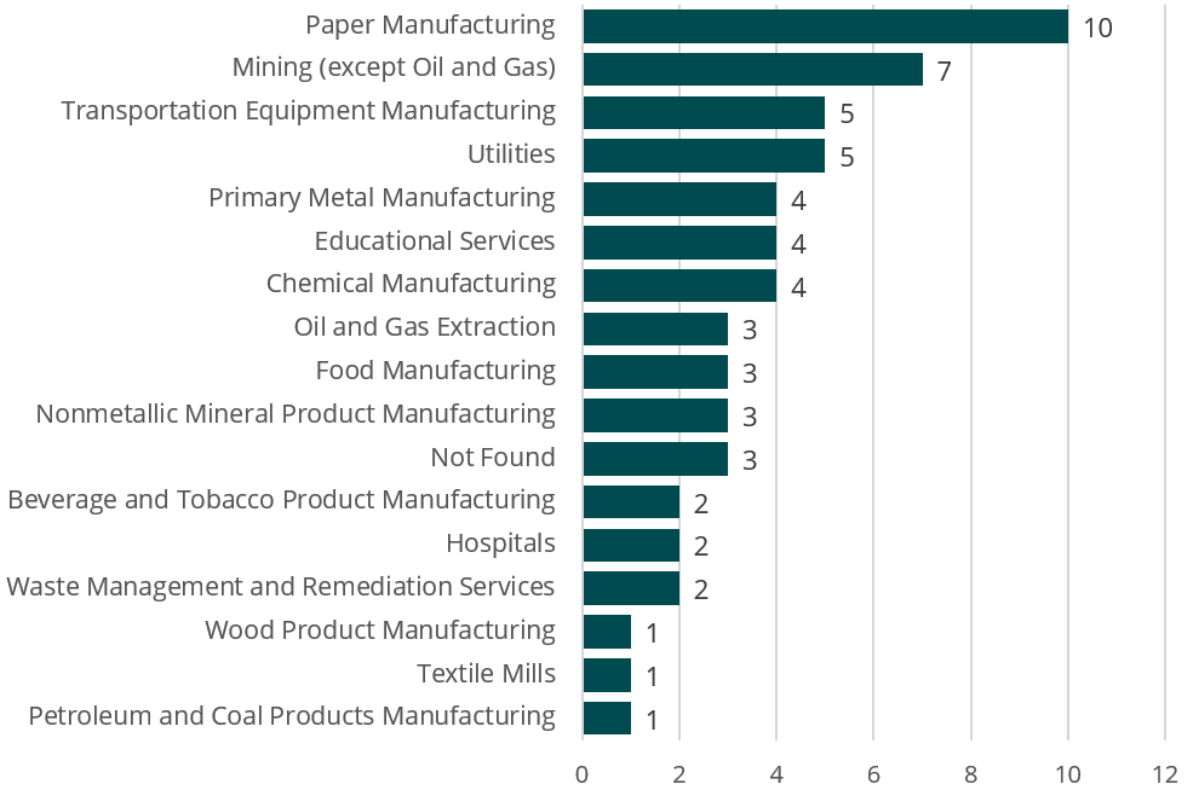
Different sections of the survey were preceded by brief explanations of key concepts. Survey questions used neutral language, and rating scales/multiple choice questions often offered "N/A" as an option for respondents with no strong feelings in either direction. To pilot the survey and test both the questionnaire itself and its method of distribution, two corporate executives working in large, Canadian companies were asked to complete and review the questionnaire. Their feedback was used to gauge their level of understanding of the subject material discussed in the survey, ensure the questions were properly worded for the audience (corporate decision-makers), and ensure the email letter was framed to encourage corporate executives to read the email and respond. After this piloting phase, the survey was sent over the following months to contacts in the distribution list.

From all 126 facilities who responded, we labeled 60 facilities as operating under OBPS (see Table 1). This is our subgroup. Our full sample size ("n") may not equal 60 due to incomplete survey responses. There are various reasons respondents did not complete the entire survey (time constraints, complexity, etc.), but their responses still provided relevant insights and were included. Following this sorting of the sample, the spreadsheet of collated results was disaggregated by question. Filtering responses by "OBPS" then enabled isolated analysis of OBPS facilities. The GHGRP Facility Greenhouse Gas Data also includes facility-level information for a number of useful metrics, including province of operation and industry of operation.

[2] Using the GHGRP database as the sole source of contacts for respondents does create potential issues, including outdated emails (e.g. retired employees). There was also risk that an unqualified employee would complete the survey on behalf of their facility. Respondents' objectivity and accurate representation of the facility's decision-making processes was not possible to assess. Glasow notes how survey respondents are themselves a source of measurement error/bias. Respondents may answer in a way they believe is desired by the interviewer or provide false responses to invalidate the survey's results (2005). The academic nature of this research as explicitly stated in the survey limited the chance of respondents responding strategically. Participation in the survey is voluntary and it is possible that nonresponse bias exists and/or that the sample of voluntary respondents are unique compared to the general population.

