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August 1, 2019

Too TIER-ed? Alberta's Proposed Re-design of Carbon Pricing for Large Emitters

By Grant Bishop

To: **Jason Nixon, Minister of Alberta Environment and Parks**

Re: **Alberta will reduce comparative advantage of lower emissions facilities with proposed facility-specific carbon pricing benchmark under TIER**

The following reflects the submission by Grant Bishop (Associate Director, Research) on behalf of the C.D. Howe Institute in response to the Alberta government's consultation process on its proposed TIER program. This document is intended to provide insight for the government based on previous and ongoing policy research. However, owing to the timelines for this consultation, this submission has not undergone the Institute's formal doubled-blinded external review process. Nonetheless, the author has benefited from various discussions with and comments by reviewers of earlier drafts.

Background

Alberta's government proposes to replace the current Carbon Competitiveness Incentive Regulation for output-based carbon pricing of large emitters on January 1, 2020. Under the proposed Technology Innovation and Emissions Reduction (TIER) system, facilities that emit more than 100,000 tonnes of carbon dioxide would have to reduce their emissions intensity by 10% compared to their average emissions between 2016 and 2018. The reduction requirement would increase by 1% per year, starting in 2021.

Under the government's proposal, facilities would have the following options to meet the requirements of TIER:

- reduce their emissions;
- use credits from facilities that have met and exceeded their emission reduction targets;
- use emissions offsets from organizations that are not regulated by TIER, but have voluntarily reduced their emissions; or
- pay into a TIER Fund.

The government proposes that the TIER Fund would be used for new and cleaner Alberta-based technologies that reduce emissions, like improved oilsands extraction methods and research and investment in carbon capture, utilization and storage. The government also proposes to use these funds to reduce Alberta's deficit and support the province's "energy war room".

TIER also proposes that electricity facilities meet a good-as-best gas standard, where their emissions are equal to the natural gas-fired generation plant with the lowest emissions intensity.

Overview of submission[1]

On July 9th, Alberta's government opened consultations on its proposed Technology Innovation and Emissions Reduction (TIER) program, intended to replace the previous government's Carbon Competitiveness Incentive Regulation (CCIR) for large greenhouse gas (GHG) emitters (above 100,000 tonnes of CO_2 equivalent emissions annually).[2]

Based on details of the proposal communicated by the government, the TIER would retain a $30 per tonne carbon price[3] for 2020 as a marginal incentive for any facility to reduce its own GHG emissions intensity – that is, a facility's GHG emissions per unit of production. However, the proposed facility-specific benchmark under TIER means that any facility that did not reduce its emissions intensity would face average carbon costs of $3 per GHG tonne in 2020, regardless of the level of its emission intensity. Relative to the product-specific benchmark under CCIR, the proposed approach under TIER risks distorting production within any sector towards more GHG emission intensive producers.

Even if Alberta establishes a facility-specific benchmark under TIER for production from existing facilities, a product-specific benchmark should apply to any new facility or expanded production capacity from an existing facility. If a facility-specific benchmark applies to expanded production, TIER would bias production growth towards expansion of capacity by facilities with higher emission intensity.

Importantly, imposing facility-specific benchmarks for all facilities under TIER would remove the advantage for producers that have already achieved less emissions-intensive production. Even if TIER allows for facility-specific benchmarks, existing facilities should be able to opt into a product-specific benchmark in order to maintain a relative advantage. Allowing opt-in to a product-specific benchmark would ensure that existing facilities with emission intensity below that benchmark face relatively lower average carbon costs per tonne than facilities above the benchmark.

In theory, providing a default facility-specific benchmark but allowing opt-in to a product-specific benchmark could generate an over-supply of GHG credits and consequently erode the value of credits. However, based on approximate calculations (detailed in the Appendix), such an oversupply is unlikely since any near-term GHG credit surpluses from non-electricity sectors are likely to be absorbed by a comparatively large GHG credit deficit in Alberta's electricity sector.

1 This submission is provided in response to the Alberta government's consultation process on its proposed TIER program. This document is intended to provide insight for the government based on previous and ongoing policy research. However, owing to the timelines for this consultation, this submission has not been undergone the Institute's formal external review process. Nonetheless, the author has benefited from comments from various discussions and comments from reviewers of earlier drafts. The C.D. Howe Institute would be pleased to further engage with Alberta's government on this important topic.

2 Alberta Environment and Parks. 2019. *Alberta's proposed Technology Innovation and Emissions Reduction system: discussion document*. Available online: https://www.alberta.ca/technology-innovation-and-emissions-reduction-engagement.aspx.

3 This submission distinguishes between the "marginal carbon price per tonne" and the "average carbon costs per tonne" faced by a facility. This distinction is critical for the economics of an output-based pricing system in which a facility receives credits for emissions based on its units of output, resulting in a divergence of the marginal carbon price from average carbon costs. Therefore, a facility faces a marginal incentive to reduce its emission intensity equal to the marginal carbon price per tonne. However, the relevant consideration for a facility's decision about how much output and emissions to produce is the facility's average carbon costs per tonne. This is elaborated by the following sections of this submission.

Finally, it is important to note that, relative to a product-specific benchmark, a facility-specific benchmark would not distort a producer's incentive to improve emissions intensity of an individual facility. Although a facility's average carbon costs per unit output is the relevant consideration for how much to produce from a facility, the marginal carbon price per GHG tonne is the relevant consideration for the decision of whether to improve a facility's emission intensity. As well, if existing facilities already optimize production to minimize emission intensity, replacing the product-specific benchmark under CCIR with a facility-specific benchmark under TIER should not impact an existing facility's level of output and emissions.

Rationale for "One Product, One Benchmark" Output-based Carbon Pricing

The CCIR followed from the recommendations of Alberta's Climate Change Advisory Panel[4] and implemented output-based carbon pricing for large emitters with a uniform product-specific emission intensity benchmark. The CCIR replaced the earlier Specified Gas Emitter Regulation (SGER), under which a facility faced a GHG emissions reduction requirement based on its own historical emissions. Output-based carbon pricing attempts to address competitiveness concerns for trade-exposed, emissions intensive sectors: domestic production in trade-exposed sectors may be displaced by "leakage" to competing foreign countries that have not imposed a carbon price. Output-based carbon pricing involves allocating credits for GHG emissions to any facility based on a benchmark emission intensity so that the facility only pays a carbon price to the extent that its emissions intensity exceeds the benchmark.

The rationale for the "one product, one benchmark" approach to output-based carbon pricing is to promote efficient allocation of production between producers of a given product: a facility with higher emissions intensity faces a higher average carbon cost per GHG tonne compared to a facility with lower emissions intensity. This average carbon cost difference reduces the costs per unit of production for a lower-emission intensity facility and provides a competitive incentive to shift production towards that facility. Under the CCIR product-specific benchmark, facilities with higher emission intensity paid correspondingly higher average carbon costs – although a Compliance Cost Containment Program may have reduced these costs for facilities with very high average carbon costs per tonne.[5]

The proposed TIER would replace the product-specific benchmark for output-based allocations under CCIR with the requirement for a facility to reduce its emissions intensity to 10% below the three-year average of its historical emissions intensity. Under the proposed TIER, a facility that did not meet its reduction requirement would need to purchase credits from facilities that exceeded their required reductions

4 Alberta Climate Change Advisory Panel. 2015. *Report to the Minister*. Available online: https://www.alberta.ca/climate-leadership-discussion.aspx.

5 Notably, in response to concerns about the economic viability of certain facilities facing additional costs under CCIR, the previous Alberta government had established a Compliance Cost Containment Program (CCP) to provide transitional support to facilities facing "economic hardship", defined as compliance costs under CCIR greater than 3% of facility sales or 10% of facility profit compared to that under the previous SGER. Financial support under this program was on an application basis and faced annual review, with cost relief proportional to the assessed level of economic risk. (See: Alberta. 2019. *Standard for Establishing and Assigning Benchmarks v 2.3*. Available online: https://www.alberta.ca/carbon-competitiveness-incentive-regulation.aspx#compliance-cost-program). Certain market participants have expressed concern that support under this CCP lacked transparency.

or be required to pay into a TIER fund. Although the Government of Alberta's discussion document does not state the rate for such payments into the TIER fund, the United Conservative Party proposed this as $20 per GHG tonne in its election platform.[6] However, the government has now indicated that it would likely establish $30 per GHG tonne as the rate for the TIER fund in 2020[7] – presumably to maintain the marginal carbon price for large emitters in line with the 2020 carbon price under the federal government's "backstop" output-based pricing system (OBPS).

Impact of TIER on Average Carbon Costs Facing Facilities

To see the impact on the applicable emission intensity benchmarks and the average carbon costs, consider the example of pricing for GHG emissions from bitumen extraction by in situ oil sands facilities.

Figure 1 exhibits the estimated emissions intensity for selected in situ bitumen extraction facilities in Alberta's oil sands, calculated using data for 2017 from the facility-level Greenhouse Gas Inventory maintained by Environment and Climate Change Canada (ECCC)[8] and facility-level bitumen production for 2017 from Alberta Energy's bitumen royalty reports.[9]

As shown, under both the CCIR and federal OBPS, in situ facilities would face a uniform benchmark for the emissions intensity per barrel of bitumen production. However, under the proposed TIER, each facility's target would be 90% of the facility's average emissions intensity for the last three years, and Figure 1 shows the implications for imposing such a facility-specific benchmark on all facilities under TIER (assuming each facility's estimated 2017 emission intensity is representative of the three-year historical average).

