



# Tightening TIER for Alberta's decarbonization

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## Executive Summary

Alberta has implemented significant policies designed to reduce greenhouse gas emissions from industrial emitters. In 2007, Alberta was the first jurisdiction in North America to introduce industrial carbon pricing. The province's output-based pricing system was revamped in 2020 and is now called the Technology Innovation and Emissions Reduction (TIER) Regulation.

Alberta, and TIER, face major challenges. The TIER system is intended to be a flexible and cost-effective way to reduce industrial emissions while maintaining economic competitiveness. Yet, as decarbonization in Alberta accelerates, there is a risk that progress on emission reductions could stall, because too few emissions are regulated by TIER. Increasingly, an oversupply of cheap carbon credits could undermine the carbon price signal. That in turn would discourage further emission reductions by Alberta industry, which requires a clear, stable price signal to invest in ongoing decarbonization. An insufficiently stringent TIER system could imperil the significant investment and new jobs that Alberta should benefit from in the emerging low-carbon economy.

Alberta is committed to being a national leader in climate action. For Canada to meet its emissions-reductions target for 2030, there must be major reductions in industrial emissions right across the country — especially in Alberta. Based on the federal government's 2030 Emissions Reductions Plan (ERP), we estimate that large industrial emitters in Alberta — in the oil and gas, electricity generation, and heavy industry sectors — will need to reduce their greenhouse gas (GHG) emissions by approximately 70 Mt by the end of the decade, if they are to cut in proportion to the reductions that the ERP expects of Canadian industrial emitters as a whole. That 70 Mt represents nearly a quarter of the total reductions required across the Canadian economy, and over half of the emissions reductions required from industry.

Under TIER, the share of any industrial facility's emissions that face a carbon price is based on the degree to which that facility's emission intensity — meaning its emissions per unit of output — exceeds a facility-specific benchmark. Rather than pay the carbon price, a facility can also meet its TIER obligations by acquiring credits or offsets. In 2020, the first year of the TIER system, benchmarks for most industrial emitters were set at 90% of the facility's historical emissions intensity. The stringency of these facility-specific benchmarks tightens by 1% per year. For example, an oil sands in situ facility faced a benchmark at 89% of its historical emissions intensity in 2021, 88% in 2022, and so on. If facilities reduce their emissions below the stringency threshold, they can generate emissions performance credits that they can sell to other emitters.

Alberta has proposed to increase the TIER tightening rate from 1% to 2% per year starting in 2023, one of several [design changes](#) needed to demonstrate TIER's equivalency with the federal Output-Based Pricing System (OBPS) for industry. Provinces and territories were recently required to submit their proposed industrial carbon-pricing systems for the 2023-2030 period to the federal government for review. These systems must meet a set of criteria called the [federal benchmark](#) for carbon pollution pricing systems in Canada. If a province or territory's pricing system fails to meet the benchmark, the federal government will impose the OBPS instead.

This paper shows that TIER's proposed 2% tightening rate would be unlikely to meet the criteria established in the federal benchmark, under a scenario where Canada meets its ERP goal of a 40% reduction in GHGs from 2005 levels by 2030. If TIER applies a 2% tightening rate, and Alberta's industrial facilities decarbonize at the rate contemplated in the ERP, there is a strong likelihood of an oversupply of emissions credits generated from decarbonization projects. An oversupply of credits puts downward pressure on credit prices, and low carbon credit prices blunt the impact of carbon pricing because emitters know they can buy cheap credits rather than paying the carbon price. Low credit prices would also discourage investment in new decarbonization projects because those projects become less economic if the credits they generate have to be sold at a significant discount to the carbon price.

The risk of credit oversupply arises from a mismatch between the emissions that face a carbon price under TIER and the reductions in Alberta's industrial emissions that are required for consistency with the ERP targets. If TIER stringency increases by 2% per year, regulated facilities will pay a carbon price on a maximum of 44 Mt of emissions in 2030.<sup>1</sup> This also represents the maximum demand for credits, since the only reason to buy credits is to avoid paying the carbon price. However, Alberta industry needs to reduce emissions by 70 Mt to achieve the ERP targets. A 70 Mt supply of credits meeting 44 Mt of demand is very likely to lead to a crash in credit prices.

This finding suggests that TIER's proposed system design for the 2023-2030 period would not meet the federal benchmark criterion requiring that provincial and territorial pricing systems "maintain a marginal pricing signal equivalent to the minimum national carbon pollution price" by ensuring that demand for credits exceeds supply during all compliance periods.

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<sup>1</sup> As part of our analysis, we also assume that the high-performance benchmark for electricity production is reduced to zero by 2035.

For credit demand to exceed supply within the TIER system while achieving the emission reductions targeted in the ERP, stringency would need to increase by 5% per year, rather than 2% as currently envisioned. This is a much more ambitious tightening rate, with cost and competitiveness implications for Alberta industry. The federal and Alberta governments should work together to understand whether additional measures need to be taken to balance the competitiveness of Alberta industry against the costs of a more stringent TIER system.

Investment in emissions reduction is unpredictable, and decarbonization will probably not be linear. Therefore, we recommend that Alberta and the federal government agree to mitigate the risk of an oversupply of TIER credits by adopting an “adaptive” approach to tightening the system. TIER should adjust the tightening rate each year to target the share of emissions that should face a carbon price, in order to ensure that credit demand exceeds supply. Any deviations from the target would directly impact the tightening rate for the following year. A minimum tightening rate would still apply even if the target was met.

TIER tightening should be increased beyond the proposed 2% annual rate in order to avoid an oversupply of credits. But the 2% tightening rate proposed for TIER also results in far fewer emissions facing a carbon price than under the proposed tightening trajectory of the federal OBPS. In order for TIER to apply a carbon price to a similar share of emissions as the federal OBPS, it would need to tighten at a rate between 3% and 4% per year. This is lower than the 5% proposed above but still notably higher than the 2% proposed by Alberta.

## Recommendations

1. **Alberta should adopt an “adaptive” approach for tightening the stringency of benchmarks under TIER** that gives market participants confidence that demand for credits and offsets will consistently exceed supply (i.e., net positive obligations). For example, Alberta might implement a rule to tighten benchmarks by the degree to which obligations as a share of TIER-regulated emissions deviated below a specified threshold (e.g., 10%) in the prior year.
2. **The federal government should evaluate TIER design under an ERP-consistent scenario.** To ensure equivalency with the federal carbon pricing benchmark, the federal government should require that all output-based pricing systems — including TIER — will credibly maintain net positive obligations (i.e., no oversupply of credits and offsets). Otherwise, credit prices will fall well below the carbon price, which would violate the federal benchmark’s criterion that the marginal carbon price signal be maintained in all

compliance periods. We specifically recommend that the federal government model scenarios consistent with the emissions reductions forecast in the ERP, as we have done in this paper.

3. **Alberta should work with the federal government and other provinces to address the impact of tightened TIER benchmarks on the competitiveness of emission-intensive, trade-exposed (EITE) sectors.** Tightened benchmarks will impose significantly higher costs for compliance and abatement. Measures to protect EITE sectors from unfair competition — like border carbon adjustments — may be needed to avoid carbon leakage. However, given the constraints of Canada’s federal-provincial division of powers and international trade law, such measures may require further harmonization of provincial output-based pricing systems or even a phase-out of such systems.

## Takeaways

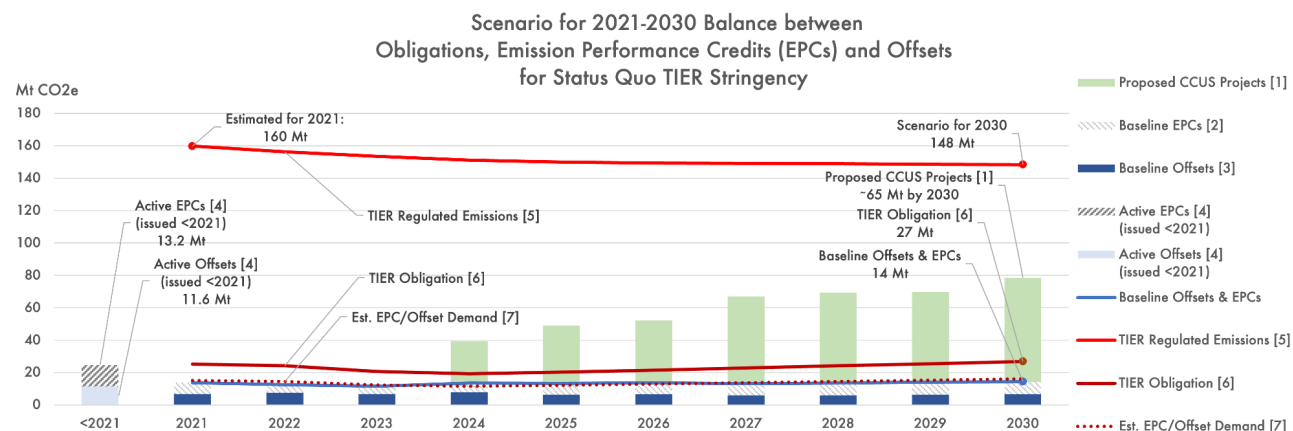
- A status-quo TIER system would result in an oversupply of offsets and credits if more than 12 Mt worth of carbon capture and storage (CCS) is built in Alberta. As illustrated in Figure 1, that's based on a conservative scenario that holds emissions constant for TIER-regulated facilities, except power generation, from 2021 to 2030 (excluding reductions from off-site CCS and other offsetting projects).
- Tightening TIER benchmarks by 2% and ramping down the electricity high-performance benchmark would oblige emitters to pay a carbon price on roughly 44 Mt of emissions by 2030 — making it possible for the system to absorb up to 44 Mt of credits and offsets. (Based on the conservative emission-reduction scenario described above.)
- For equivalence with the current federal OBPS, Alberta must tighten TIER benchmarks by 2% annually from 2023 onwards. TIER benchmarks would need to be tightened by 4% annually for equivalence with obligations under a proposed 2% annual tightening of the federal OBPS — as illustrated in Figure 2, based on the conservative emission-reduction scenario described above.
- Significant further tightening of TIER benchmarks will also be required if Alberta is to decarbonize in a way that is consistent with the 2030 ERP — which implies emission reductions of 70 Mt across Alberta industry by 2030.
- Alberta must tighten TIER's benchmarks by 5% annually from 2023 onwards and ramp-down the electricity high-performance benchmark to zero by 2035 in order to maintain the marginal carbon price signal and reduce emissions and emission intensities as projected by the 2030 ERP. This is illustrated in Figure 3.
- Tightening TIER's stringency would increase costs — either for compliance or abatement — and potentially impact the competitiveness of EITE sectors. Measures to protect EITE sectors from unfair competition — like border carbon adjustments — may be needed to avoid carbon leakage. However, given the constraints of Canada's federal-provincial division of powers and international trade law, such measures may require further harmonization of provincial output-based pricing systems or even a phase-out of such systems.
- Significant uncertainty surrounds the emission reduction outlook for large emitters in Alberta: engineering design, permitting lags, supply-chain constraints, and construction bottlenecks could prolong timelines for decarbonization projects to actually enter service.