Results

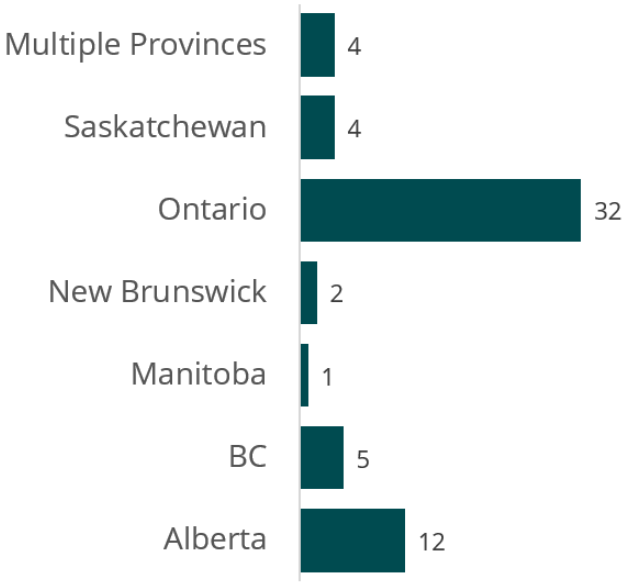
Figure 1: Industry of OBPS facilities surveyed (n=60)



The industry is derived by matching the respondents' public contact emails to publicly available data from the GHGRP associated with their facility.[3]

[3] The GHGRP data has a six-digit North American Industry Classification System (NAICS) code for each facility. Some public contact emails were associated with multiple facilities, operating in multiple industries. In these cases, all six-digit NAICS codes associated with the public contact email, across multiple facilities, were included. According to the NAICS, the first two digits of the code classifies facilities by sector, and the first three digits of the code classifies facilities by sub-sector. The first three digits of the NAICS codes were used to classify each facility by sub-sector, which was used to determine their industry.

Figure 2: Number of respondents by province (n=60)



To determine province of operation for each surveyed facility, we matched respondents' public contact emails from their unique survey link to publicly available data from the GHGRP. Some public contact emails associated with operations across multiple provinces, listed as "Multiple Provinces". These facilities were not included within their respective provinces to avoid double counting and skewing of any sub-analysis by province.[4]

Figure 3: How many full-time equivalent people are employed in the facility you are answering on behalf of? (n=60)

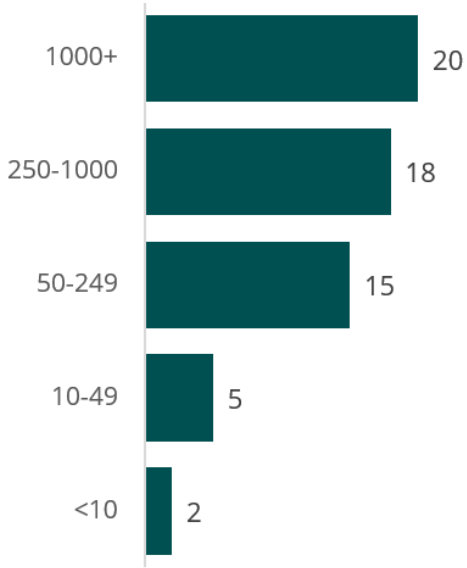
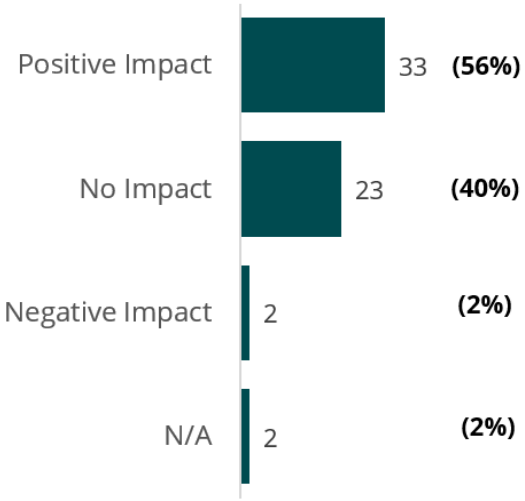


Figure 3 shows how many full-time equivalent people are employed in the OBPS facilities included in this analysis. The sample skews to larger facilities. This result was somewhat expected, given that OBPS targets emissions-intensive sectors and facilities, which are typically large, carbon-intensive operations. Most provinces have high emissions thresholds for OBPS participation (either voluntary or mandatory), capturing Canada's highest-emitting facilities.

[4]Facilities operating in Quebec were omitted from this analysis because the province uses cap-and-trade rather than OBPS (though the program does provide output-based allocations in some EITE sectors). Multiple Atlantic provinces are also not represented in this sample (NS, PEI, NL), as well as all Canadian territories. Six facilities from B.C. responded that they operate under a provincial carbon tax, despite the B.C. OBPS coming into effect in April 2024. As such, these six facilities were not included in the "OBPS" sample.

Figure 4: Impact of OBPS on facility environmental performance (n=59)[5]



Respondents were asked about the impact of OBPS participation on six areas of environmental performance:

1. achieving GHG emission reductions;
2. investment in alternative energy sources;
3. investment in energy efficiency measures;
4. electrification of machinery;
5. process efficiency; and
6. collaboration with suppliers to reduce emissions.

Respondents selected the impact of participating in OBPS on each of the six areas with the following options: 1) large negative impact; 2) small negative impact; 3) small positive impact; 4) large positive impact; 5) no impact; and 6) not applicable.

[5]The total across all bars may not sum to 59 due to rounding.

Table 2: Impact of OBPS on facility environmental performance				
n = 59	**Positive impact**	**No impact**	**Negative impact**	**N/a**
Investments in energy efficiency measures	**73%** (43)	**25%** (15)	**2%** (1)	0
Achieving GHG emission reductions	**63%** (37)	**31%** (18)	**7%** (4)	0
Process efficiency (environmental)	**71%** (42)	**29%** (17)	0	0
Investments in alternative energy sources	**49%** (29)	**46%** (27)	**2%** (1)	**3%** 2
Electrification of machinery	**46%** (27)	**46%** (27)	**3%** (2)	**5%** (3)
Collaboration with suppliers to reduce emissions	**34%** (20)	**61%** (36)	0	**5%** (3)
Aggregate impact	56%	40%	2%	2%

The results show that 56% of facilities reported that OBPS has a positive impact on their overall environmental performance, 40% reported no impact, and only 2% of facilities reported that OBPS has a negative impact on their environmental performance. The results also highlight some potential underlying issues with OBPS given that almost 40% of facilities reported that it has no impact on their environmental performance.