Figure 2 illustrates the implications for the estimated average carbon costs of the given in situ facility under CCIR, the federal OBPS and the proposed TIER (average carbon costs are calculated using the formula outlined in Appendix A of the recent C.D. Howe Institute publication, "Moving the Coal-Posts: Ottawa's Wrong Turn on Carbon Pricing for Electricity Generation").[10]

Under the CCIR and federal OBPS, a facility faces average carbon costs per GHG tonne proportional to the difference between its emissions intensity and the benchmark. Facilities with relatively higher

6 Alberta United Conservative Party. 2019. UCP Platform: Getting Alberta Back to Work. Available online: https://www.albertastrongandfree.ca/policy/.

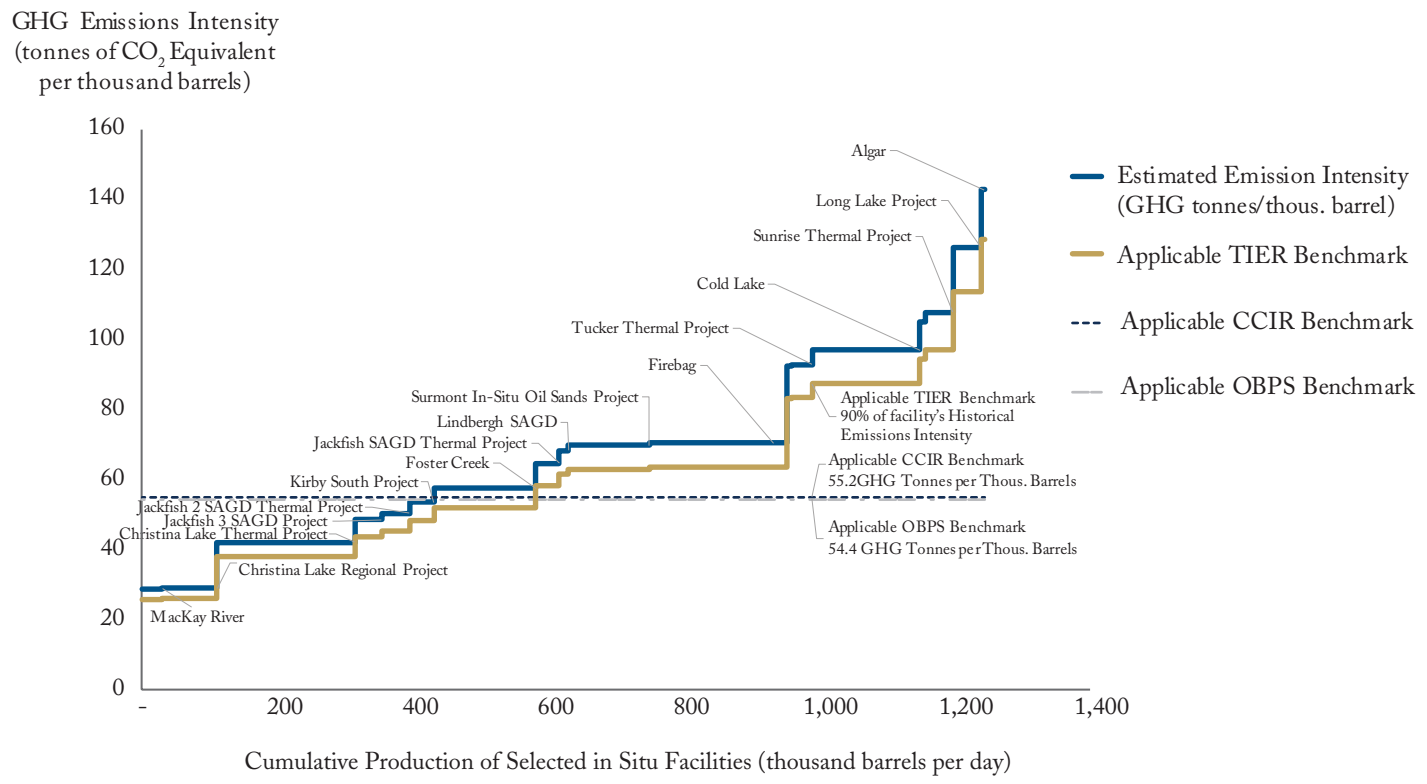
7 Stephenson, Amanda. 2019. "Carbon price on heavy emitters up for consultation: Government no longer committed to $20/tonne," *Calgary Herald*. July 11. Available online: https://calgaryherald.com/business/local-business/carbon-price-on-heavy-emitters-up-for-consultation-government-no-longer-committed-to-20-tonne.

8 Environment and Climate Change Canada. 2019. *Greenhouse Gas Reporting Program (GHGRP) – Facility Greenhouse Gas (GHG) Data* (Published 27 March 2019). Available online: https://open.canada.ca/data/en/dataset/a8ba14b7-7f23-462a-bdbb-83b0ef629823.

9 Alberta. 2019. *Alberta Oil Sands Royalty Data: 2017 Oil Sands project data as of May 4, 2019* (Published July 2019). Available online: https://open.alberta.ca/opendata/alberta-oil-sands-royalty-data1.

10 Bishop, Grant. 2019. *Moving the Coal-Posts: Ottawa's Wrong Turn on Carbon Pricing for Electricity Generation*. C.D. Howe Institute. Available online: https://www.cdhowe.org/public-policy-research/moving-coal-posts-ottawa%E2%80%99s-wrong-turn-carbon-pricing-electricity-generation.

Figure 1: Estimated Greenhouse Gas Emissions Intensity for In Situ Bitumen Extraction Projects*



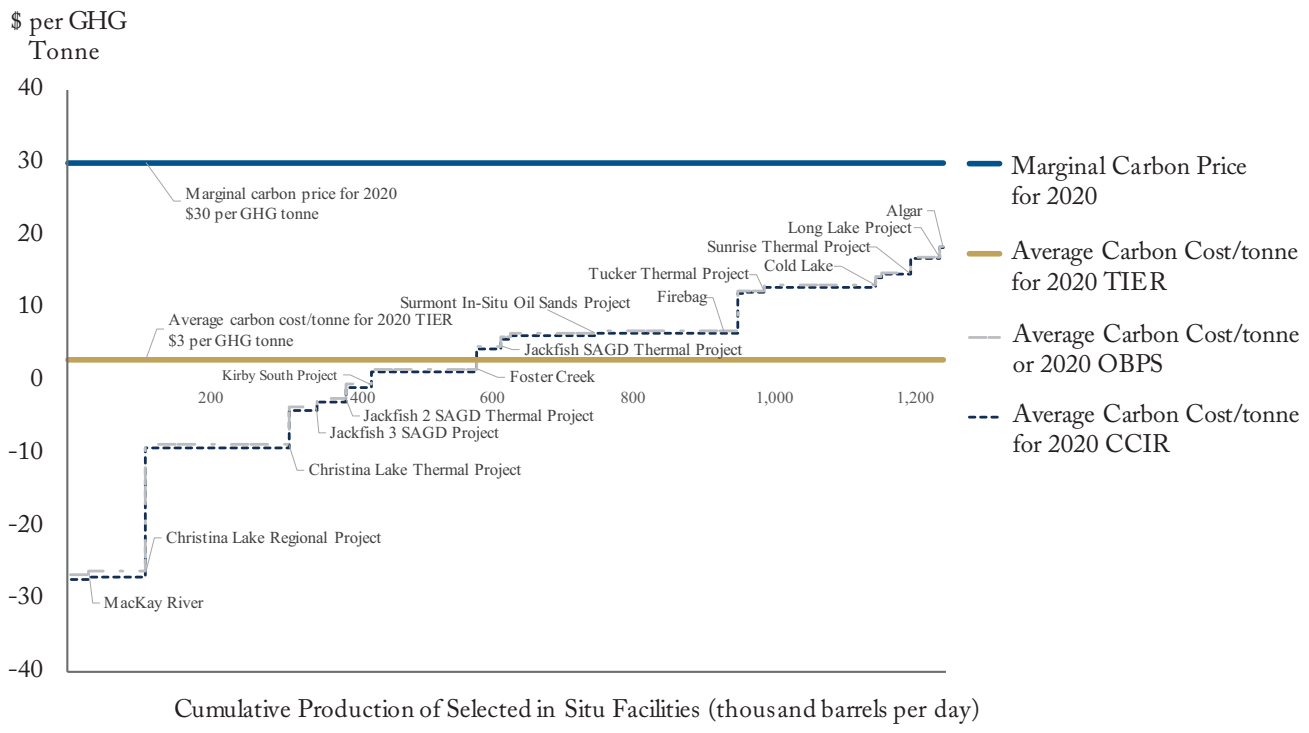
* Note that computed emission intensity for bitumen production by certain facilities may be impacted by on-site steam and electricity co-generation that is included in the reported GHG emissions for the given facility. That is, certain facilities include GHG emissions for the production of other outputs along with those for bitumen production. Unfortunately, neither the facility-level GHG inventories from ECCC or Alberta Environment and Parks decompose the production to which a facility's emissions are attributed.

Source: Author's calculations of 2017 emissions intensity based on ECCC GHG Inventory for 2017 and reported 2017 bitumen production from Alberta Energy.

emissions intensity pay correspondingly higher average carbon costs per GHG tonne. A facility with emissions intensity below the benchmark receives a credit. The difference in average carbon costs improves the relative competitiveness of the lower emission intensity facilities and encourages these less emissions intensive facilities to grow production.

In contrast, assuming a facility does not reduce its emissions intensity in 2020 from its three-year historical average, the facility-specific benchmark under the proposed TIER would result in average carbon costs of $3 per GHG tonne – regardless of the relative emissions intensity of the facility. Again, note that a facility would internalize the $30 carbon price as the marginal incentive to invest in reducing its own emission intensity under either OBPS, federal OBPS or proposed TIER (for a formal exposition of the economics for this decision, see "Investment Decision

Figure 2: Estimated Average 2020 Carbon Costs for Selected In Situ Bitumen Extraction Projects



Source: Author's calculations of 2017 emissions intensity based on ECCC GHG Inventory for 2017 and reported 2017 bitumen production from Alberta Energy.

to Improve GHG Emissions Intensity" in Appendix A of "Moving the Coal-Posts").