In addition, important policies are still pending, like the proposed federal cap on oil and gas emissions and the Clean Electricity Standard.

- Given this uncertainty, Alberta should revisit and revise the tightening rate for TIER benchmarks annually. Alberta should commit to market participants that tightening will be “adaptive,” to ensure that the quantity of emissions facing a carbon price exceeds the quantity of credits and offsets available for purchase (i.e., net positive obligations).
- An “adaptive” approach could be a rule to tighten benchmarks by a specified percentage if the last year’s net obligations are less than some threshold (e.g., 10%) of TIER regulated emissions. Continually adjusting stringency to ensure that net positive obligations represent a meaningful share of emissions would help avoid credit oversupply in a way that responds to current market circumstances.



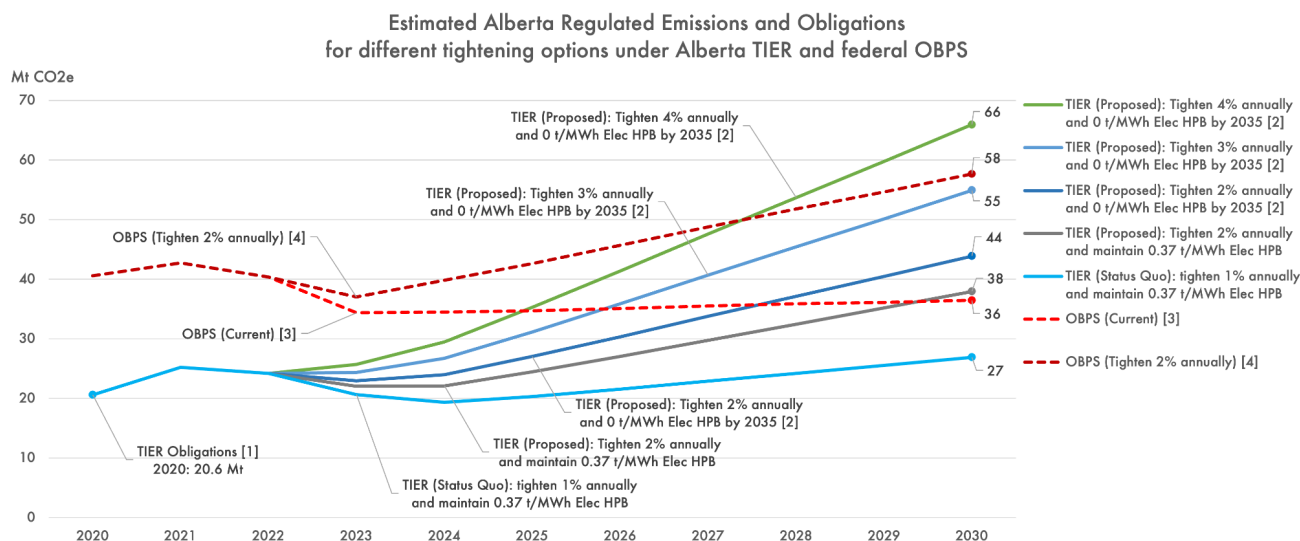
**Figure 1: Scenario for 2021-2030 balance for status quo TIER stringency**



Sources: Alberta Carbon Registries (ACR); Alberta Major Projects Inventory; company webpages; Alberta Electric System Operator (AESO) Annual Market Statistics (AMS) and Long-Term Outlook (LTO); Alberta Environment & Parks (AEP) "Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation" (TIER Report); "Draft Methodology for the Electricity Grid Displacement Factor" (EGDF); Technology Innovation and Emissions Reduction Regulation, Alta Reg 133/2019 (TIER Reg.); and "TIER Standard for Developing Benchmarks, Version 2.1" (Benchmark Standard);

Notes: [1] Proposed CCUS Projects (with respective planned capacity and in-service date) compiled from Alberta Major Projects Inventory and company webpages/press releases. [2] Projected Emission Performance Credits (EPCs) estimated based on 2020 EPCs from TIER Report, Benchmark Standard and projected generation in AESO LTO. [3] Baseline Offset projection includes: (a) offsets from existing CCUS Projects from estimated annual emission reductions over offset period in respective Project Plan (available in ACR); (b) Projected wind and solar offsets based on annual MWh renewable generation in AESO LTO at assumed 0.52 t/MWh EGDF for 2023-24 and 0.37 t/MWh thereafter, and 2021 wind generation from facilities contracted for Renewable Energy Credits or participating in Alberta's Renewable Energy Program deducted from eligible generation for future offsets; and (c) other offsets from estimated annual emission reductions over offset period in respective Project Plan (available in ACR) from, e.g., pneumatic devices, biomass, conservation cropping. [4] 13.2 Mt of active EPCs and 11.6 Mt of active offsets (i.e., not retired, pending retirement or cancelled) issued prior to 2021 in ACR as of August 2022. [5] TIER Regulated Emissions aggregates estimated regulated emissions of each sector, with power generation based on generation by fuel in AESO AMS by year for 2022-30 in LTO, and other sectors estimated for 2021 based on economic driver (e.g., GDP, output, throughput) and held constant to 2030. [6] TIER Obligation estimated using annual benchmark stringency by sector (Benchmark Standard, p.41) and High-Performance Benchmark for power generation (incl. cogen). [7] TIER EPC/Offset Demand calculated as 60% of TIER Obligation (TIER Reg., s. 13(9)).

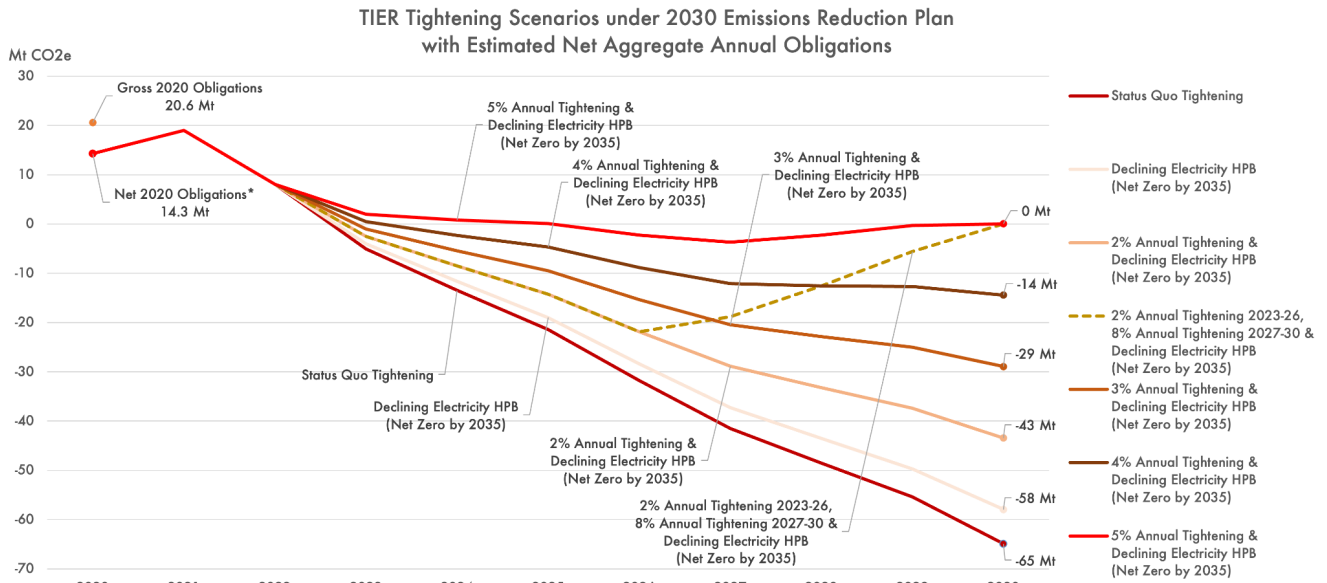
**Figure 2: GHGs and obligations for tightening options under Alberta TIER and federal OBPS**