The strongest positive impacts on environmental performance are in investments in energy efficiency measures (73%), environmental process efficiency (71%), and achieving GHG emission reductions (63%). Of note, 'achieving GHG emission reductions' also had the largest reported negative impact from facilities, though it is small (7%). In two areas — electrification of machinery and investments in alternative energy sources — almost an equal number of facilities reported a positive impact or no impact. On investments in alternative energy sources, 46% reported no impact, which was still less than those who reported a positive impact in this area (49%). An equivalent percentage of facilities reported a positive impact and neutral impact on electrification of machinery (46%). When asked

about collaboration with suppliers to reduce emissions from OBPS, 61% of facilities reported no impact, while 34% reported a positive impact.

As reported directly by facilities, OBPS effectively drives emissions reductions and improves environmental performance. High percentages of facilities reported positive impacts on achieving GHG emission reductions (63%), process efficiency (71%), and energy efficiency investments (73%).[6] Less widespread effects on investments in alternative energy sources (49%) and electrification of machinery (46%) suggests facilities are prioritizing shorter-term efficiency improvements over capital-intensive, long-term decarbonization. Process and energy efficiency improvements are incremental and yield immediate cost savings, while alternative energy adoption and electrification require more substantial capital investments with a longer payback period. It is possible that uncertainty around industrial carbon pricing could be inhibiting the economic case for large mitigation investments for many OBPS facilities (Clark et al., 2022).

[6]This research does not attempt to cross-reference the results with actual facility emissions data to corroborate these claims. While facilities may perceive environmental performance improvements, this does not necessarily translate into actual, observable emissions reductions. However, the findings do provide important context directly from decision-makers at OBPS facilities that confirm broader research findings on the efficacy of OBPS, as has been widely examined through modelling work (i.e. Beugin et al., 2024).

Figure 5: Impact of OBPS on facility business performance (n=59)

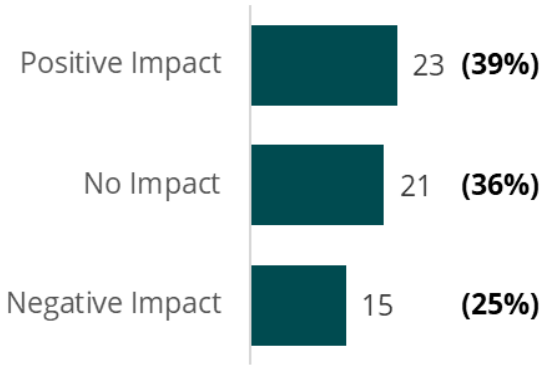


Figure 5 shows the reported impact of OBPS on business performance. Respondents were asked about OBPS's impact on four areas of business performance:

1. profitability;
2. overall capital investments;
3. process efficiency; and
4. competitiveness.

They were asked to select the impact that participating in OBPS has had on each of the four areas with the following options: 1) small negative impact, 2) large negative impact, 3) small positive impact, 4) large positive impact, 5) no impact, and 6) not applicable. The results from all four questions were aggregated to derive these results, and the small/large impacts were combined for ease of comparison.

Table 3: Impact of OBPS on facility business performance

n = 59	**Positive impact**	**No impact**	**Negative impact**
Profitability	**32%** (19)	**25%** (15)	**42%** (25)
Overall capital investments	**46%** (27)	**37%** (22)	**17%** (10)
Process efficiency	**51%** (30)	**37%** (22)	**12%** (7)
Competitiveness	**29%** (17)	**44%** (26)	**27%** (16)
Aggregate impact	**39%**	**36%**	**25%**

*** percentages may not add to 100% due to rounding*

Table 3 breaks down the results in Figure 5, showing the aggregated responses to each sub-question. **Over three quarters of facilities reported a positive or neutral impact on business performance.** The strongest positive impacts on business performance are in process efficiency (51%) and overall capital investments (46%), while 37% of facilities reported no impact on both areas. These two areas had the lowest rate of reported negative impact, with 12% for process efficiency and 17% for overall capital investments. When assessing profitability, 32% indicated OBPS has a positive impact, 25% reported no impact, and 42% a negative impact. This is the highest negative result across all areas. When assessing competitiveness, 44% of facilities reported no impact and 29% of facilities reported a positive impact, while 27% reported a negative impact.

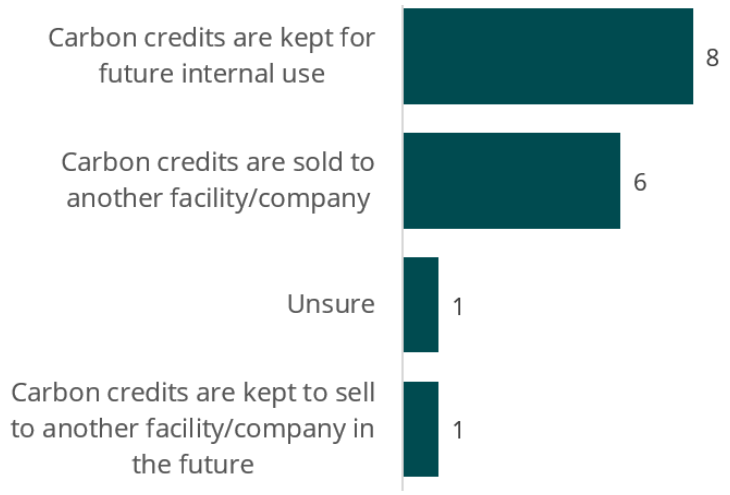
Most facilities report either a neutral or positive impact on their competitiveness (73%) and overall business performance (75%). The findings indicate that OBPS has encouraged process efficiency, low-carbon innovation, and low-carbon investments that have led to improved business performance. This supports the notion that well-designed carbon pricing systems can drive efficiency gains and low-carbon investments without unduly harming economic performance (Beugin, 2019; Dion, 2017; Turcotte et al., 2019).