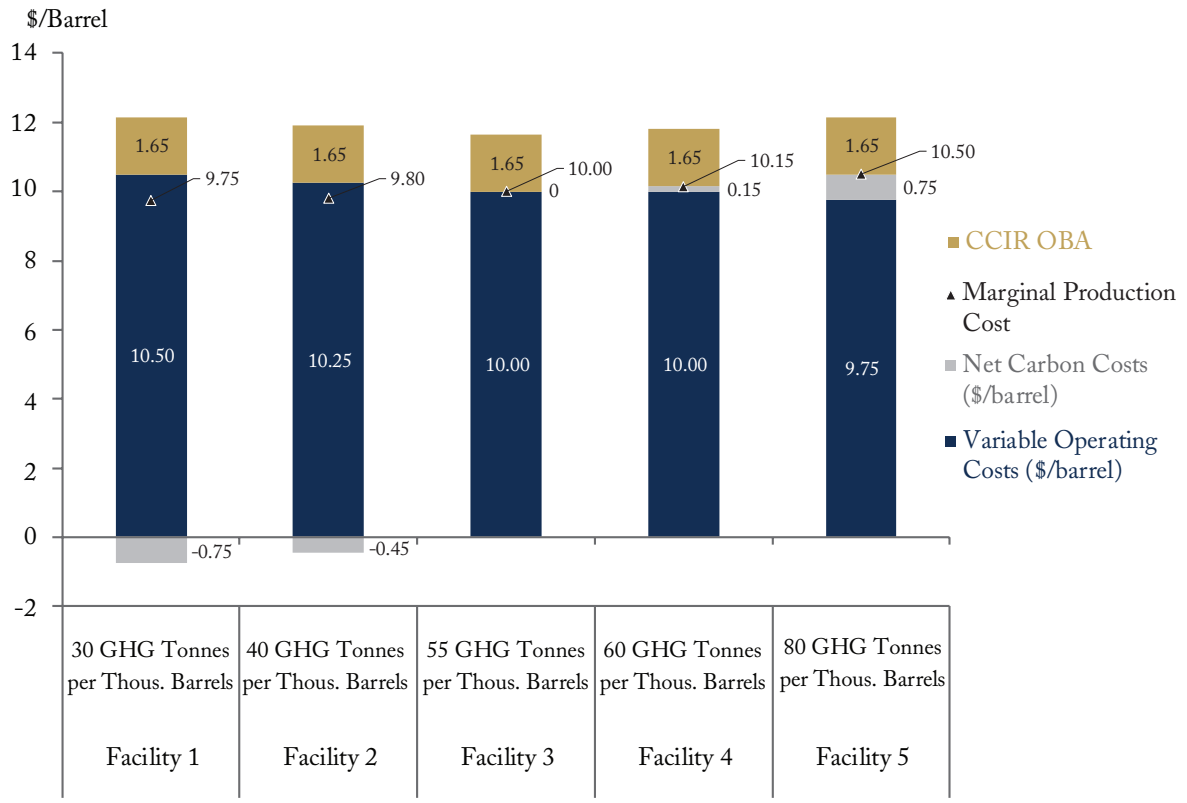
Reduction of Competitiveness for Lower Emissions Facilities under TIER

The move to the facility-specific benchmarks under TIER could have significant implications for the competitiveness of lower emissions facilities. Specifically, the policy shift could potentially re-order the marginal production costs between facilities – and diminish the relative competitiveness of lower emissions facilities.

As an illustrative example, consider five hypothetical in situ oil sands facilities with different emissions intensities and variable operating costs that, under the current CCIR and with a $30 per GHG tonne carbon price, result in marginal production costs as exhibited in Figure 3. For the example in Figure 3, the two facilities with emission intensity less than CCIR benchmark (55 GHG tonnes per thousand barrels) face higher variable operating costs (reflecting the costs of achieving the lower emission intensity). However, net of carbon costs, Facility 1 and Facility 2 achieve lower marginal production costs than Facilities 3, 4 and 5 under the product-specific CCIR benchmark.

Imposing a facility-specific benchmark on all facilities under TIER would remove this advantage for the facilities with lower emissions intensity. As illustrated in Figure 4, a facility-specific benchmark

Figure 3: Illustrative Marginal Production Costs for Example In Situ Facilities under CCIR



Source: Author's calculations based on hypothetical facilities for illustrative example.

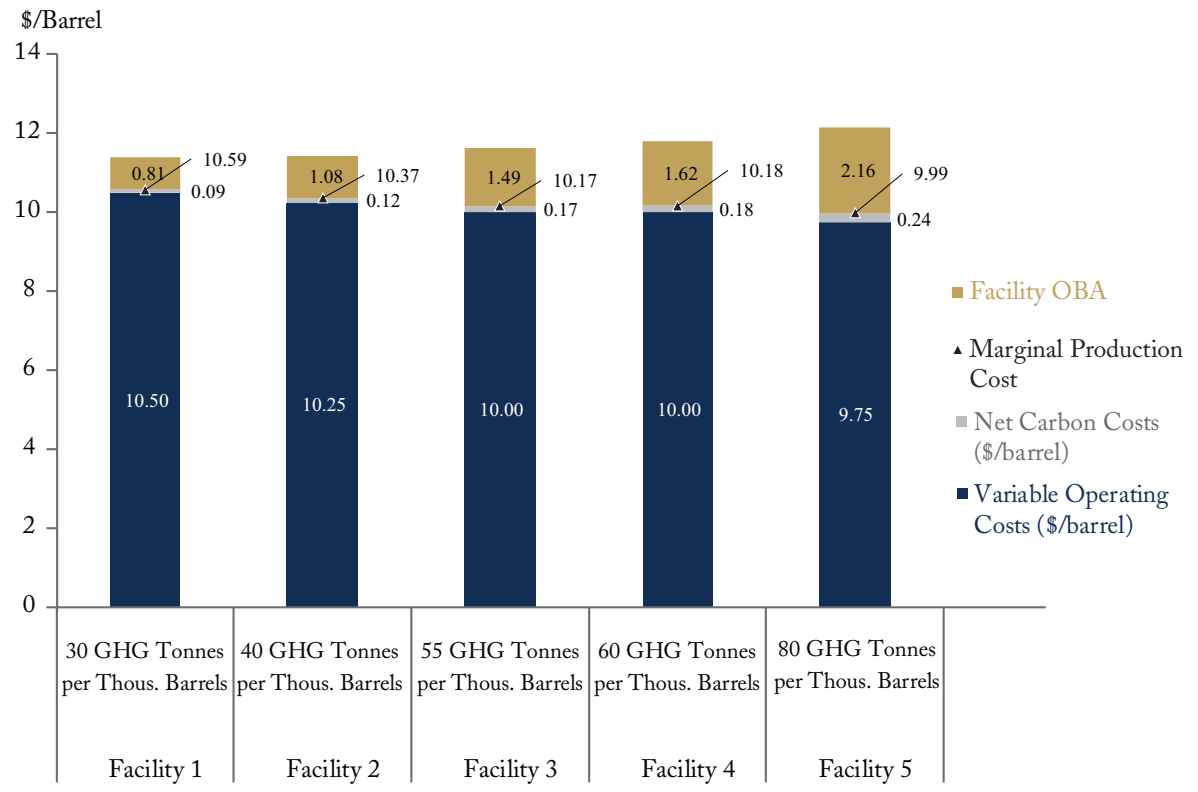
at 90% of the historical emissions intensity will mean that Facility 5 has a cost advantage over Facility 1 – despite the lower emission intensity of the latter. In this example, the move to a facility-specific benchmark under TIER would reverse the order of marginal production costs for the five facilities. Indeed, relative to the illustration under the CCIR in Figure 3, marginal production costs under TIER increase for all facilities but that with highest emissions intensity (Facility 5).

Opt-in to Product-specific Benchmark under Proposed TIER

The Alberta government's TIER discussion document indicates the possibility of retaining product-specific benchmarks as an option for "best-in-class" facilities.[11] Allowing such opt-in for product-specific benchmarks would allow facilities with lower emission intensity to retain a comparative advantage. As illustrated above, imposing a facility-specific benchmark would penalize facilities that have already achieved emission intensity below the product-specific benchmark.

11 Alberta Environment and Parks, *supra* note 2 at page 7 (section 8.3).

Figure 4: Illustrative Marginal Production Costs for Example In Situ Facilities under Proposed TIER



Source: Author's calculations based on hypothetical facilities for illustrative example.

In theory, providing a default facility-specific benchmark but allowing opt-in to a product-specific benchmark could generate an over-supply of GHG credits and consequently erode the value of credits. However, for the Alberta context, such an aggregate over-supply is unlikely based on approximate calculations (detailed in the Appendix to this submission). This is because the TIER discussion document proposes to maintain a product-specific "best gas" benchmark for its electricity sector, and, given the present GHG emissions profile for power generation in Alberta, its electricity sector would likely face substantial net deficits for GHG credits.

Specifically, the estimated GHG credit deficit from Alberta's electricity sector is likely to equal approximately 22% of the GHG emissions from large emitters in Alberta's non-electricity sectors. For large emitters in Alberta's non-electricity sectors to generate sufficiently-sized GHG credit surpluses to cause an over-supply of credits would require implausibly large variance of emission intensity within these sectors. Therefore, any near-term GHG credit surpluses from non-electricity sectors are likely to be absorbed by a comparatively large GHG credit deficit in Alberta's electricity sector. The step-by-step reasoning for this conclusion is detailed in the Appendix to this submission.