Sources: Alberta Environment & Parks (AEP) "Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation" (TIER Report); Environment and Climate Change Canada (ECCC) "Review of OBPS Regulations: Consultation Paper" (OBPS Discussion Paper), and Regulatory Impact Analysis Statement (RIAS) for OBPS; Alberta Electric System Operator (AESO) "Net-Zero Emissions Pathways Report" (NZE); and various sources to project GHGs for scenario (as documented in text)

Notes: [1] TIER Obligations for 2020 as reported in AEP's TIER Report. [2] 0 t/MWh for Electricity HPB by 2035 assumed in AESO NZE. [3] Estimated obligation under OBPS (Current) based on scenario assumptions by sector, benchmarks for gas-fired generation (i.e., pre/post-2021, coal-to-gas), 54.4 kg/BOE for oil sands (27% below 74.9 kg/BOE oil sands emission intensity from 2019), 20% share of oil and gas GHGs and 10% share of GHGs otherwise assumed (from sector assigned stringency in RIAS). [4] 2% tightening, starting in 2023, assumed for sectors other than electricity, based on OBPS Discussion Paper (see section 3.1.2.1); however, proposed 1% tightening of OBPS benchmarks for certain sectors (e.g., cement, steel) ignored since these sectors comprise small share of Alberta GHGs these sectors (e.g., cement <1% of TIER-regulated GHGs in 2020).

**Figure 3:** TIER tightening scenarios under ECCC's ERP with estimated annual obligations and EPCs



Sources: Alberta Environment & Parks (AEP) "Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation" (TIER Report); Technology Innovation and Emissions Reduction Regulation, Alta Reg 133/2019 (TIER Reg.); "TIER Standard for Developing Benchmarks, Version 2.1" (Benchmark Standard); Environment and Climate Change Canada (ECCC) "Greenhouse Gas Reporting Program", "Greenhouse Gas National Inventory" and "2030 Emissions Reduction Plan" (ERP); and Alberta Electric System Operator (AESO) "Net-Zero Emissions Pathways"

Note: \* "Net" obligations under TIER shown here (i.e., gross obligations less emission performance credits created in given year). Based on TIER Report, Net Obligations in 2020 were 14.3 Mt. This reflects 20.6 Mt of reported (i.e., gross) obligations less 6.3 Mt of requested Emission Performance Credits.

## Introduction

Alberta is the frontline of Canada's efforts to decarbonize our economy. With 11% of Canada's population and representing 17% of Canada's economy, Alberta accounted for 38% of Canada's greenhouse gas (GHG) emissions in 2019:<sup>2</sup> 279 megatonnes (Mt) of Canada's total 738 Mt.<sup>3</sup>

In June 2022, Alberta's government launched a review of its carbon pricing system, the Technology Innovation and Emissions Reduction (TIER) Regulation.<sup>4</sup> TIER is by far the most important regime for reducing GHGs from industrial facilities in Canada. In 2020, TIER covered over 50% of GHGs from large emitting facilities across Canada: 154 Mt under TIER<sup>5</sup> relative to the total 273 Mt from Canadian large emitters.<sup>6</sup> Figure 4 illustrates the relative importance of TIER in the context of Canada's overall GHG emissions across provinces and sectors.

Alberta's review of TIER was framed by a discussion document from Alberta Environment and Parks (AEP) setting out options for modifications to the regime — particularly around increasing the stringency of TIER to ensure equivalence with the federal carbon pricing regime for industrial emitters.<sup>7</sup> This report considers potential changes to TIER, recommending heightened stringency of TIER benchmarks to accelerate Alberta's industrial decarbonization.

The present federal government has committed to ramp-up carbon pricing across Canada to \$170 per tonne by 2030 — and compliance costs under TIER in Alberta should follow suit. With this trajectory, carbon pricing will become increasingly important to company performance and will propel investments in decarbonization.

Canada also has federal legislation, the Greenhouse Gas Pollution Pricing Act (GGPPA),<sup>8</sup> in place as a nation-wide "backstop" for pricing carbon. Under the GGPPA, the Minister of Environment

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<sup>2</sup> Given the impacts on economic activity and consequently GHGs as a result of the COVID-19 pandemic, we generally use 2019 as the representative year for reporting GHGs, except where otherwise appropriate or constrained by available data. As elaborated below, this report also provides estimated TIER-regulated emissions for 2021 based on near-term data for output in different sectors and reported TIER-regulated emissions for 2020.

<sup>3</sup> Environment & Climate Change Canada. April 2022. *Canada's Official Greenhouse Gas Inventory*. Available online: <https://open.canada.ca/data/en/dataset/779c7bcf-4982-47eb-af1b-a33618a05e5b>

<sup>4</sup> Alta Reg 133/2019.

<sup>5</sup> Alberta Environment & Parks. October 2021. *Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation*. Available online: <https://open.alberta.ca/publications/alberta-industrial-greenhouse-gas-compliance>

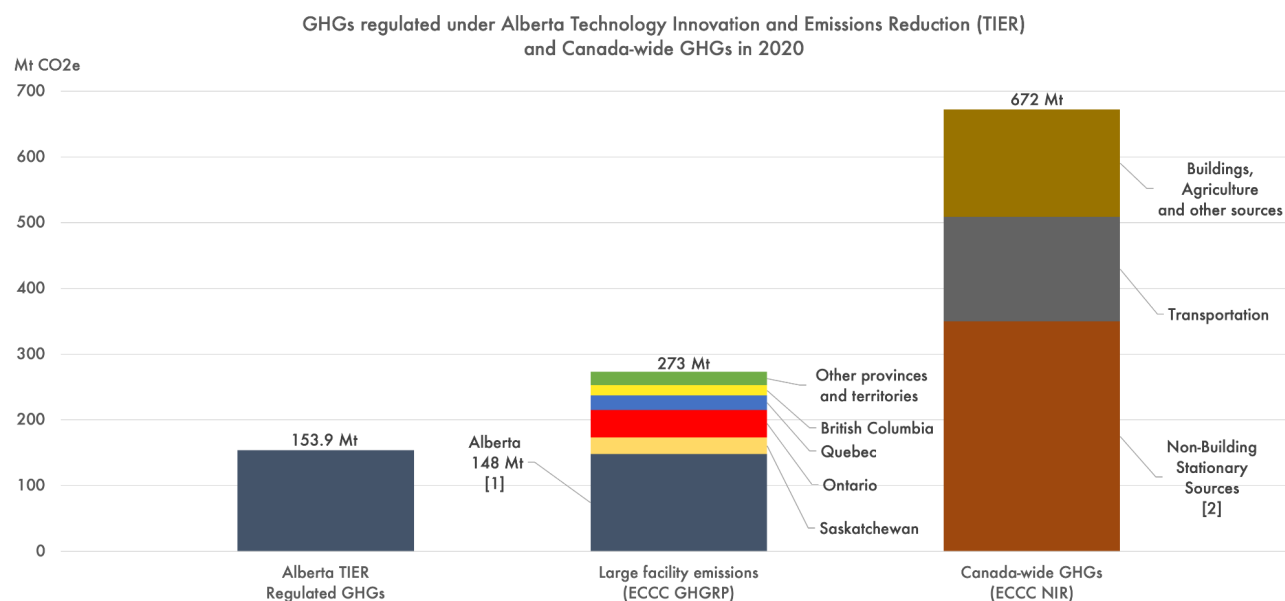
<sup>6</sup> Environment & Climate Change Canada. April 2022. *Greenhouse Gas Reporting Program (GHGRP) - Facility Greenhouse Gas (GHG) Data*. Available online: <https://open.canada.ca/data/en/dataset/a8ba14b7-7f23-462a-bdbb-83b0ef629823>

<sup>7</sup> Alberta Environment & Parks. June 2022. *Technology Innovation and Emissions Reduction Review: Discussion Document*. Available online: <https://www.alberta.ca/technology-innovation-and-emissions-reduction-regulation-review.aspx>

<sup>8</sup> SC 2018, c 12, s 186.

and Climate Change has discretion to apply part or all of the federal regime in any province where a province lacks carbon pricing or where the Minister deems a province's pricing regime of insufficient stringency. Part 2 of the GGPPA provides for an output-based pricing system (OBPS) to price GHGs from industrial emitters and authorizes regulations to establish output-based standards for different industrial activities.<sup>9</sup>

**Figure 4:** GHGs under Alberta's TIER and Canada-wide GHGs in 2020



Sources: Alberta Environment & Parks "Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation; and Environment and Climate Change Canada (ECCC) Greenhouse Gas National Inventory Report (NIR) and Greenhouse Gas Reporting Program (GHGRP)

Notes: [1] Alberta TIER Regulated GHGs exceed large facility GHGs in Alberta because TIER includes facilities that do not report to ECCC GHGRP (e.g., aggregated oil & gas) [2] Aggregate of GHGs from Oil & Gas, Electricity, Heavy Industry, Waste, Coal Production and Light Manufacturing sectors in ECCC NIR

Environment and Climate Change Canada (ECCC) published its update to the federal benchmark for equivalence of provincial carbon pricing systems for 2023-2030 in August 2021.<sup>10</sup> The federal benchmark prescribes minimum criteria for the Minister to recognize either provincial cap-and-trade and price-based systems (including output-based pricing-type systems) as equivalent. The criteria include that a provincial pricing system cover an equivalent share of GHGs from combustion, maintain a marginal price signal aligned with the federal pricing

<sup>9</sup> *Output-Based Pricing System Regulations*, SOR/2019-266

<sup>10</sup> Environment & Climate Change Canada. August 2021. Update to the Pan-Canadian Approach to Carbon Pollution Pricing 2023-2030. Available online:

<https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/carbon-pollution-pricing-federal-benchmark-information/federal-benchmark-2023-2030.html>

schedule (i.e., \$170/tonne by 2030) and be sufficiently stringent that compliance obligations exceed available tradable units (i.e., credits and offsets).