Some facilities have mitigated the costs of OBPS and actually benefit financially from participating. However, 42% of facilities reported a negative impact on profitability.

Carbon market dynamics

Figure 6 shows how OBPS facilities manage their allotted carbon credits when their emissions are below their annual limit, as determined by their emission intensity in relation to their performance standard. When facilities' emissions are below their annual limit, firms receive carbon credits, which they can then sell, or keep for future internal use.

Figure 6: Management of additional carbon credits for overperforming OBPS facilities (n=16)



This question also asked whether facilities are keeping the carbon credits to sell to another facility/company in the future, to reveal how many companies are strategically holding on to carbon credits to sell in future years, when the benchmark carbon price rises. Firms can hold carbon credits for up to five years in most programs before they expire and can no longer be used for compliance (expiry rules vary by program).

Figure 7: Carbon credit compliance for underperforming OBPS facilities (i.e. facilities operating above the benchmark) (n = 34)

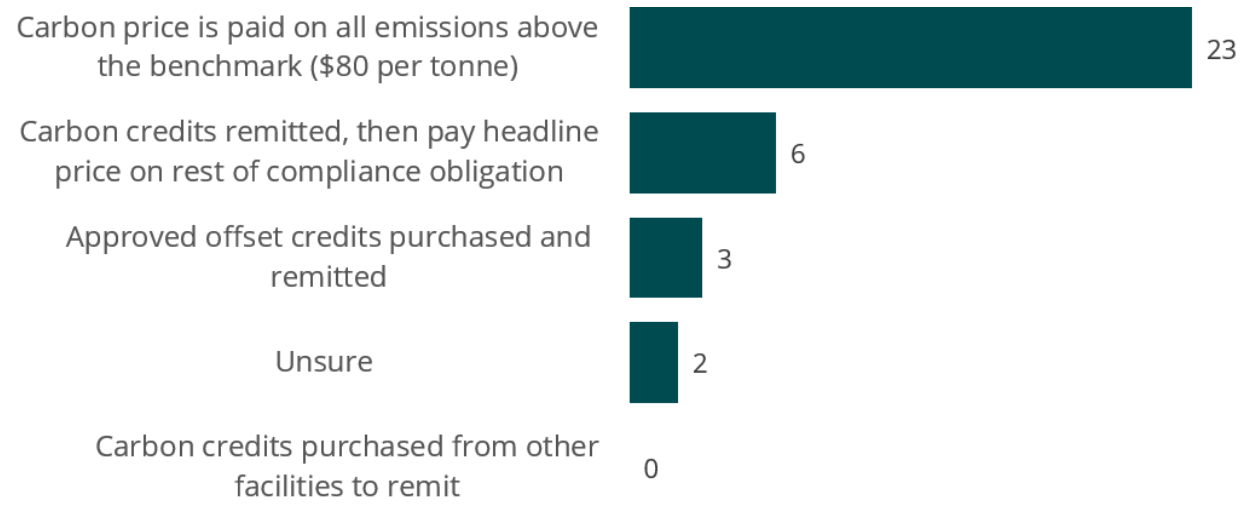


Figure 7 shows how OBPS facilities addressed their compliance obligation when their emissions are above their annual limit, as determined by their emissions intensity standard. When facilities' emissions are above their annual limit, they have up to four

options to meet with their compliance obligation: 1) they can pay the headline carbon price on all emissions above the benchmark ($95/tonne as of April 1, 2025); 2) they can purchase carbon credits from other facilities regulated under the same program and remit them to the government; 3) they can remit carbon credits saved from previous years; or 4) they can purchase preapproved carbon offset credits and remit these to the government (where applicable across OBPSs).

Figure 6 shows that half of facilities allotted carbon credits (50%) are holding them for future remittance, while 37.5% of facilities sold their allotted carbon credits on the trading market. A further 6.3% of facilities indicated that they keep the carbon credits to sell to other facilities/companies in the future, and another 6.3% of facilities indicated that they are unsure of how to manage their carbon credits. Within the total sample, only 29.6% of facilities reported that they typically emit less than their annual limit, which means that less than a third of sampled facilities have the ability to sell credits on the trading market.

As Figure 7 shows, the majority of OBPS facilities owing a compliance obligation (67.6%) chose to meet their obligation by paying the headline price, rather than redeeming carbon credits. Over a third of facilities (37.5%) sell their excess carbon credits (Figure 6), the results show that functional trading markets do exist, with many facilities participating in credit trading. Only 17.6% of facilities indicate that they complied by remitting carbon credits. A further 8.8% of facilities indicated that they purchased approved carbon offset credits to remit, and 5.9% of facilities were unsure of how they met their compliance obligation.

These findings offer insight into how OBPS facilities engage in Canadian carbon credit markets and manage their credits. The finding that half of facilities are banking surplus credits for future internal use suggests there is a preference among facilities for future risk management and longer-term planning, rather than immediate financial gains from selling credits. Facilities appear to mostly be risk averse in managing their credits, so as to meet any future compliance needs. This may also reflect expectations of rising carbon prices,

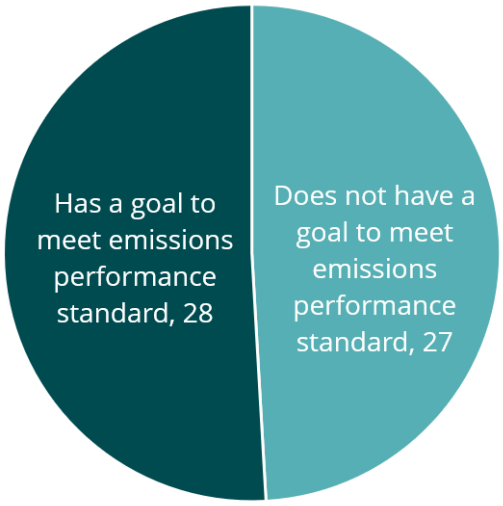
which would make banking credits an attractive option compared to selling them, however, only 6.3% of facilities indicated that they are banking credits to sell in the future.