Unchanged Incentive for Reducing Existing Facility's Emissions Intensity

Relative to the CCIR or federal OBPS, the TIER would not diminish the marginal incentive from a $30 per tonne carbon price in 2020 for an existing facility to reduce its emissions intensity. (For a formal exposition of the economics for this decision, see "Investment Decision to Improve GHG Emissions Intensity" in Appendix A of "Moving the Coal-Posts".)

Since a facility that improves its emissions intensity nonetheless retains its facility-specific benchmark under the TIER proposal, the operator could potentially profitably invest to improve emissions intensity. The incentive for such an investment (i.e., $30 per GHG tonne for 2020) will remain the same under either a "grandparented" facility-specific benchmark or a product-based benchmark (e.g., CCIR or federal OBPS).

To see this, consider a hypothetical in situ oil sands facility that presently emits 80 GHG tonnes. per thousand barrels of production but can invest in upgrades that improve its emissions intensity to approximately 55 GHG tonnes per thousand barrels. Under the proposed TIER, the facility would face a benchmark of 72 GHG tonnes per thousand barrels while, under the current CCIR, the facility faces the product-specific benchmark of approximately 55 GHG tonnes per thousand barrels.

Figure 5 illustrates the equivalent reduction in the facility marginal production cost under the TIER and CCIR – equal to $0.75 per barrel under either program.[12] That is, an operator should be willing to make an investment with an amortized cost of up to $0.75 per barrel to improve emission intensity.

As long as the facility faces the same benchmark after as before the improvement, the operator should only consider the before/after difference in emission intensity and the marginal carbon price. Whether it is a facility- or product-specific benchmark should be irrelevant to an operator's decision to improve emissions intensity since the benchmark does not impact the incentive for increased emissions intensity.

Arguments to "Grandparent" Emissions of Existing Facilities through Facility-specific Benchmark

An argument for the facility-specific benchmark under TIER may be that carbon pricing – even with a product-specific benchmark to offset carbon costs – imposes large relative costs on certain facilities that were established in previous decades using earlier generation technology and have higher relative emission intensity. In the context of in situ oil sands facilities, the geological character of the resource will also impact a given facility's emission intensity. An argument for a facility-specific benchmark for in situ facilities is that certain producers lost the "resource lottery" and face geology from which bitumen extraction requires greater GHG emissions per barrel extracted.

However, while carbon pricing may negatively impact such a producer, it is not clear that the public policy objective of reducing emissions at the lowest economic cost warrants preferential treatment through a facility-specific benchmark. If the policy aims are to internalize the cost of the externality and

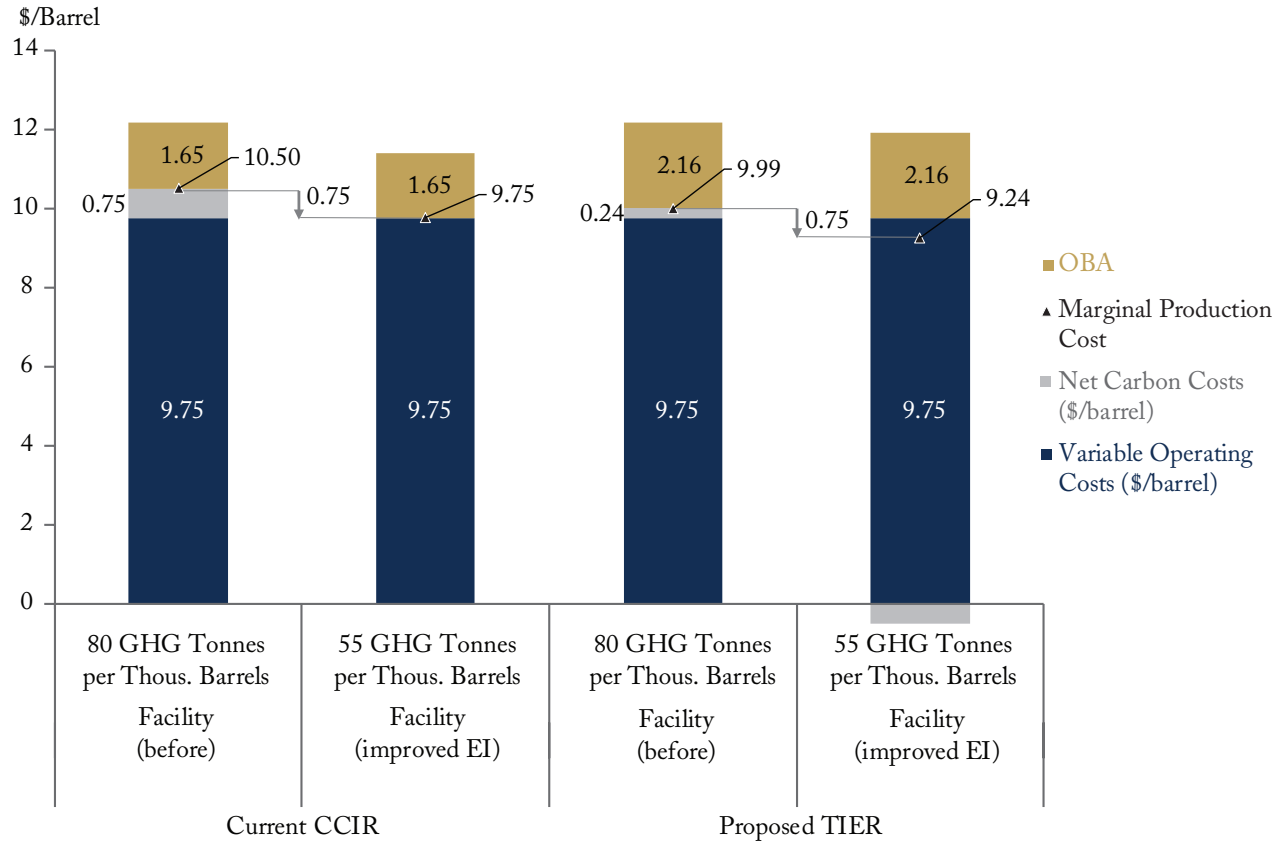
12 Following Appendix A in "Moving the Coal-Posts": under either the TIER or CCIR, the profit incentive is computed as the GHG price incentive multiplied by output and minus the amortized cost of the new technology – that is:

$$\Delta\pi = p_{GHG}(I_{High} - I_{Low})Y - c_{Tech}.$$

In this example, the calculation of the price incentive per barrel will be:

($30/tonne)x(0.080 tonnes/barrel – 0.055 tonnes/barrel)=$0.75/barrel.

Figure 5: Illustrative Marginal Incentive for Emission Intensity Reduction for In Situ Facility



Source: Author's calculations based on hypothetical facilities for illustrative example.

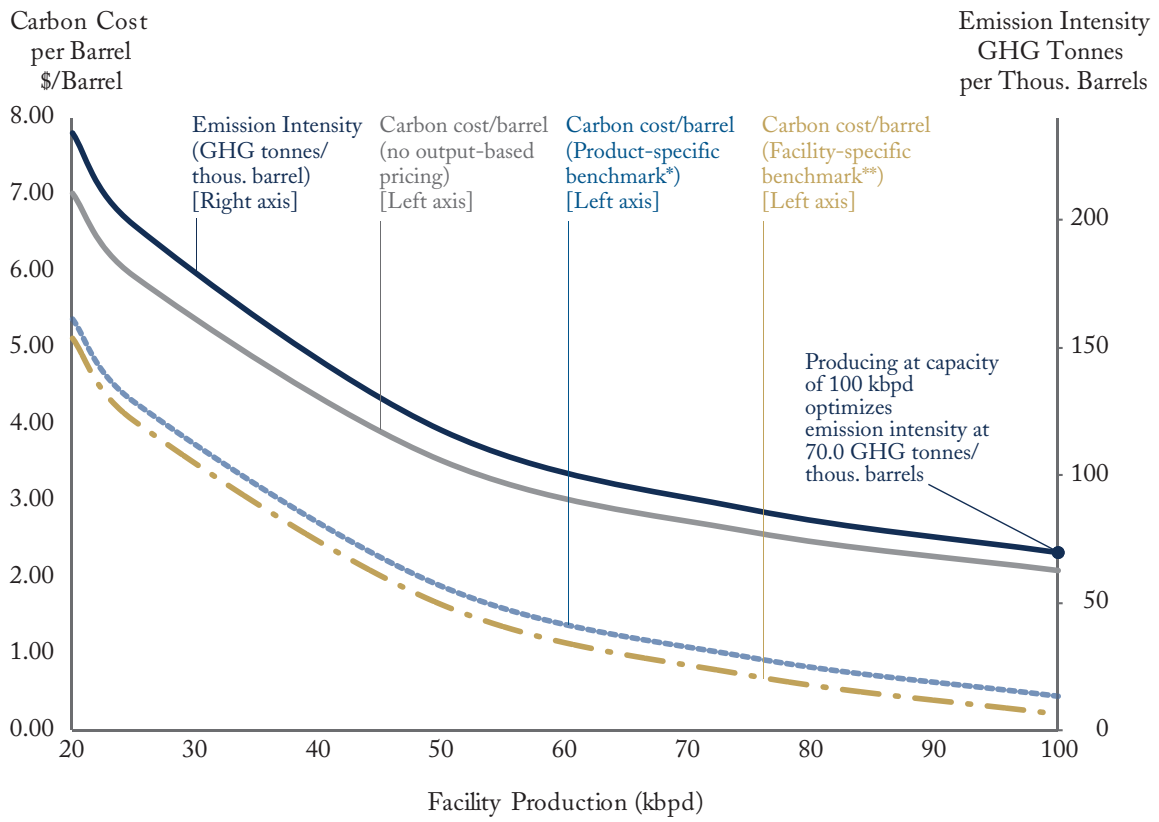
preserve the competitiveness of a sector as a whole, a product-specific benchmark will promote the efficient allocation of production between facilities, increasing the cost competitiveness of lower emission facilities.