Additionally, ECCC launched consultations in 2021 around the OBPS — specifically to evaluate the OBPS stringency required for Canada’s GHG reduction goals while addressing competitiveness and so-called “carbon leakage” for emissions-intensive trade-exposed industries.<sup>11</sup> With ECCC’s consultations on the OBPS now concluded, provincial governments and other stakeholders await ECCC’s decision on revisions to the OBPS. These OBPS revisions will complement ECCC’s earlier update to its federal carbon pricing benchmark in March 2021, which set out the minimum national stringency criteria to assess provincial carbon pricing systems, including output-based pricing systems like TIER.<sup>12</sup>

To frame the federal government’s overall GHG targets, ECCC published its 2030 Emissions Reduction Plan (ERP) in May 2022. The ERP detailed ECCC’s projections for Canada-wide reductions by sub-sector and province as well as certain economic assumptions (e.g., production of oil and gas) underlying these projections.<sup>13</sup> Notably, along with emission reductions across sectors, ECCC’s ERP nonetheless projects growth in production of oil and gas, including from the oil sands, until 2030.

Alongside other emission reduction options, carbon capture and storage (CCS) is recognized as a critical pathway for decarbonizing Alberta industry. The federal government introduced support for CCS in the form of investment tax credit (ITC) in the latest budget, and the recently published federal Clean Fuel Regulations (CFR)<sup>14</sup> provide for CCS to create credits under that regime (albeit notably excluding carbon captured from exported petroleum).

As well, Alberta’s government has advanced several initiatives to promote roll-out of CCS projects — including request for full project proposal (RFPP) process to establish open-access CCS hubs in Alberta’s industrial heartland. CCS projects are presently eligible for offsets under TIER, and AEP’s

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<sup>11</sup> Environment & Climate Change Canada. December 2021. Review of the OBPS Regulations: Consultation paper. Available online: <https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/output-based-pricing-system/2022-review-consultation.html>

<sup>12</sup> Environment & Climate Change Canada. March 2021. *Update to the Pan-Canadian Approach to Carbon Pollution Pricing 2023-2030*. Available online:

<https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/carbon-pollution-pricing-federal-benchmark-information/federal-benchmark-2023-2030.html>

<sup>13</sup> Environment & Climate Change Canada. May 2022. 2030 Emissions Reduction Plan: Clean Air, Strong Economy. Available online: <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030.html>

<sup>14</sup> SOR/2022-140.

discussion document for the TIER review contemplates streamlining of the crediting regime for CCS.

However, for CCS and other long-lived investments in industrial decarbonization, project developers face ongoing uncertainty around the value of incentives from carbon pricing over a given project's lifetime. Without sufficient stringency such that emitters' aggregate obligations exceed the availability of credits and offsets under TIER, an oversupply would reduce prices for credits and offsets — and consequently depress returns for any decarbonization investment. Therefore, if carbon pricing under TIER is to fulfill its full potential for incenting decarbonization, project developers require either confidence in the future balance between obligations and offsets/credits under TIER to sustain prices or other guarantees from governments, such as contracts for difference.<sup>15</sup>

As well, ECCC published discussion papers concerning both (a) a Clean Electricity Standard (CES) in support of a net-zero electricity sector, in March 2022<sup>16</sup> and (b) implementing a cap on GHGs from the oil and gas sector in July 2022.<sup>17</sup> ECCC envisions such measures as functioning independently of provincial carbon pricing systems, but the reductions required will alter the supply and demand dynamics for offsets/credits and thus influence decarbonization incentives.

For pathways to decarbonize and GHG projections for Alberta electricity, the Alberta Electric System Operator (AESO) both published its regular long-term outlook in 2021 (2021 AESO LTO)<sup>18</sup> and a Net-Zero Emissions Pathways Report in 2022 (NZE Report).<sup>19</sup> The AESO's NZE Report considered three distinct scenarios, which differed primarily in the mix of renewables versus abated thermal units (primarily combined-cycle generation with CCS). These reports from AESO provide detailed year-by-year projections of GHGs from electricity in Alberta.

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<sup>15</sup> See: Dale Beugin and Blake Shaffer. June 2021. "The Climate Policy Certainty Gap and How to Fill It," C.D. Howe Institute. Available online: <https://www.cdhowe.org/intelligence-memos/buegin-shaffer-%E2%80%93-climate-policy-certainty-gap-and-how-fill-it>

<sup>16</sup> Environment & Climate Change Canada. March 2022. A clean electricity standard in support of a net-zero electricity sector: discussion paper. Available online: <https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/achieving-net-zero-emissions-electricity-generation-discussion-paper.html>

<sup>17</sup> Environment & Climate Change Canada. July 2022. Options to cap and cut oil and gas sector greenhouse gas emissions to achieve 2030 goals and net-zero by 2050 — discussion document. Available online: <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/oil-gas-emissions-cap/options-discussion-paper.html>

<sup>18</sup> Alberta Electric System Operator. June 2021. AESO 2021 Long-term Outlook. Available online: <https://www.aeso.ca/grid/forecasting/>

<sup>19</sup> Alberta Electric System Operator. July 2022. AESO Net-Zero Emissions Pathways Report. Available online: <https://www.aeso.ca/market/net-zero-emissions-pathways/>

In this report, we leverage these various sources to consider the required tightening for benchmarks under TIER for equivalence with the federal OBPS and maintaining the marginal price signal (i.e., net positive obligations across TIER-regulated facilities), both for a “conservative” scenario of emission reduction and significantly deeper reductions under ECCC’s ERP.

This report proceeds by discussing the following:

1. An overview of TIER’s current design
2. The risk of credit oversupply under the current TIER design
3. TIER tightening required to align with the federal OBPS
4. TIER tightening required to avoid credit oversupply under ECCC’s ERP
5. A proposal for an “adaptive” approach for tightening TIER benchmarks
6. Competitiveness considerations
7. Recommendations
8. Conclusion



## 1. TIER emissions and obligations

The most recent snapshot of compliance with the TIER Regulation was the summary for 2020, released in October 2021 by Alberta Environment & Parks (AEP).<sup>20</sup>

Notably, 2020 was the first year that TIER applied to Alberta's large emitters. TIER replaced the previous Carbon Competitiveness Incentive Regulation (CCIR, in effect from 2018 to 2019), which, in turn, replaced the Specified Gas Emitter Regulation (SGER, in effect from mid-2007 to 2017).

SGER, CCIR, and TIER all are "output-based carbon pricing systems," under which facilities in certain trade-exposed industries receive credits at a specified emission intensity benchmark (i.e., emissions per unit of output). The consequence of output-based carbon pricing is that an emitter only pays the carbon price to the extent that its emission intensity exceeds the applicable benchmark.

Reciprocally, if an emitter's emission intensity is below the benchmark, that emitter accrues Emission Performance Credits (EPCs), which can be traded to other emitters to satisfy their compliance obligations. A notable present limitation under TIER is that only 60% of a given facility's "true-up obligation" can be satisfied by its retirement of purchased EPCs or offsets.<sup>21</sup>

As well, under TIER (as well as for its predecessor pricing systems), emission offsets for specified projects that reduce emissions are available in accordance with quantification protocols published by AEP.<sup>22</sup> These offsets can be transferred and applied against an emitter's compliance obligation under TIER.

Projects eligible for offsets include wind and solar electricity generation, CO<sub>2</sub> capture and storage in deep saline aquifers and through enhanced oil recovery (EOR), reduced methane from pneumatic devices, vent gas reductions, waste heat recovery, and landfill gas capture. Projects for conservation cropping (until 2021) and tillage system management (until 2011) projects were also previously significant sources of offsets.