The finding that just over two thirds of facilities with emissions above their annual limit solely pay the benchmark carbon price suggests that this compliance method is the most straightforward strategy. The value of tradable carbon credits may be lower than the benchmark carbon price, as is the case with Alberta's Technology Innovation and Emissions Reduction (TIER) credits, which trade at ~$30/tonne (as of December 2024) (Sawyer et al., 2024). This would mean that facilities have a financial incentive to pursue these credits ahead of paying the national minimum carbon price ($95/tonne as of April 2025). However, this compliance behaviour suggests there may be hidden transaction costs due to the bilateral nature of carbon credit trading. Facilities participating in these disaggregated credit markets must bilaterally negotiate and purchase carbon credits. In this system, there are likely administrative complexities and transaction costs for firms, as employees must use their paid time to handle these transactions. The low percentage of facilities purchasing carbon offset credits (8.8%) further reinforces these concerns. This trend is also likely exacerbated by the varying eligibility or availability of offset credits across different OBPSs. While the system overall appears to facilitate some credit purchasing for facilities (17.6% purchased credits), the intended flexibility and financial incentives of credit trading may not be fully realized.

Price incentives and incorporation of performance standards under OBPS

Figure 8 shows the portion of OBPS facilities that have a goal to keep emissions below the performance benchmark — the emissions intensity standard set for their facility — and that direct investments towards meeting this goal. Of the 55 facilities who answered this question, 49% (27) stated that they did not have a goal to keep emission intensity below the benchmark, and 51% (28) stated that they did.

Figure 8: Facilities With a goal to meet their emission performance standard (n=55)



The results highlight a split in strategic approaches towards emissions performance benchmarks. Firm compliance behaviour is quite divided, with roughly half of facilities displaying a proactive investment strategy to meet their performance standard. Just under half of facilities appear to be connecting their investment decisions to their emissions performance standard.

Economic theory would not suggest this outcome (Dion, 2017; ECCC, 2021; Leach, 2012; Sawyer & Steibert, 2017). If many facilities are actively integrating the performance standard into their strategic decision-making, they may not be balancing marginal costs against marginal benefits as expected of a profit-maximizing firm. Based on these results, many OBPS facilities appear to be planning and evaluating their longer-term investments to align with OBPS emission performance standards. A number of facilities showed a high degree of sophistication in their qualitative responses surrounding emission intensity standards, with two directly linking their short-term annual GHG emissions target to their emissions performance standard. Therefore, facilities are not ignoring their emissions performance standards; in fact, many are optimizing around it.

Figure 9: Carbon price used by OBPS facilities in important financial decisions on new projects (n=56)

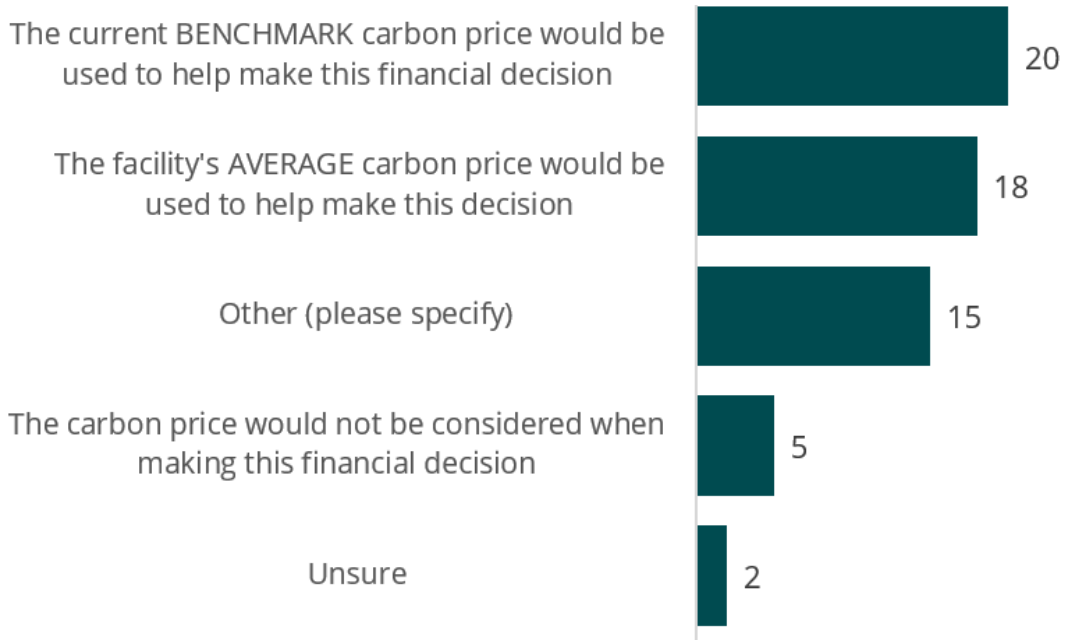


Figure 9 shows which carbon price surveyed facilities use when making important financial decisions, such as whether to pursue a new project that alters its emissions profile. The benchmark price of carbon is the marginal price signal facing OBPS firms, which is the national minimum carbon price ($95/tonne as of April 2025). This is the potential value of a carbon credit, or the opportunity cost for a facility emitting one tonne of carbon. This holds because if facilities were to mitigate those emissions and receive a credit instead, it could be sold at this price (Dion, 2017; Sawyer & Steibert, 2017). The average price is the total amount of payments for excess emission credits, divided by total facility emissions in tonnes. For OBPS facilities, the average price is not equal to the marginal price of carbon since a large proportion of output is effectively subsidized with free allocation of credits.