Nonetheless, the operational character of in situ facilities may present a unique feature in that a facility may achieve its lowest emissions intensity at a particular level of production. That is, a facility's emissions intensity may not be constant across levels of production and decreasing bitumen production from certain resources may increase a facility's emission intensity. For example, the steam-to-oil ratio for extraction may be optimized at a given reservoir pressure and production level.

If existing facilities are already designed to operate at a production level that optimizes emission intensity, a product-specific benchmark for existing production capacity will impose an additional cost without impacting the producer's behaviour. In such a case, an existing facility's output would be the same under either facility- or product-specific benchmark.

Figure 6 provides an illustration for a hypothetical in situ facility with production capacity of 100 kbpd and for which emission intensity increases at lower

Figure 6: GHG Emission Intensity and Carbon Costs at Varying Production Levels for Hypothetical In Situ Oil Sands Facility



* Product-specific benchmark equal to 55 GHG tonnes per thousand barrels (as under CCIR for 2020)

** Facility-specific benchmark equal to 90% of historical emission intensity (as proposed under TIER program)

Source: Author's calculations based on hypothetical facilities for illustrative example.

levels of production. In this example, the producer would optimize its emission intensity by producing at the facility's top capacity.

Therefore, whether the facility faces a product- or facility-specific benchmark, the producer would minimize its carbon costs per barrel by producing 100 kbpd. That is, the facility's output would be unchanged regardless of which benchmark applies. However, a product-specific benchmark would impose higher carbon costs for the facility compared to a facility-specific benchmark. If GHG emissions from existing facilities involve declining emission intensity with increasing production (as for the example in Figure 6), applying the facility-specific, rather than product-specific, benchmark to existing production may not distort the level of production. As well, as elaborated above, a facility-specific benchmark will preserve the same marginal incentive as under product-specific benchmark for any facility to reduce its emission intensity.

However, as explained in detail below, a product-specific benchmark should apply to any expanded production from an existing facility since applying a facility-specific benchmark to expanded production would distort production growth towards higher emission facilities.

Facility-specific Benchmark for New Facilities Would Discourage Lower Emissions Investments

In its discussion document, the Alberta government seeks comment on the appropriate benchmark for new facilities under TIER and notes consideration of product-specific benchmarks.[13] The adoption of facility-specific benchmarks for new facilities could severely distort the investment decision, biasing new investments towards high emission facilities.

Figure 7 illustrates the potential distortion from applying a facility-specific benchmark to a new facility relative to a product-specific benchmark. This exhibits the break-even price per barrel for two alternative designs for a hypothetical in situ oil project – respectively, a high emission design with 80 GHG tonnes per barrel and a low emission design with 30 GHG tonnes per barrel. For simplicity, the designs are assumed to have equal amortized capital costs per barrel; however, the low emission design would have slightly greater operating costs. As shown, the product-specific benchmark would yield a cost advantage for the low emission design – equal to $0.75 per barrel under the current CCIR's benchmark for in situ extraction of 55 tonne per thousand barrel and a $30 carbon price.

In contrast, applying a facility-specific benchmark (assumed as 90% of the facility's emission intensity) would result in a cost advantage for the high emission design relative to the low emission design – equal to $0.60 per barrel in the example shown in Figure 7.

Product-specific Benchmark Should Apply to Expanded Production from Existing Facilities

A product-specific benchmark should apply to production growth from existing facilities. If production growth from existing facilities benefits from a facility-specific benchmark under TIER, the program will both:

1) create an inefficient advantage for expanding production from existing facilities with high emissions relative to existing facilities with low emissions, and
2) inefficiently encourage operators to grow existing facilities with high emissions rather than invest in new facilities with low emissions.

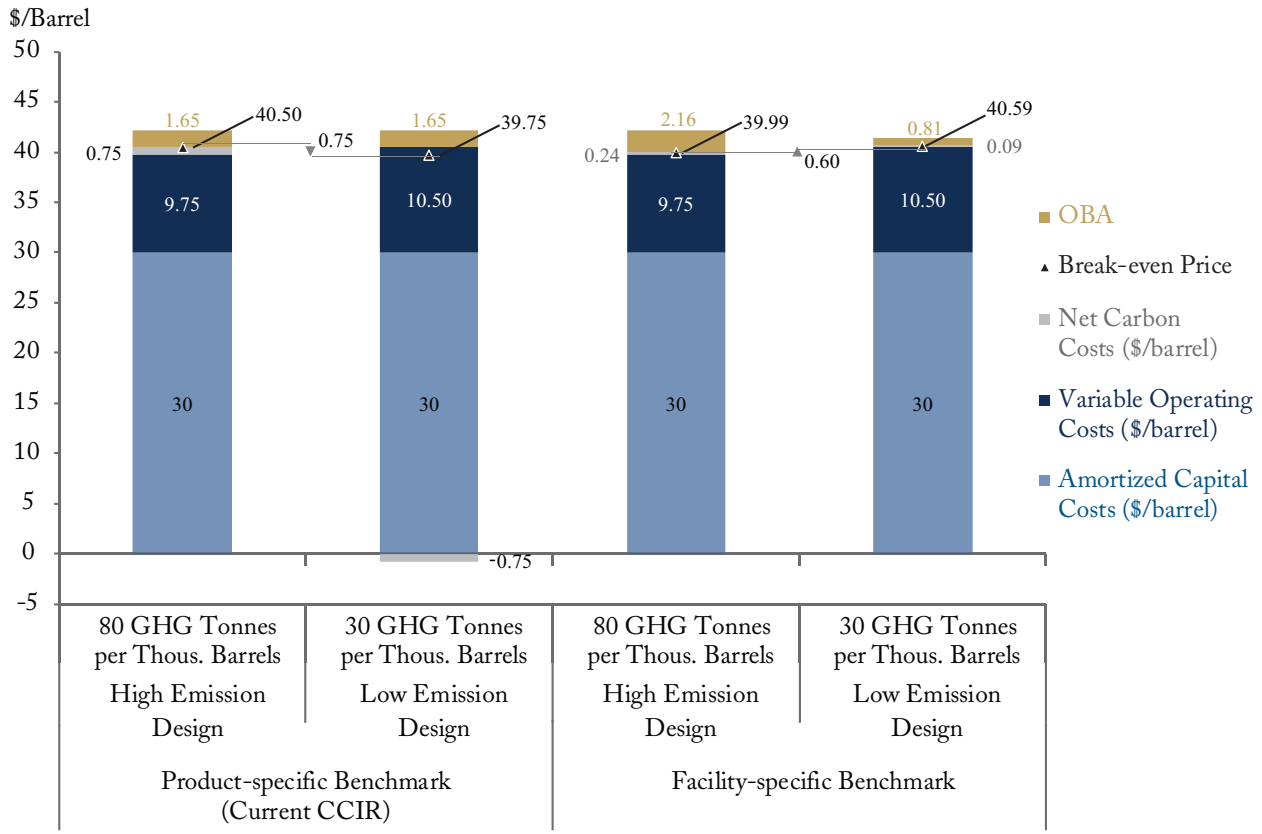
A product-specific benchmark that applies to all production growth – whether for a new facility or expansion of an existing facility – will provide a level playing field for growth of existing facilities and avoid distorting the choice between expansion and new facilities.

As exhibited in Figure 8, the expansion of existing in situ oil sands schemes, rather than the addition of new schemes, has contributed the bulk of year-to-year growth in Alberta's in situ sands production since 2010.

A bias towards growth of facilities with relatively higher emissions will increase the overall emissions intensity for a given product. As shown earlier for the example of illustrative in situ facilities in Figure 3, the product-specific benchmark in the current CCIR can create an cost advantage for lower emission facilities, providing incentive to expand production of these facilities and reducing overall emissions intensity. In contrast, as illustrated earlier in Figure 4, a facility-specific benchmark would bias production growth towards higher emission facilities.

13 TIER Discussion Document, *supra* note 2 at page 8 (section 8.4).

Figure 7: Break-even of New Investments in High/Low Emission In Situ Projects under Product- versus Facility-Specific Benchmark