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<sup>20</sup> Alberta Environment & Parks. Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation. Available online: <https://open.alberta.ca/publications/alberta-industrial-greenhouse-gas-compliance>

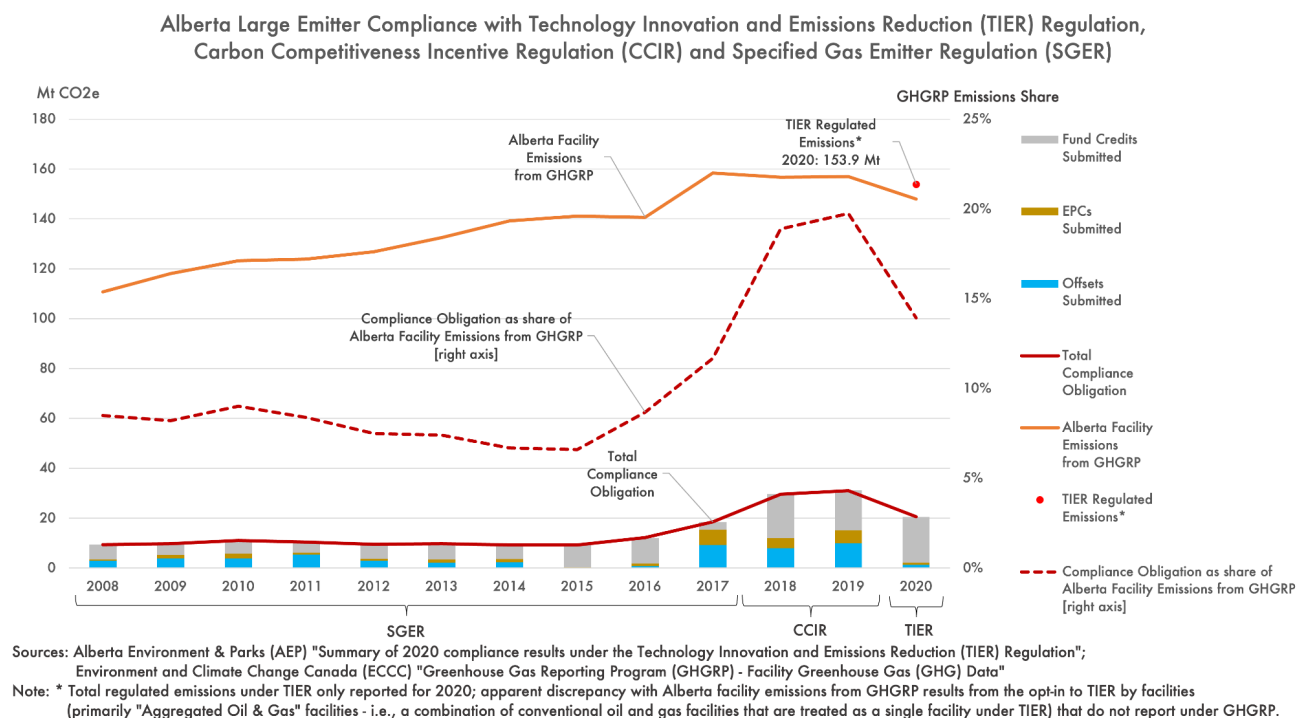
<sup>21</sup> TIER Regulation, s.13(9).

<sup>22</sup> See: Alberta Environment & Parks. Alberta Emission Offset System. Available online: <https://www.alberta.ca/alberta-emission-offset-system.aspx>



Figure 5 exhibits compliance obligations (i.e., the aggregate of emitters' excess emissions, net of credit allocations for output) under SGER, CCIR, and TIER since 2008, as well as showing the EPCs and offsets submitted and fund payments to satisfy emitters' obligations.

**Figure 5:** Alberta large emitter compliance with TIER, CCIR, and SGER



As well, Figure 5 shows the total emissions regulated under TIER and the aggregate emissions of Alberta large emitters (defined as emitting over 10,000 tonnes of CO<sub>2</sub>e emissions annually), which report to Environment and Climate Change Canada (ECCC) under the Greenhouse Gas Reporting Program (GHGRP).<sup>23</sup>

Plotting the annual compliance obligation as a share of the GHGRP reported emissions, Figure 5 shows the relative stringency of obligations under TIER versus CCIR and SGER for Alberta's large emitters. Relative to CCIR, the compliance obligation under TIER (i.e., the TIER obligation) comprises a significantly lower share of large emitters' emissions.

<sup>23</sup> Interestingly, AEP reported 153.9 Mt of emissions regulated by TIER in 2020, which exceeds the 147.9 Mt of emissions from large emitters in Alberta reported in ECCC's GHGRP dataset. This discrepancy results from the opt-in to TIER by facilities (primarily "Aggregated Oil & Gas" facilities — i.e., a combination of conventional oil and gas facilities that are treated as a single facility under TIER) that would not have reported under the GHGRP.

TIER's lower stringency relative to CCIR results from the shift from a product-specific benchmark under CCIR to a facility-specific benchmark under TIER.<sup>24</sup> While under CCIR all facilities producing a given product received credits at the same benchmark, the applicable facility-specific benchmark under TIER is based on a given facility's historic emission intensity — although an efficient facility can opt into a “high-performance benchmark” (HPB).

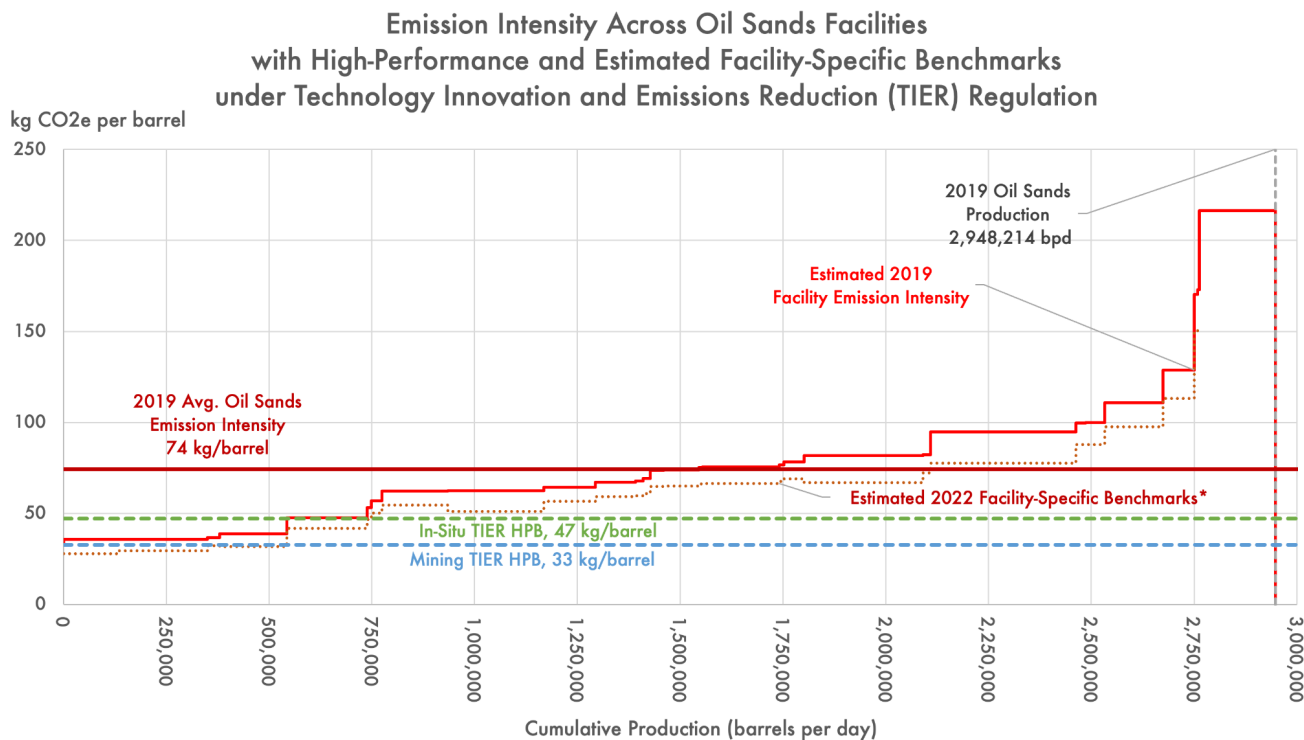
Notably, while facility-specific benchmarks apply to other sectors under TIER, all power generation facilities still face a product-specific HPB, set at the “best gas” emission intensity of 370 kg CO<sub>2</sub>e/MWh (i.e., that of a low-emission combined cycle gas turbine power plant).

Using the example of the oil sands, Figure 6 below shows how facility-specific benchmarks under TIER differ from product-specific benchmarks (i.e., the illustrated HPB). The TIER obligation shown above in Figure 5 represents the aggregate of all large emitters' net obligations (i.e., the difference between each facility's actual emission intensity and its respective benchmark multiplied by the facility's output).