The results show that many OBPS facilities (35.7%) are using the benchmark price of carbon when making financial decisions. These facilities are responding to signals at the margin, as predicted by economic theory (Dion, 2017; ECCC, 2021; Leach, 2012; Sawyer & Steibert, 2017). However, almost a third of facilities (30.4%) use their average cost of carbon instead.

While many facilities do respond to the marginal price signal as expected, 58.9% incorporate another price or no price at all.

For facilities that do not factor in pricing at all, decision-makers may be viewing carbon pricing as a fixed compliance or regulatory cost, rather than a dynamic factor in investments and decision-making. Market distortions such as an oversupply of credits or low credit demand in trading markets are possible explanations for the marginal price incentive not holding (Beugin, 2019). If the value of tradable credits is too low, there is also a lower incentive for firms to reduce emissions beyond the benchmark, regardless of the benchmark price (Beugin, 2019). Lack of awareness of these incentives under OBPS among facility decision-makers, or a lack of capacity to effectively integrate these signals into financial analysis and investment decisions are other possibilities.

Uncertainty and confidence in long-term carbon pricing

Figure 10: **Facilities' confidence in the long-term benchmark carbon price (n=51)**

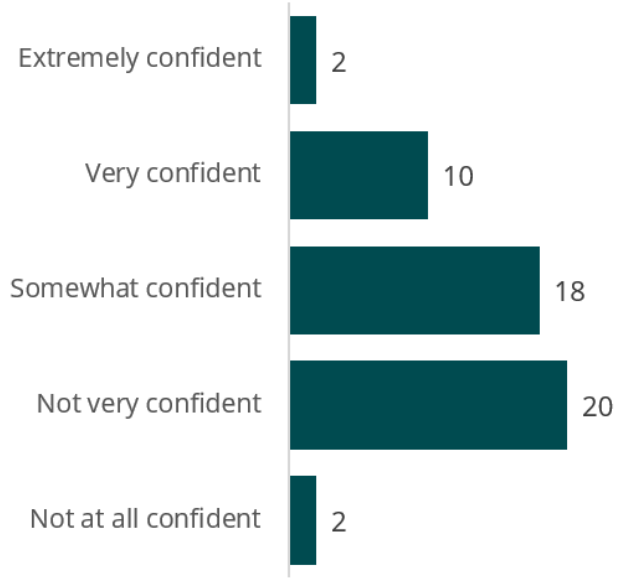


Figure 10 shows the reported confidence of OBPS facility respondents that the benchmark carbon price — or the national minimum carbon price — will reach $170/tonne by 2030. There was low confidence among surveyed OBPS facilities that the carbon price would rise over time, as currently scheduled. While this question asked respondents to report the confidence of decision-makers at their facility, personal bias may influence respondents' answers due to the nature of this question. Furthermore, these responses are snapshots that reflect their

environment at the time of answering (either federally, or in their province of operation), which changed throughout the survey collection period.

Overall, a combined 41.2% of facilities did not have confidence in long-term carbon pricing trajectories, 35.3% somewhat had confidence, and only 23.5% had confidence. This highlights a significant challenge in the effectiveness of OBPS, as low confidence in long-term price stability has direct implications for investment decisions and the functioning of carbon credit markets.

Uncertainty and low confidence can deter long-term investment in low-carbon technologies, as firms may not want to allocate capital towards emissions reductions if they suspect future governments may weaken or repeal carbon pricing policies (Clark et al., 2022; Richstein & Neuhoff, 2022). Even among facilities somewhat confident in long-term carbon pricing (35.3%), there is still a degree of uncertainty that could influence strategic decision-making and investment decisions. This could partly explain why facilities appear to be favouring shorter-term efficiency improvements over longer-term capital investments in clean technologies and deep decarbonization (Richstein & Neuhoff, 2022). If facilities cannot reasonably expect their investment will yield returns via avoided compliance costs or credit sales, there is a weaker incentive to invest in these larger-scale, longer-term decarbonization projects (Clark et al., 2022).

Conclusion

Modeling studies suggest that OBPS currently reduces emissions more than any other climate policy in Canada. By collecting responses directly from Canadian industry, this survey analyzed how OBPS participation impacts environmental and business performance of participating firms, and how it influences decision-making, financial analysis, and carbon management strategy.

This paper presents important findings that provide conceptual support for the system while also highlighting areas for improvement. OBPS is effective in driving improved

environmental performance, with a strong majority of facilities reporting positive impacts on GHG emission reductions, energy efficiency investments, and process efficiency. While it appears that most facilities are pursuing shorter-term efficiency improvements over longer-term decarbonization investments, the findings indicate that OBPS is driving tangible progress in facility environmental management, as reported directly by facilities.