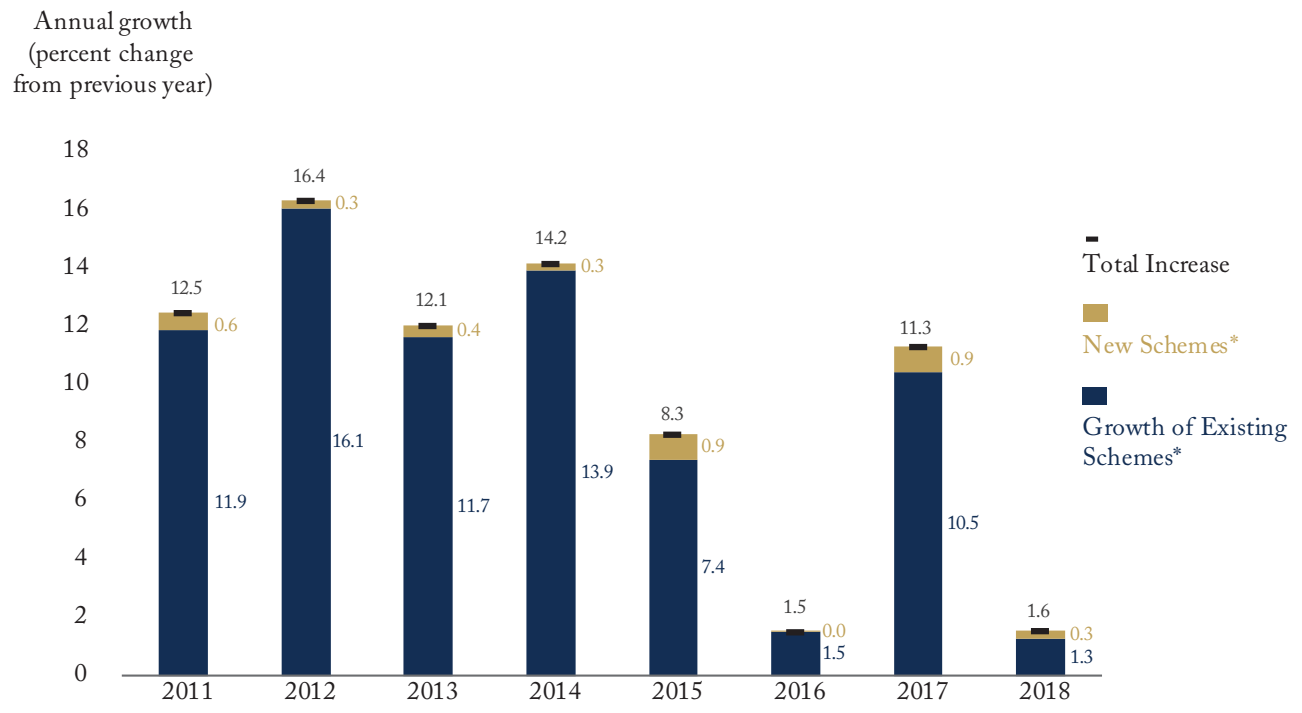


Source: Author's calculations based on hypothetical facilities for illustrative example.

Even if the Alberta government adopts a facility-specific benchmark for production from existing facilities under the TIER program, a product-specific benchmark should apply to a significant expansion of any existing facility. Applying an incremental product-specific benchmark (i.e., a product-specific benchmark would apply to the additional production beyond the existing capacity) would ensure a level playing field between facilities with respect to the average carbon costs per barrel for any expansion. In contrast, applying a facility-specific benchmark to the expanded production would provide a greater incentive for higher emissions facilities to expand relative to lower emissions facilities.

An expansion of production may be accompanied by upgrades that reduce a facility's emission intensity. For example, an existing facility with production capacity of 100 kbpd and initial emission intensity of 70 GHG tonnes per thousand barrels might undertake upgrades that expand capacity by 50% (i.e., to 150 kbpd) and also reduce emission intensity to 55 GHG tonnes per thousand barrels.

Figure 8: Composition of New and Existing Schemes in Growth of Alberta's In Situ Oil Sands Production



Source: Author's calculations from Alberta Energy Regulator Report ST-53 2010-2018.

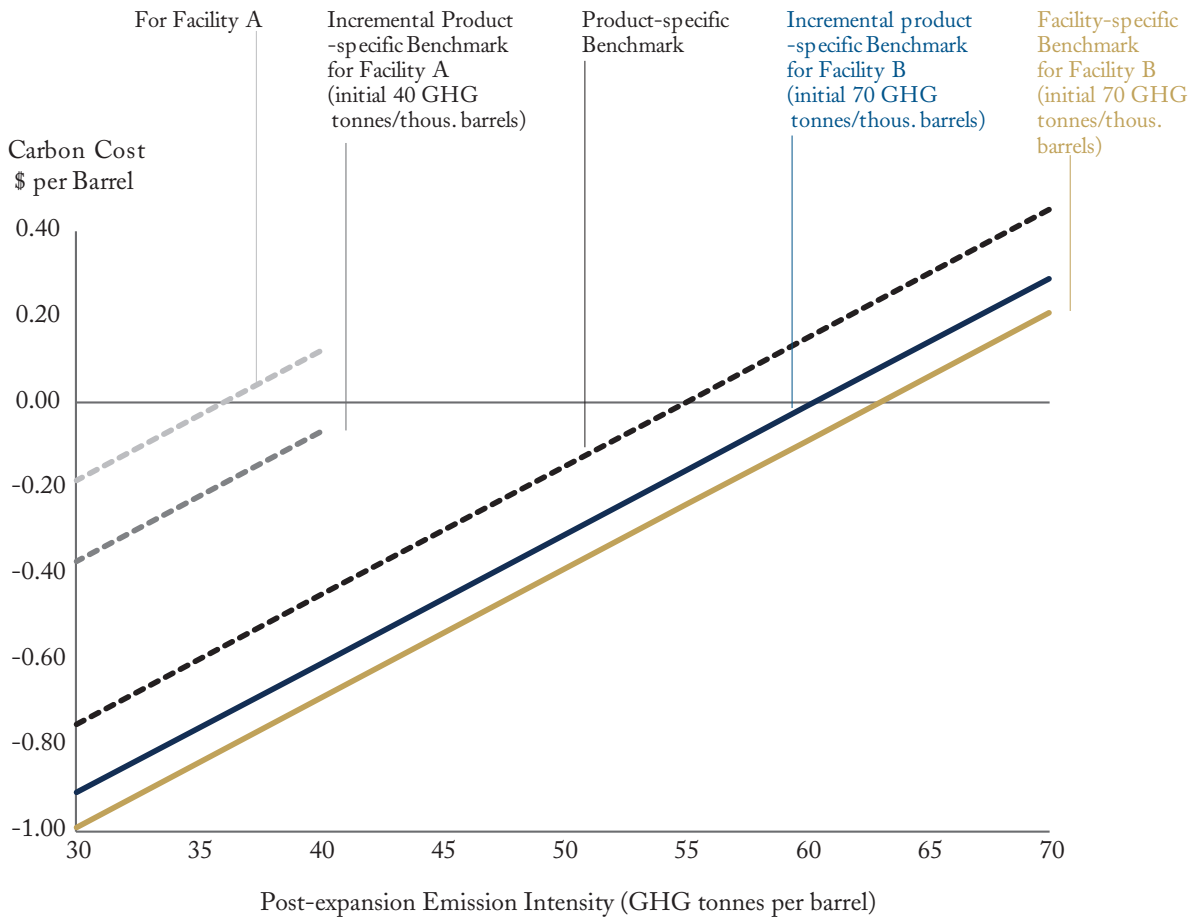
Note: Schemes defined by numeric identifier in approval number from ST-53.

However, if an overall reduction in emissions intensity is the objective, policy should not indicate a preference for the expansion of higher emission facilities over lower emission facilities.

Figure 9 exhibits the post-expansion carbon cost per barrel under different benchmarks for two example facilities with equal initial production capacity of 100 kbpd but different initial emission intensities (40 and 70 GHG tonnes per thousand barrels, respectively, for Facility A and B). For these two example facilities, the figure illustrates the carbon costs per tonne following a 50% expansion of production and improved post-expansion emission intensity under each of a facility-, product- and incremental product-specific benchmark.

Under the product-specific benchmark, carbon costs per barrel are proportional to the facility's emission intensity, declining as emission intensity improves. However, under the facility-specific benchmark, carbon costs per barrel vary based on the facility's historical emission intensity. In Figure 9, Facility B (with initial emission intensity of 70 GHG tonnes per thousand barrels) would face $0 carbon costs per tonne if it could reduce its emission intensity to 63 GHG tonnes per thousand barrels (90% of its historical emission intensity).

Figure 9: Carbon Costs per Barrel for 50% Expansion and Emission Intensity Improvement under Facility-, Product- and Incremental Product-specific Benchmark



Source: Author's calculations based on hypothetical facilities for illustrative example.

As illustrated in Figure 9, at that reduced emission intensity, Facility B would face lower carbon costs under a facility-specific benchmark than Facility A despite the latter facility's much lower emission intensity.

Applying the facility-specific benchmark to any expanded production would mean lower carbon costs per barrel for expanding an upgraded Facility B (e.g., with $0 carbon costs per barrel if achieving emission intensity of 63 GHG tonnes per thousand barrels) relative to Facility A (at $0.12 carbon costs per barrel for its emission intensity of 40 GHG tonnes per thousand barrels). Despite the lower emission intensity of Facility A, the facility-specific benchmark would provide a preference for the expansion of an upgraded Facility B relative to Facility A.

In contrast, an incremental product-specific benchmark (i.e., production capacity of existing

facilities is "grandparented" under a facility-specific benchmark but a product-specific benchmark applies to any incremental expansion of production capacity) would ensure that production growth is on a level playing field between facilities.

For example, while the historical 100 kbpd capacity of Facility B would benefit from a facility-specific benchmark of 63 GHG tonnes per thousand barrels, its additional 50 kbpd expansion of production would be subject to the product-specific benchmark (e.g., 55 GHG tonnes per thousand barrels). This would ensure parity of carbon costs per barrel between expanding Facility B and expanding Facility A. That is, under the incremental product-specific benchmark, Facility B would need to reduce its emission intensity to 40 GHG tonnes per thousand barrels before the production from the incremental expansion would have carbon costs per barrel equal to those for expanded production from Facility A.

However, note that this incremental product-specific benchmark would preserve the incentive for overall reduction of Facility B's emission intensity. As illustrated in Figure 9, carbon costs per barrel for an upgraded and 50% expanded Facility B would be less than Facility A under an incremental product-specific benchmark. This is because, in this example, the 100 kbpd existing production capacity would face the facility-specific benchmark at 90% of historical emissions and the 50 kbpd expansion would be subject to a product-specific benchmark.

This illustration highlights the importance of applying a product-specific benchmark to incremental expansions of production. Applying a facility-specific benchmark to expansions would distort production growth towards the expansion of high emission facilities.

Conclusion

If the aim is to reduce GHG emissions at the least economic cost, policy should harness market competition to reward competitors that produce output with relatively fewer GHG emissions. Alberta's government should reconsider any policy change that will make lower emissions facilities less competitive and favour growth of higher emissions facilities.