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<sup>24</sup> For elaboration concerning the economic implications of TIER's move to a facility-specific benchmark, see: Grant Bishop. August 2019. Too TIER-ed? Alberta's Proposed Re-design of Carbon Pricing for Large Emitters. C.D. Howe Institute. Available online: <https://www.cdhowe.org/public-policy-research/too-tier-ed-albertas-proposed-re-design-carbon-pricing-large-emitters>

**Figure 6:** Emission intensity across oil sands facilities and TIER benchmarks



Sources: Environment and Climate Change Canada (ECCC) Greenhouse Gas Reporting Program and National Greenhouse Gas Inventory; ECCC 2030 Emissions Reduction Plan (2022 ECCC Plan); Alberta Energy Regulator (AER) Statistical Reports ST-3, ST-39 and ST-53; Technology Innovation and Emissions Reduction Regulation, Alta Reg 133/2019 (Schedule 2); and Alberta Environment and Parks (AEP) TIER Standard for Developing Benchmarks

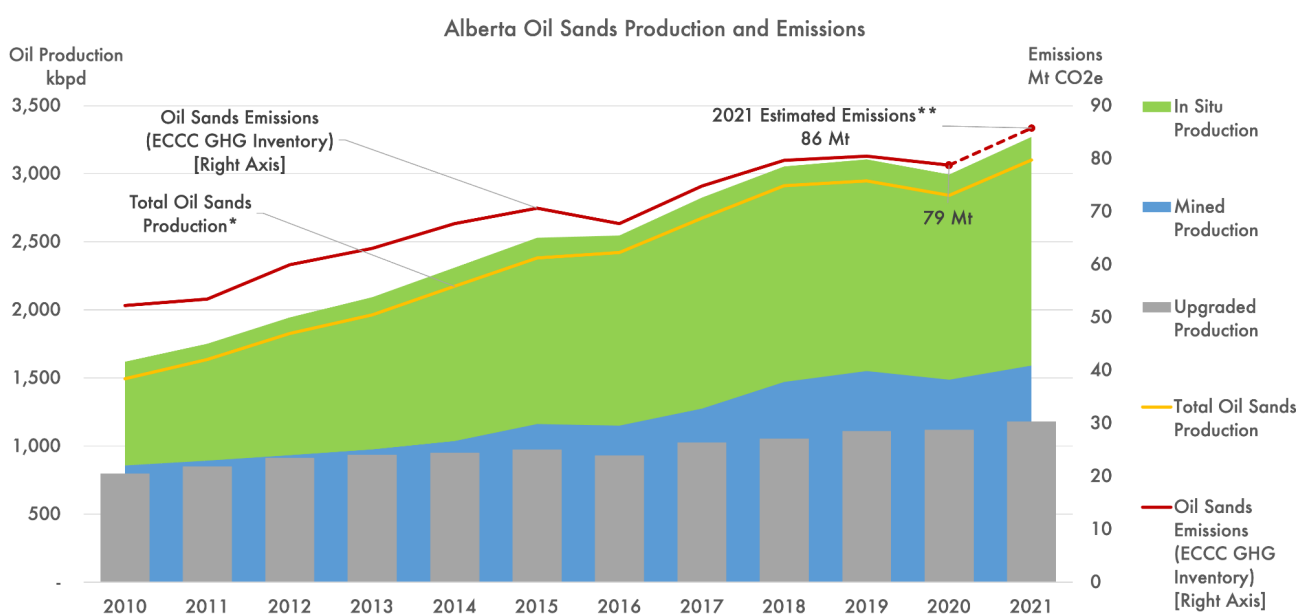
Note: \* Facility-Specific Benchmark for 2022 shown as 82% of 2019 emission intensity for mining and upgrading facilities (i.e., 18% target reduction) and 88% of 2019 emission intensity for in situ facilities (i.e., 12% target reduction) based on TIER Standard (see: p.32-41).

Importantly, because of the exceptional impacts on demand and production from the COVID-19 pandemic, the 2020 datapoint for TIER-regulated emissions provides an anomalously depressed starting point for estimating TIER-regulated facilities' obligations for the coming decade.

Specifically, based on data from ECCC's GHGRP, emissions from Alberta's large emitters declined by almost 6% from 2019 to 2020. Therefore, unless TIER-regulated facilities made significant improvements to emission intensity during 2020, the pickup in Alberta's economic activity during 2021 points to a likely increase in large emitters' emissions during 2021. Therefore, to construct a more accurate starting point for obligations under TIER over the coming decade, we have estimated the total TIER regulated emissions in 2021 using assumed drivers for emissions in each sector.

For example, using data from ECCC's National GHG Inventory, Figure 7 shows Alberta's oil sands emissions since 2010 alongside production from each of mining, in situ, and upgrading, compiled from reporting by the Alberta Energy Regulator (AER). Using the calculated emission intensity for each of mining, in situ, and upgrading in 2020 and 2021 data on production, we estimate the 2021 emissions for the oil sands overall at 86 Mt, an increase of nearly 9% from 79 Mt in 2020 (based on ECCC's national greenhouse gas inventory).<sup>25</sup>

**Figure 7:** Alberta oil sands production and emissions



Sources: Alberta Energy Regulator (AER) "ST3: Alberta Energy Resource Industries Monthly Statistics (Oil)"; and Environment and Climate Change Canada (ECCC) "Canada's Official Greenhouse Gas Inventory"

Notes: \* Total Production differs from sum of In Situ and Mined Production because bitumen consumed by Further Processing (see AER ST3).

\*\* 2021 Estimated Emissions based on calculated 2020 emission intensities for in situ, mining and upgrading applied to respective 2021 production.

For Alberta power generation, Alberta's generation mix continued its shift from coal generation to gas and renewables. We have estimated the TIER-regulated emissions for electricity in 2021 using the emission intensity for each fuel type from the latest 2021 AESO LTO and applying these

<sup>25</sup> An important caveat is that oil sands operators may have improved emission intensity during 2021. Indeed, overall oil sands emission intensity declined by 21% from 2010 to 2020, particularly driven by improved emissions performance for upgrading. For in situ production, a driver of in situ emission intensity is the steam-to-oil ratio (i.e., given the use of steam for extraction and emissions from steam production) and decline of the aggregate steam-to-oil ratio in 2021 will likely translate into improved emission intensity for in situ production. However, emission intensity remained relatively flat over 2016-2020 and this scenario aims for relatively conservative assumptions about emissions reduction. Therefore, awaiting updated emissions reporting from oil sands operators for 2021, we use the 2020 emission intensities for each activity to estimate oil sands emissions for 2021, estimating a year-over-year increase of nearly 9% to 85.8 Mt.

to generation by fuel type from the AESO's Annual Market Statistics (AMS) for 2021. This results in a continued decline in electricity emissions from 2020 to 2021.

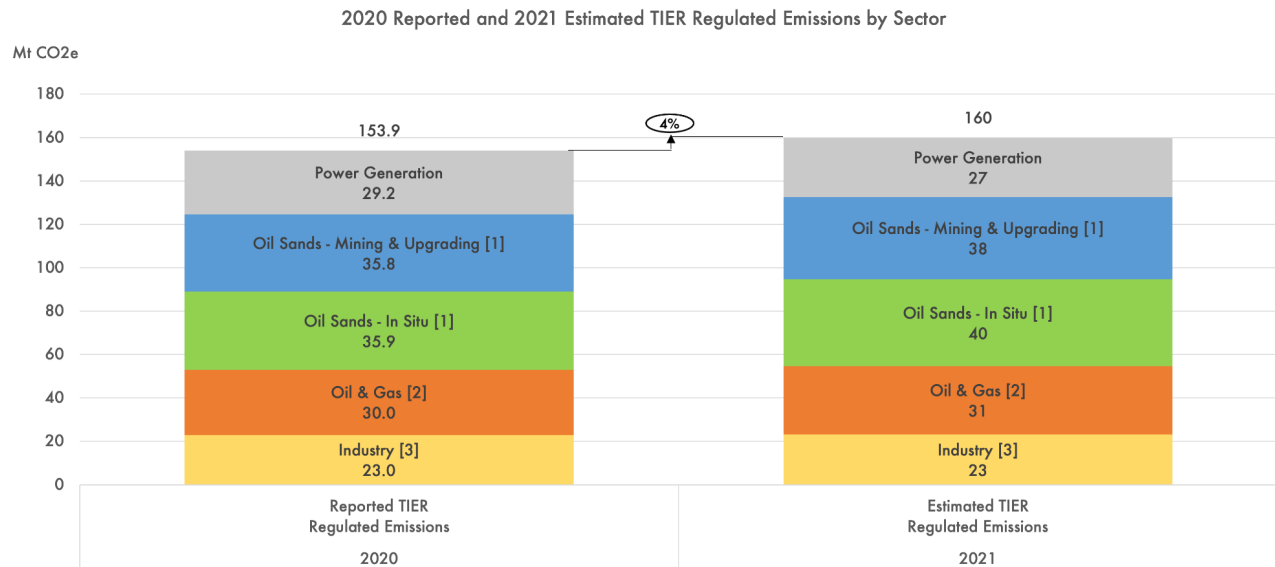
For other industrial sectors in Alberta, we estimate emissions in 2021 based on the year-over-year change in an assumed economic driver for each sector's emissions, detailed in Table A below, then applying that to the given sector's TIER Regulated Emissions in 2020. Figure 8 exhibits the aggregate estimate of 160 Mt for 2021 TIER Regulated Emissions, representing an increase of 4% from 2020.