Annex A: Output-Based Pricing Systems across Canada							
Jurisdiction	**Voluntary participation threshold**	**Mandatory participation threshold**	**Estimated # of facilities**	**Nature of standard**	**Annual benchmark tightening rate**	**Covered emissions (% MtCO2e)**	**Source**
Federal OBPS (Manitoba, Nunavut, PEI, Yukon)	**≥ 10,000 tCO2e/yr** *(designated sectors/activities)*	**≥ 50,000 tCO2e/yr** *(designated sectors/activities)*	**37 facilities** *(2023)*	Mostly sector-based	**1%**: *very high-risk EITE sectors* **2%**: *all other*	**8%** *(as of 2021)* **56.5 MtCO2e**	ICAP
British Columbia OBPS	**No threshold** *(regulated products)*	**≥ 10,000 tCO2e/yr** *(certain regulated industrial products)*	N/A	Mostly sector-based	**0%**: *industrial process emissions for all sectors* **1%**: *all other*	N/A	ICAP, (Government of British Columbia, 2025)
Alberta TIER *(Technology Innovation and Emissions Reduction Regulation)*	**≥ 2,000 tCO2e/yr*** *(EITE sectors)* **or aggregated facilities with 2 or more small conventional oil and gas facilities*	**≥ 100,000 tCO2e/yr*** *(no sector req)* ** or imported > 10,000 tonnes hydrogen*	**455 facilities** *(2022)*	Mostly facility-based (some sectoral)	**0%**: *industrial process emissions* **2%**: *facility-specific or sector-specific benchmarks* **4%**: *oil sands mining, in situ and upgrading (2029 and 2030)*	**59%** *(as of 2022)* **160 MtCO2e** *(as of 2022)*	ICAP, (Cui, 2025)
Saskatchewan OBPS	**No threshold** *(in designated or demonstrable EITE sectors)*	**≥ 25,000 tCO2e/yr** *(industrial facilities)* **≥ 10,000 tCO2e/yr** *(electricity facilities)*	**166 facilities** *(2023)*	Facility-based other than electricity	**1.67%**: *oil and gas sector* **1.25%**: *all other*	**38%** *(as of 2023)* **28.9 MtCO2e**	ICAP, (Cui, 2025)
Ontario EPS *(Emissions Performance Standard)*	**≥ 10,000 tCO2e/yr** *(designated sectors/activities)*	**≥ 50,000 tCO2e/yr** *(designated sectors/activities)*	**216 facilities** *(as of 2023)*	Mostly sector-based	**2.4%**: *2023 relative to 2022* **1.5%**: *2024-2030*	**26%** *(as of 2020)* **38.6 MtCO2e**	ICAP, (Cui, 2025), (MECP, 2024)
Nova Scotia OBPS	**≥ 10,000 tCO2e/yr** *(industrial facilities)*	**≥ 50,000 tCO2e/yr** *(industrial facilities)*	**15 facilities** *(2023)*	Facility-based other than electricity	**0%**: *industrial process emissions* **1%**: *EITE products* **1.5%**: *all other*	**36%** *(as of 2023)* **5.3 MtCO2e**	ICAP, (Cui, 2025)

Newfoundland Labrador PSS *(Performance Standard System)*	**≥ 15,000 tCO2e/yr** *(industrial facilities)*	**≥ 25,000 tCO2e/yr** *(industrial facilities)*	**15 facilities** *(2022)*	Mostly facility-based	**0%**: *industrial process emissions* **2%**: *all other emissions*	**36%** *(as of 2022)* **3.1 MtCO2e**	ICAP, (Cui, 2025)
New Brunswick OBPS	**≥ 10,000 tCO2e/yr** *(industrial facilities)*	**≥ 50,000 tCO2e/yr** *(industrial facilities)*	**15 facilities** *(2023)*	Facility-based other than electricity	**0%**: *industrial process emissions* **1%**: *all other emissions*	**54%** *(as of 2022)* **6.2 MtCO2e**	ICAP

*** The Northwest Territories does not have an OBPS in place (ECCC, n.d.). Quebec has a cap-and-trade system in place which does allocate some free credits to vulnerable sectors but differs from OBPS (ECCC, n.d.).*

Annex B: Research summary

OBPS is designed to limit adverse impacts on industrial competitiveness and reduce risk of carbon leakage (Dobson et al., 2017; Sawyer & Steibert, 2017). These design features ensure that OBPS can drive emissions reductions and steer firms towards enhanced environmental performance without significant costs. There is evidence showing that stronger environmental performance can also improve some areas of economic performance; OBPS is designed to promote this by pricing emissions based on emission intensity of output (Gonzales-Benito & Gonzalez-Benito, 2005).

While the theoretical underpinning of OBPS says that firms face a marginal price incentive equal to the benchmark/market price of carbon, it is still unclear whether this is informing important financial decisions in the real world. Furthermore, it has not been tested whether Canadian facilities consider the emission intensity standard in their strategic decision-making.

Economic theory contained in both academic and grey literature shows that output-based carbon pricing can effectively reduce emissions. Modelling has provided empirical evidence to support this in the Canadian setting. Most provinces in Canada have their own OBPS in place for industrial emitters, which are similar in design to the federal OBPS, but differ in

stringency and regulatory design (ECCC, n.d.). Annex B provides an overview of all OBPSs across Canada, including their thresholds for participation and the number of facilities covered.

Under OBPS, the cost of carbon pricing is determined by facilities' emission intensity of production (emissions per unit of output) in relation to an emissions intensity performance standard. There are two types of standards: sector-specific standards, set as a percentage of the average emissions intensity for a sector; and facility-based standards, set as a percentage of a facility's historical emission intensity (Turcotte et al., 2019). The performance standard is used to determine a facility's annual emissions limit, calculated by multiplying the standard by facility output. OBPS facilities receive free carbon credits for emissions up to the annual limit and then face a compliance obligation for the portion of emissions above the limit. To meet the compliance obligation, they can: 1) pay the national minimum carbon price on those emissions (equal to the benchmark price of carbon); 2) remit carbon credits saved from previous years; 3) remit carbon credits purchased from other facilities; or 4) remit pre-approved carbon offset credits. Conversely, when facility emissions are below this limit, facilities are allotted carbon credits that they can then: 1) save to use for compliance in future years; or 2) sell to other facilities (PBO, 2020). By definition, output-based allocations scale with output, so as firms increase or decrease their production, they receive more or fewer allocations of credits in the following year (ECCC, 2021).