As for any policy change, in changing the Alberta's framework for output-based carbon pricing, government should carefully consider the impact that instability in regulatory design may have on investor certainty going forward.

Various producers anticipated a product-specific standard (i.e., when the CCIR came into effect) and invested in technology to reduce emissions intensity. These long-lived investments required risky innovations and were predicated on policy that rewarded reductions of emission intensity. Basing a facility-specific benchmark on the past three years of historical emission intensity would diminish the comparative advantage for facilities that invested in reducing emission intensity prior to that three-year horizon.

Notwithstanding the inefficiency of distorting production towards higher emissions facilities, Alberta's government should not deprive producers of an efficient comparative advantage they won through risky investment and innovation. In order to retain a comparative advantage for facilities that have already reduced emission intensity, TIER should allow facilities to opt into a product-specific benchmark.

Notably, such opt-in could theoretically result in surpluses of GHG credits from certain of the sectors covered by TIER. However, based on approximate calculations (detailed in the Appendix), a projected deficit for credits in Alberta's electricity sector should be sufficiently large to absorb any surplus of credits from Alberta's non-electricity sectors.

Finally, applying a facility-specific benchmark to expanded production would privilege the growth of high emission facilities. Even if "grandparenting" existing production capacity under a facility-specific benchmark, the Alberta government should apply an incremental product-specific benchmark to the expansion of production.

Appendix: Risk of over-supply of GHG credits from opt-in to product-specific benchmark

The TIER discussion document proposes that facilities can meet benchmarks by using credits from other facilities that have exceeded their reduction requirements. If some facilities are subject to a facility-specific benchmark but other facilities can opt-in to a product-specific benchmark, a surplus of GHG credits relative to demand for credits could cause an erosion of the value of credits.

Whether an over-supply would result will depend on the distribution of facility-level emission intensities within covered sectors and the size of the projected credit deficit in the electricity sector relative to credit surpluses in other sectors. As elaborated below, given the relative share of GHG emissions from Alberta's electricity sector and the proposal to retain a "best gas" product-specific benchmark for power generation under TIER, it is likely that the deficit of GHG credits from power generation would be sufficiently large to fully absorb any net surpluses of GHG credits from non-electricity sectors.

Assignment of Product-specific Benchmarks

Under the CCIR, an established benchmark was assigned for different product categories using one of three broad benchmark approaches – either (1) a best-in-class emission intensity; (2) top-quartile emission intensity; or (3) 80%, 90% or 100% of the production-weighted average emission intensity for the given product.[14] For example, in the case of in situ bitumen production, the benchmark was assigned as the top-quartile production-based emission intensity.

Notably, electricity generation in Alberta was subject to a product-specific "best-gas" benchmark at 0.370 GHG tonnes per MWh. For electricity, zero-emission generation facilities (e.g., hydro) received credits based on their power output. However, most of Alberta's fossil-fuel powered generation facilities produce at estimated emission intensities above this "best gas" benchmark.[15]

For other sectors, assigning a product-specific benchmark that was below the average emission intensity ensured that, in a given product category, at least 50% of emissions from facilities would be above the product-specific benchmark. For example, the CCIR established a benchmark of 55.71 GHG tonnes per thousand barrels of bitumen for in situ oil sands production.[16] Appendix Figure 1 exhibits the historical average emission intensity across in situ facilities from 2004 to 2017 compared to this 2018 benchmark. Note that the product-specific benchmark is approximately 25% less than the average emission intensity of 74 GHG tonnes per thousand barrels for in situ oil sands production in 2017. Under this product-specific benchmark and a $30 per tonne carbon price, the average carbon costs per barrel across all in situ facilities should be approximately $7.35 per tonne.[17]

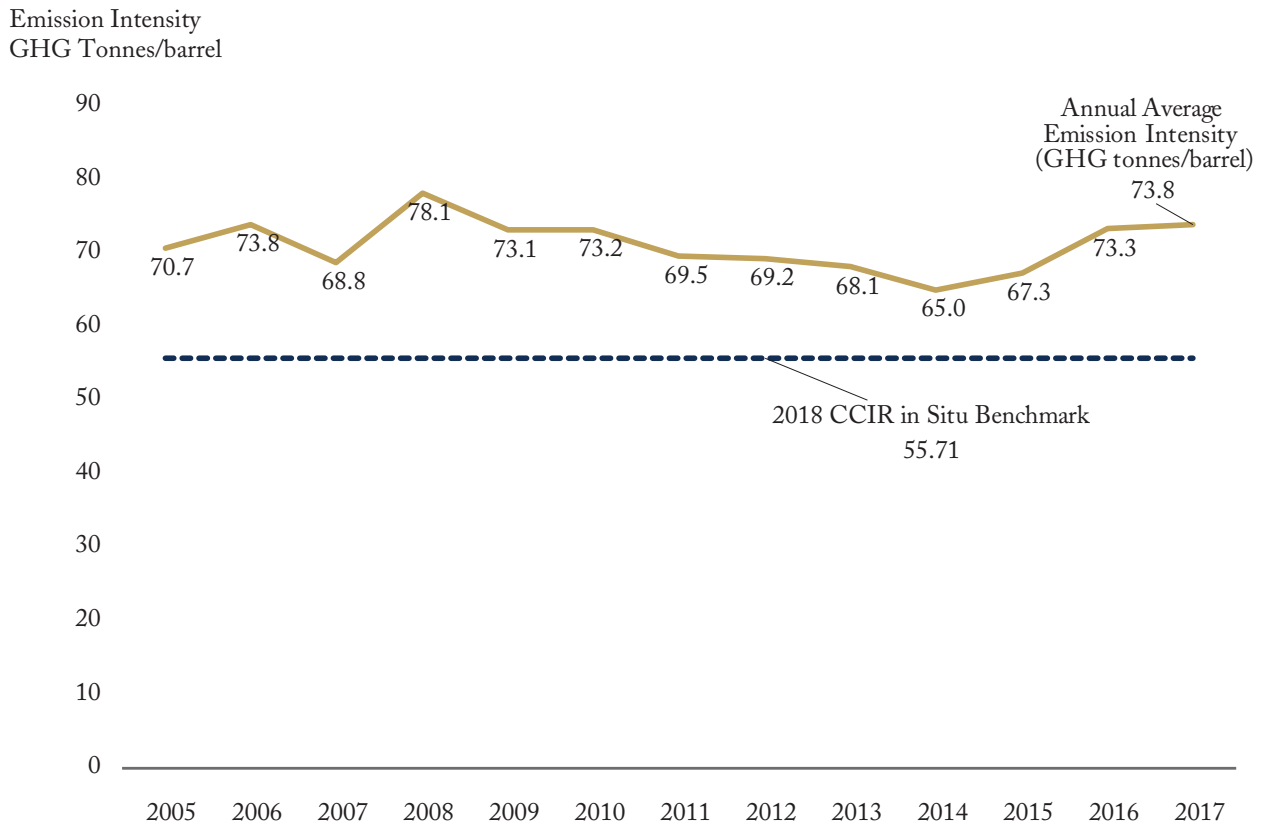
14 See: Alberta. 2019. *Standard for Establishing and Assigning Benchmarks v 2.3* at page 29 (section 5.0). Available online: https://www.alberta.ca/carbon-competitiveness-incentive-regulation.aspx#compliance-cost-program.

15 See: Bishop 2019, *supra* note 10 at page 8.

16 The stated standard for 2018 is 0.3504 CO2 tonnes per m^3 of bitumen. This is converted to barrels applying a factor of 6.29 barrels/m^3. See: *Carbon Competitiveness Regulation*, AR 255/2017 at page 50 (Schedule 2: Table – Established Benchmarks for Products). Available online: http://www.qp.alberta.ca/1266.cfm?page=2017_255.cfm&leg_type=Regs&isbncln=9780779800193.

17 As detailed in Appendix A of "Moving the Coal-posts", the average carbon costs per tonne are calculated as: $p_{GHG}(1-I_{OBS}/I_{Plant})$.
Here, the calculation is: ($30 per tonne) x (1 – 55.71 GHG tonnes per thous. barrels / 73.8 GHG tonnes per thous. barrels)

Figure A1: Historical Average GHG Emission Intensity for Alberta In Situ Oil Sands Bitumen Production



Historical average emission intensity for in situ oil sands computed using:

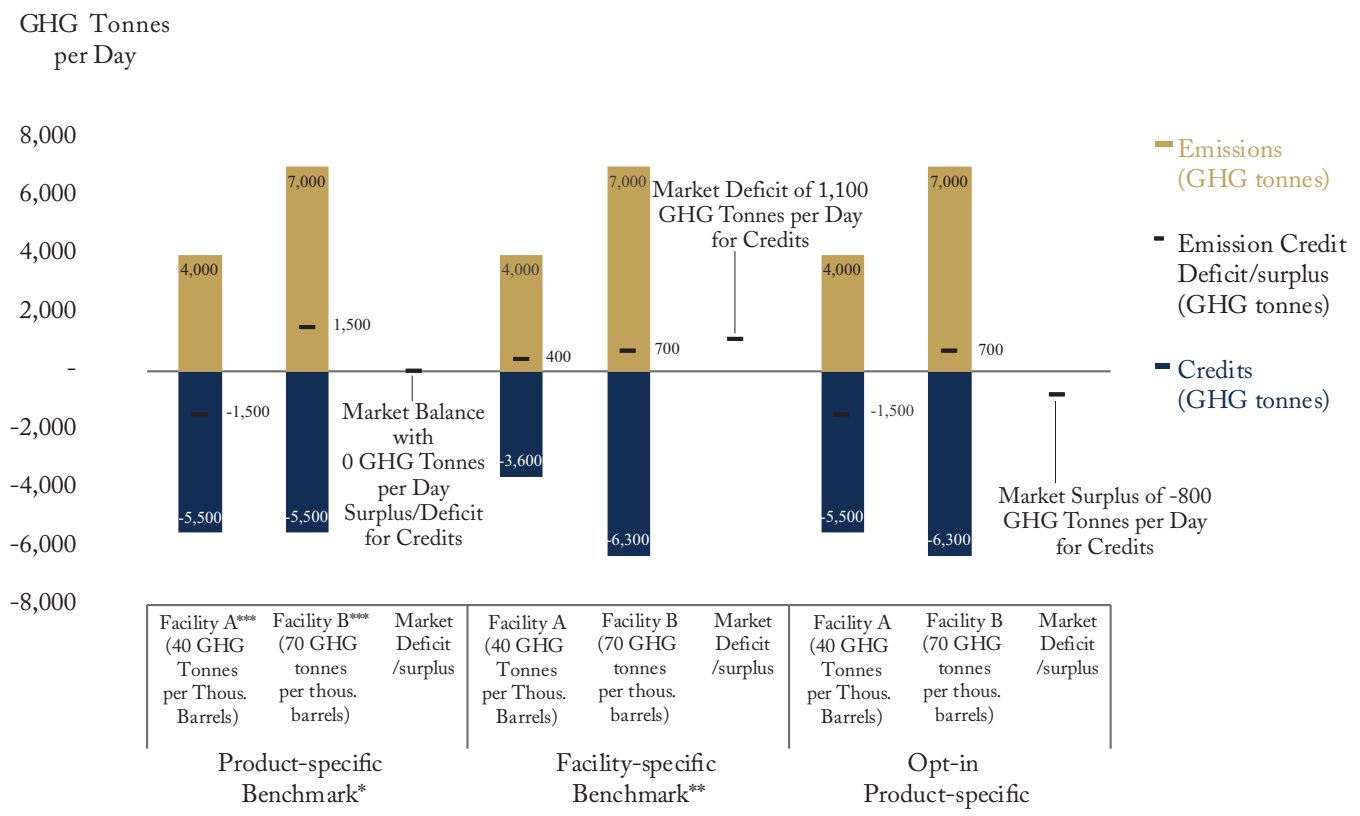
- Environment and Climate Change Canada. 2019. *Greenhouse Gas Inventory – Economic Sector Tables*. Available online: http://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/B-Tables-Canadian-Economic-Sector-Canada/?lang=en.
- National Energy Board. 2018. *Canada's Energy Future 2018: Energy Supply and Demand Projections to 2040 – Crude Oil Production*. Available online: https://apps.neb-one.gc.ca/ftrppndc/dflt.aspx?GoCTemplateCulture=en-CA.

Source: Author's calculations based on hypothetical facilities for illustrative example.

Theoretical Possibility of Net Credit Surplus for Certain Sectors under Product-specific Benchmark

As shown above in Figure 1, various facilities have emission intensity below this benchmark and will generate surplus credits by that out-performance. However, other facilities have emission intensity above the benchmark and will face a deficit equal to the difference between their total emissions and their total credits. The higher-than-benchmark facilities will be required to address this deficit by either paying the carbon price or acquiring credits from out-performing facilities. However, because the product-specific benchmark under the CCIR is less than average emission intensity for most products (e.g., a top-quartile benchmark applies to in situ oil sands facilities), the net surplus of GHG credits from facilities with emission intensity below the

Figure A2: Illustration of Over-supply of GHG Emission Credits for Opt-in Product-specific Benchmark



* Product-specific benchmark equal to 55 GHG tonnes per thousand barrels (as under CCIR for 2020)

** Facility-specific benchmark equal to 90% of historical emission intensity (as proposed under TIER program)

*** Each of Facility A and Facility B produce 100 kbpd in this example

Source: Author's calculations based on hypothetical facilities for illustrative example.

benchmark should be less than the aggregate deficit from those facilities with emission intensity above the benchmark.

Allowing facilities to opt into the product-specific benchmark while providing a default facility-specific benchmark could produce a surplus of credits in a given sector. Whether this would result in an aggregate over-supply will depend on the relative size of the deficit for credits in Alberta's electricity sector.

Appendix Figure 2 provides a stylized illustration of this potential surplus of credits when facilities can opt into a product-specific benchmark. To illustrate this risk, consider a simplified market with two facilities, each producing 100 kbpd but with different emission intensity: Facility A emits 40 GHG tonnes per thousand barrels while Facility B emits 70 GHG tonnes per thousand barrels. In the example, the average emission intensity for the sector is 55 GHG tonnes per thousand barrels.

Therefore, if both facilities face a product-specific benchmark of 55 GHG tonnes per thousand barrels, Facility A will generate a surplus of credits of 1,500

GHG tonnes per day while Facility B will have a deficit of 1,500 GHG tonnes per day. The overall market for credits will be in balance – that is, Facility A's surplus offsets Facility B's deficit.

In the case of a facility-specific benchmark equal to 90% of the facility's emission intensity, both facilities would face a deficit of credits. Both facilities would need to pay for their deficit by paying the carbon price.

However, with an opt-in product-specific benchmark, Facility A would opt into the product-specific benchmark while Facility B would prefer the facility-specific benchmark. The consequence would be that Facility A generates a greater surplus of credits than the deficit faced by Facility B. The overall market for credits would be in a surplus position as shown below in Appendix Figure 2.

If opt-in to product-specific benchmarks caused such an aggregate over-supply of GHG credits across all sectors, Alberta's government would need to support by allowing any surplus credits to be redeemed at some established price. Otherwise, such an over-supply of credits would drive down the market value of credits.

Low likelihood of GHG Credit Over-supply for Opt-in to Product-specific Benchmark in Alberta

However, the risk of an aggregate over-supply for GHG credits is mitigated by the Alberta government's expressed intention under TIER to maintain a "best-gas" product-specific benchmark for the electricity sector.

Since Alberta lacks publicly available data on emission intensity at the facility-level,[18] it is not feasible to provide a conclusive projection of the extent of sector-by-sector GHG credit surpluses if facilities could opt-in to a product-specific benchmark under TIER. However, an approximate calculation indicates a substantial likelihood that a deficit of credits in the electricity sector would be sufficient to absorb credits from other sectors.

Specifically:

- The overall emission intensity for power generation in Alberta for 2016 was 0.76 GHG tonnes per MWh.[19]
- Under TIER, the Alberta government proposes to maintain a "best-gas" product specific benchmark of 0.37 tonnes per MWh for electricity generation.[20]
- In 2017, total GHG emissions from power generation facilities were 46 MT (representing 29% of the total 156 MT GHG emissions from large emitters in Alberta for 2017).[21]
- Assuming the same emissions from 2017, this implies that Alberta's electricity sector would have an approximate deficit of GHG credits equal to 24 MT

  (i.e., 46 MT x (1- 0.37 T per MWh / 0.76 T per MWh)).
- In 2017, non-electricity large emitting facilities

18 The above estimates of emission intensity for individual in situ facilities is possible because of the publication of facility-level production data. Similarly, the transparency of Alberta's power market allowed compilation of facility-level power generation used in Bishop 2019, *supra* note 10. However, beyond oil sands production and power generation, facility-level output data is not available for other covered sectors.

19 See: Bishop 2019, *supra* note 10 at page 7 (Figure 3), based on calculations from ECCC GHG Inventory and NEB Canada's Energy Future 2018.

20 Alberta Environment and Parks, *supra* note 2 at page 1.

21 ECCC GHG Inventory, *supra* note 6.

emitted 110 MT.[22] Therefore, in order for Alberta to face an over-supply of GHG credits, non-electricity sectors would need to generate a surplus of GHG credits equal to approximately 22% of the total GHG emissions from these sectors (i.e., 24 MT/110 MT).

- Under the facility-specific benchmark proposed for TIER at 90% of a facility's historical emission intensity, a facility would face a maximum deficit for credits equal to 10% of its GHG emissions (assuming no reduction from the facility's historical emission intensity).
- Since a producer would prefer a facility-specific benchmark for any facility with emission intensity above a product-specific benchmark (i.e., above-benchmark facilities), only facilities below the product-specific benchmark (i.e., below-benchmark facilities) would opt into the product-specific benchmark.
- Therefore, in order to cause an aggregate over-supply of credits, below-benchmark facilities in non-electricity sectors would need to generate a net surplus of credits, after netting the 10% deficit from above-benchmark facilities.
- In order to generate a net surplus of 22% of GHG emissions from a sector for which the benchmark was 100% of the production-weighted average emission intensity, the average emission intensity for below-benchmark facilities would need to be roughly 50% of the average emission intensity for above-benchmark facilities.
- In order to generate a net surplus of 22% of GHG emissions from a sector for which the benchmark was 80% of the production-weighted average emission intensity, the average emission intensity for below-benchmark facilities would need to be roughly 30% of the average emission intensity for above-benchmark facilities.
- Under CCIR, the highest emitting non-electricity sectors were subject to either top quartile product-based benchmarks (e.g., in situ and mined bitumen, together representing 44% of GHG emissions from large emitters in Alberta for 2017) or best-in-class (e.g., petroleum refineries and high-value petrochemical manufacturing). If TIER allows opt-in to the same product-specific benchmarks under CCIR, these sectors would be unlikely to generate significant net surpluses since the share of above-benchmark facilities would be small to negligible.
- With the size of the GHG credit deficit in Alberta's electricity sector, it is unlikely that non-electricity sectors would generate net surpluses of GHG credits large enough to cause an aggregate over-supply of GHG credits. Specifically, although facility-level emission intensity data is not available for sectors beyond power production and oil sands in Alberta, it is unlikely the variance for emission intensity across facilities within non-electricity sectors would be sufficiently wide to generate the required net surplus of credits.

22 ECCC GHG Inventory, *supra* note 6.