**Table A:** Assumed 2020-21 change in TIER regulated emissions by industry

	2020 Reported TIER Regulated Emissions (Mt)	2021 Estimated TIER Regulated Emissions (Mt)	Assumed Y/Y % Chg.	Basis for Assumed Y/Y % Chg. in TIER Regulated Emissions
<b>Oil &amp; Gas</b>	<b>30.0</b>	<b>31.4</b>	<b>4.6%</b>	
Aggregated Oil & Gas	18.6	19.1	2.9%	Conventional Crude Oil Production (from AER ST3)
Gas Plant	6.6	7.1	7.6%	Gas Plant Dispositions (from AER ST13A)
Pipeline	4.8	5.1	7.1%	Pipeline throughput volumes at key points for NGTL, Alliance and Foothills systems (from CER pipeline throughput data)
<b>Industry</b>	<b>22.1</b>	<b>22.3</b>	<b>0.7%</b>	
Manufacturing	2.1	2.2	4.4%	Real GDP for Manufacturing [NAICS 31-33] in Alberta
Chemical	9.0	8.7	-3.3%	Real GDP for Basic chemical manufacturing [NAICS 3251] in Alberta
Coal Mines	0.2	0.2	-23.1%	Alberta Raw Coal Production (from AER ST26)
Agroindustry	0.3	0.2	-30.8%	Real GDP for Crop and animal production [NAICS 11A] in Alberta
Food Processing	0.3	0.3	9.2%	Real GDP for Food manufacturing [NAICS 311] in Alberta
Fertilizer	6.2	6.6	5.9%	Real GDP for Pesticide, fertilizer and other agricultural chemical manufacturing [NAICS 3253] in Alberta
Refining	4.0	4.1	2.5%	Western Canada Refinery Runs (from CER Weekly Crude Runs)
Landfill	0.0	0.0	3.9%	Real GDP for Waste management and remediation services [NAICS 562] in Alberta
Distilling	0.0	0.0	-45.0%	Real GDP for Wineries and distilleries [NAICS 3121A] in Alberta

Sources: Alberta Energy Regulator (AER) statistical reports (ST3, ST13A, ST26);  
Canada Energy Regulator (CER) Weekly Crude Run Data and Pipeline Throughput and Capacity Data; and  
Statistics Canada (Table 36-10-0402-01: Gross domestic product (GDP) at basic prices, by industry, provinces and territories)

**Figure 8:** 2020 Reported and 2021 estimated TIER regulated emissions



Source: Alberta Environment & Parks (AEP) "Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation" (TIER Report)

Notes: [1] Note that TIER-regulated emissions shown here for oil sands (as reported in TIER Report and estimated for 2021 based on production growth) and these values differ from 2020 reported emissions for oil sands from "Canada's Official Greenhouse Gas Inventory" Environment (and 2021 estimate shown in Figure 8).

[2] "Oil & Gas" includes Aggregated Oil & Gas, Gas Plant and Pipeline regulated emissions.

[3] "Industry" includes regulated emissions of all other sectors in AEP TIER Report

(Manufacturing, Chemical, Coal Mines, Agroindustry, Food Processing, Fertilizer, Refining, Landfill and Distilling).

## 2. Oversupply of offsets relative to obligations under TIER's status quo stringency

In order to maintain the marginal carbon price signal, the aggregate obligation under TIER must exceed available offsets and credits. That is, if the available offsets and credits exceed the aggregate obligation, the oversupply will depress the price any TIER-regulated facility is willing to pay for offsets/credits.

Put another way, TIER's stringency creates demand from TIER-regulated facilities for offsets and credits to the extent of the aggregate annual obligation. Without expectation that the aggregate annual obligation will consistently exceed offsets and credits (i.e., a net positive aggregate annual obligation), project developers will not have an incentive to invest in emission reduction projects (e.g., CCS).

In turn, the stringency of benchmarks under TIER will determine the aggregate annual obligation across TIER-regulated facilities. Since TIER involves facility-specific benchmarks, any facility's obligation follows from emission intensity relative to its benchmark.

Therefore, to illustrate the risk of an oversupply, we present a "what if" scenario with relatively conservative emission reductions by TIER-regulated facilities from 2021 to 2030. Using this conservative scenario illustrates TIER-regulated facilities' maximum obligations for credits and offsets. If offsets and credits exceed TIER-regulated facilities' aggregate annual obligations even in this conservative scenario, the risk for an oversupply of offsets would be exacerbated if emitters achieve emission intensity reductions.

For this conservative scenario, we assume that Alberta's electricity generation follows the trajectory for emission reduction projected in the AESO LTO and that TIER-regulated facilities' emissions and emission intensities otherwise remain constant at 2021 levels.<sup>26</sup>

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<sup>26</sup> Various companies that operate TIER-regulated facilities have announced commitments to reduce emissions by 2030. Perhaps most notably, the Oil Sands Pathways to Net Zero consortium of major oil sands operators (subsequently renamed the Pathways Alliance) have announced a plan to reduce emissions by 22 Mt by 2030 — split between 8.5 Mt of CCS and 13.5 Mt of other improvements. However, for this conservative scenario, we ignore such commitments in order to illustrate the maximum obligations across TIER-regulated facilities for the years to 2030 (i.e., assuming no reductions in emissions and emission intensities, except for electricity).

Under this conservative scenario, Alberta's electricity sector reduces emissions by 12 Mt from 2021 to 2030.<sup>27</sup> Emissions from all other sectors are held constant at those estimated for 2021. Therefore, from the estimated 160 Mt across TIER-regulated facilities in 2021, the 12 Mt reduction in this conservative scenario means TIER-regulated emissions only decline by 7% from 2021 to 2030.

Again, the objective of assuming such a small reduction of TIER-regulated emissions in this conservative scenario is to illustrate the maximum size of aggregate annual obligations under TIER's status quo stringency.

Figure 9 illustrates this conservative scenario and the resulting obligations after applying the status quo stringencies to each sector's emissions.

Briefly, since facilities' emission intensities also remain constant in this conservative scenario,<sup>28</sup> the aggregate annual obligation is estimated as a share of each sector's emissions in the given year, based on the status quo emission reduction target applicable to the given sector. In Appendix A to this report, we explain our approach for estimating and projecting the obligations of each sector in future years, leveraging the 2020 obligations reported for each sector by AEP.

To model obligations under TIER, we assume that the stringency of facility-specific benchmarks (rather than the respective high-performance benchmark for a given sector) determine the given sector's respective obligations (except for electricity, where no facility-specific benchmarks apply). Since Alberta does not report the benchmarks applicable to each facility (i.e., whether facility-specific or opted into the respective high performance benchmark for a given product), we make the simplifying assumption throughout the modelling in this report that the facility-specific benchmarks determine the compliance obligations for any sector.

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<sup>27</sup> Throughout this report's text and exhibits, we specify values for greenhouse gas emissions from our modelling rounded to the nearest megatonne (Mt). This precision is provided to allow the reader to follow our reasoning, understand the correspondence between exhibits, and compare implications between policy options. However, as elaborated in the report, our estimates rely on various assumptions and, as explained, are intended to illustrate the logic underlying our conclusions about different policy options — particularly the required tightening of TIER benchmarks for equivalence with the federal OBPS and maintaining TIER's marginal price signal while reducing emissions in-line with ECCC's ERP. By providing this precision, we do not intend to overstate the accuracy of our modelling, and all emissions estimates should be understood as approximate.

<sup>28</sup> The assumption of constant emissions and constant emission intensities across TIER-regulated facilities (except electricity) means that no production growth occurs in these sectors from 2021 to 2030. This assumption is certainly unrealistic, but the purpose in this section is to explore "what if" for obligations in this conservative scenario for emission reductions. TIER-regulated emissions and obligations would be proportionately greater if assuming production growth and no change in emission intensity.



For electricity, the high-performance benchmark of 370 kg CO<sub>2</sub>e/MWh is applied to the projections for power generation by fuel type from the AESO LTO. Oil sands mining and upgrading facilities face facility-specific benchmarks with an emission intensity reduction target starting at 17% in 2021 and tightening in subsequent years.<sup>29</sup> For other sectors (i.e., in situ oil sands and other industry), emission intensity reduction targets started in 2020 at 10% such that the facility-specific benchmark was set at 90% of the facility's historical emissions intensity. The reduction target increases at 1% per year (i.e., reduction targets of 11% in 2021, 12% in 2022, etc.).

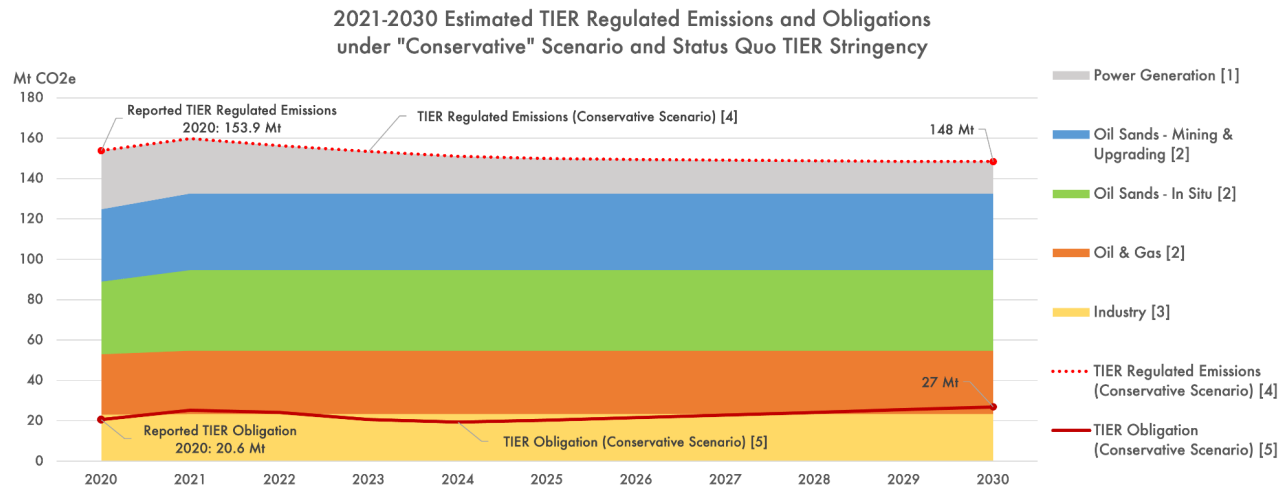
Notably, in Figure 9, we separately show demand for EPCs and offsets, calculated as 60% of the aggregate annual obligations across TIER-regulated facilities. This follows from the limitation in the TIER Regulation, s.13(9) that only 60% of a given facility's obligation can be satisfied by its retirement of purchased EPCs or offsets. As proposed in AEP's discussion document for the TIER review, this 60% usage limit could be eliminated so that TIER-regulated facilities can apply EPCs and offsets to satisfy their annual obligations, and this change would increase demand for EPCs and offsets. Therefore, for the remainder of this report, we consider only the aggregate annual obligation relative to available offsets and EPCs (i.e., rather than estimating demand for EPCs and offsets as the obligation multiplied by 60%).