Many Canadian companies compete with companies that operate in jurisdictions without carbon pricing. Because of this unequal playing field, companies subject to full carbon pricing under the federal fuel charge would be put at a competitive disadvantage compared to those who are not subject to carbon pricing without additional action (Dobson et al., 2017; Haites et al., 2018). This impact on competitiveness can result in a loss of market share or could incentivize companies to shift production to other jurisdictions with lower environmental standards (Dobson et al., 2017; Sawyer & Steibert, 2017). This phenomenon is known as carbon leakage, which results in lost domestic economic activity and hampered

global emission reductions (Bohringer et al., 2017; Dobson et al., 2017; Sawyer & Steibert, 2017). To mitigate these effects and protect firm competitiveness, output-based pricing gives additional support to emissions-intensive, trade-exposed (EITE) facilities by reducing the cost of compliance, as facilities must only remit carbon credits for a portion of emissions (Beugin, 2019; Beugin et al., 2024; Bohringer et al., 2017; Branger & Sato, 2017; Sawyer & Steibert, 2017).

Carbon pricing has a strong theoretical and applied backing, with many economists holding that market-based approaches are the most cost-effective and economically efficient way to reduce carbon emissions (Dobson et al., 2017; Elgie and McClay, 2013, Jaccard & Rivers, 2008). A recent meta-analysis of carbon pricing efficacy ex-post across 21 carbon pricing schemes found that 17 of these carbon pricing policies yielded immediate and substantial emission reductions (Dobbeling-Hildebrandt et al., 2024). This ranged from -5% to -21% across the cap-and-trade and carbon tax schemes, even despite low carbon prices (Dobbeling-Hildebrandt et al., 2024). British Columbia's carbon tax was shown to have reduced emissions by between 5-15% nine years after its implementation and had low impact overall on economic performance (Murray and Rivers, 2015).

Holland (2012) determined that, when confronted with the potential for carbon leakage, output-based pricing is advantageous compared to a carbon tax and cap-and-trade, and can be considered the first-best policy when combined with a consumption tax (2012). Empirical analysis of Alberta's Specified Gas Emitters Regulation (SGER), a precursor to its current OBPS (TIER), showed that it "provided identical incentives to reduce emissions intensity, weaker incentives to reduce emissions through reductions in output, and stronger incentives to improve productivity" for existing facilities, compared to full carbon pricing (Leach, 2012).

Modelling by 440 Megatonnes found that large-emitter trading systems (LETS) — including the federal OBPS, provincial/territorial OBPSs, and Quebec's cap-and-trade system — will contribute the most to reducing national emissions across all climate policies in Canada

(Beugin et al., 2024). Compared to a carbon price on all emissions, OBPS produces a lower overall cost burden from carbon pricing due to the implicit subsidization of output through free output-based allocations (Branger & Sato, 2017; Fischer and Fox, 2012). The stringency of OBPS performance standards — reflecting the level of free emission allocation — impacts both the costs incurred by facilities and, potentially, emissions reductions (Arjmand et al., 2024; Beugin, 2019).

Because facilities receive free credits for a large portion of emissions under OBPS, the average cost that facilities pay across all emissions is relatively low. With covered firms only needing to remit credits when their emissions exceed their annual limit, this lower cost burden also results in fewer costs being passed downstream to consumers in higher prices of goods, which weakens the demand substitution effect (Branger & Sato, 2017; Fischer & Fox, 2012, Sawyer & Steibert, 2017).

Despite lower average costs from the policy, there is still a marginal price incentive equal to the market price of carbon that incents emission reductions for OBPS facilities (Dion, 2017; ECCC, 2021; Leach, 2012; Sawyer & Steibert, 2017). This holds for two reasons. First, for every tonne of emissions exceeding their annual limit, facilities need to remit purchased carbon credits or pay the national minimum carbon price. To avoid this cost, firms can reduce emissions until they fall below their annual limit. Second, for firms that reduce emissions below their annual limit, the marginal price incentive remains because each credit still holds value and can be sold to other firms, or can be banked by the facility for future compliance use (Dion, 2017; Sawyer & Steibert, 2017). Therefore, each carbon credit has an opportunity cost equal to this market value; the benefit that is foregone if facilities choose not to reduce their emissions.A profit-maximizing firm would then be expected to reduce emissions until the marginal abatement cost — the cost of abating one unit of emissions — reaches the marginal price of carbon (Dion, 2017; Sawyer & Steibert, 2017). In practice, however, it is possible that firms are not responding to this marginal price incentive and are instead making decisions based on their average costs, which under OBPS, is not aligned with the marginal price. Currently, it is unclear whether facilities are

actually valuing credits using the marginal (market) price of carbon and using this to make decisions at the margin. Market distortions, such as an oversupply of credits or low credit demand in trading markets, can lower the value of credits relative to the national minimum carbon price, which could result in firms not responding to this marginal carbon price signal (Beugin, 2019).

There are several dimensions to consider concerning the economic efficiency of carbon taxes, including price stability, a credible price signal, and harmonization across jurisdictions (Haites et al., 2018). Almost all actions by companies or facilities to reduce emissions involve capital investments, such as investing in more energy efficient machinery or in alternative energy sources (Haites et al., 2018). A credible and stable price signal facilitates these investment decisions, as companies can project future costs and benefits from their investments in carbon abatement and can better evaluate all of their potential abatement options (Haites et al., 2018). If firms anticipate that carbon pricing will be lowered or removed in the future, they will choose the most flexible compliance strategies and may choose to reduce their output to abate emissions (Hanoteau and Talbot, 2019). By doing this, facilities would be avoiding sunk costs in capital-intensive equipment that support decarbonization with an uncertain return on investment, driven by carbon cost reduction (Hanoteau and Talbot, 2019).

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Research Ethics Disclaimer

Before conducting this research and distributing surveys, the University of Ottawa Office of Research Ethics and Integrity was consulted to determine whether this study would require review by the Research Ethics Board (REB). The Director of the Office confirmed that this study would not require an ethics approval after reviewing the survey instrument and research questions, since it does not fall under the scope of research as indicated in Article 2.1 of the TCPS2. A formal letter granting exemption from REB review was issued by the Director on March 5th, 2024.