These annual obligations are shown below in Figure 11 along with a baseline projection of offsets and credits (estimated as 12-14 Mt annually from 2021 to 2030). In this conservative scenario, TIER-regulated facilities face roughly a 27 Mt aggregate obligation in 2030. Therefore, relative to the baseline projection for offsets, TIER-regulated facilities' aggregate annual obligation could absorb approximately 13 Mt additional offsets (e.g., from additional CCS) in 2030.

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<sup>29</sup> See section 8.2 of the "Standard for developing benchmarks" under TIER (Version 2.1). Available online at: <https://open.alberta.ca/publications/standard-developing-benchmarks-tier-version-2>

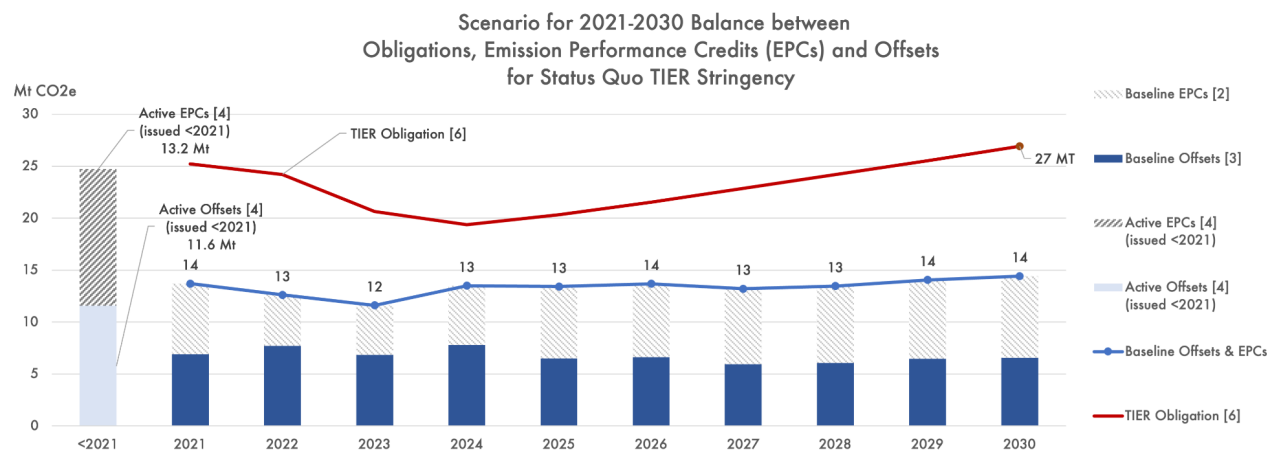
**Figure 9: 2021-30 Scenario for TIER obligations and EPC/offset demand**



Sources: Alberta Environment & Parks (AEP) "Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation" (TIER Report); Technology Innovation and Emissions Reduction Regulation, Alta Reg 133/2019 (TIER Reg.); "TIER Standard for Developing Benchmarks, Version 2.1" (Benchmark Standard); Environment and Climate Change Canada (ECCC) "Greenhouse Gas Reporting Program" and "Greenhouse Gas National Inventory"; and Alberta Electric System Operator (AESO) "Long-Term Outlook" (LTO)

- Notes: [1] Power Generation GHGs from "Clean-Tech Scenario" from AESO LTO.  
 [2] Oil Sands and Oil & Gas GHGs (including Aggregated Oil & Gas, Gas Plant and Pipeline) based on respective avg. ann. percentage GHG reductions from 2019-30 from ECCC ERP.  
 [3] "Industry" includes regulated emissions of all other sectors in AEP TIER Report and based on average annual percentage GHG reductions from 2019-30 from ECCC ERP.  
 [4] TIER Regulated Emissions aggregates estimated regulated emissions of each sector.  
 [5] TIER Obligation estimated using annual benchmark stringency by sector (Benchmark Standard, p.41) and High-Performance Benchmark for power generation (incl. cogen), assuming no reduction in emission intensity for given sector, except for power generation (based on AESO LTO).

**Figure 10:** Scenario for 2021-2030 balance for status quo TIER stringency



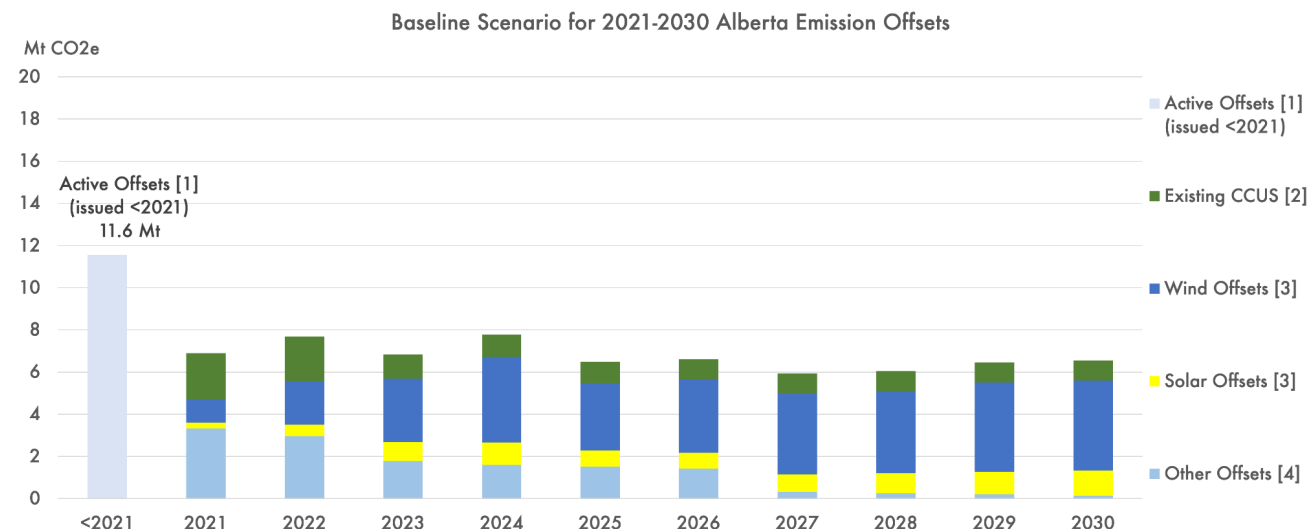
Sources: Alberta Carbon Registries (ACR); Alberta Major Projects Inventory; company webpages; Alberta Electric System Operator (AESO) Annual Market Statistics (AMS) and Long-Term Outlook (LTO); Alberta Environment & Parks (AEP) "Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation" (TIER Report); "Draft Methodology for the Electricity Grid Displacement Factor" (EGDF); Technology Innovation and Emissions Reduction Regulation, Alta Reg 133/2019 (TIER Reg.); and "TIER Standard for Developing Benchmarks, Version 2.1" (Benchmark Standard);

Notes: [1] Projected Emission Performance Credits (EPCs) estimated based on 2020 EPCs from TIER Report, stringency from Benchmark Standard and projected cogeneration in AESO LTO.  
[2] Baseline Offset projection includes: (a) offsets from existing CCS Projects from estimated annual emission reductions over offset period in respective Project Plan (available in ACR); and 2021 wind generation from facilities contracted for Renewable Energy Credits or participating in Alberta's Renewable Energy Program deducted from eligible generation for offsets; and (c) other offsets from estimated annual emission reductions over offset period in respective Project Plan (available in ACR) from, e.g., pneumatic devices, biomass, conservation cropping.  
[3] 13.2 Mt of active EPCs and 11.6 Mt of active offsets (i.e., not retired, pending retirement or cancelled) issued prior to 2021 in ACR as of August 2022.  
[4] TIER Obligation estimated using annual benchmark stringency by sector (Benchmark Standard, p.41) and High-Performance Benchmark for power generation (incl. cogen) applied to assumed TIER Regulated Emissions aggregates estimated regulated emissions of each sector, with power generation based on generation by fuel in AESO AMS and LTO, and other sectors estimated for 2021 based on economic driver (e.g., GDP, output, throughput) and held constant to 2030.

The baseline projection for offsets in Figure 10 is based on existing offset projects presently registered with the Alberta Carbon Registries (ACR) and generation from wind and solar under the AESO's LTO (Clean-Tech Scenario). Specifically, the ACR publishes each offset project's project plan and verification of registered offsets. Each project's plan details the offset period for the project and provides an estimate of the annual emissions reductions and offsets that the developer expects the project to yield over its offset period.

Based on the present quantification protocols and offset projects, Figure 11 exhibits a baseline scenario for emission offsets from 2021 to 2030. For "Existing CCS" and "Other Offsets", the annual totals aggregate emission reduction estimates from the active offset projects in the ACR. "Existing CCS" includes deep aquifer sequestration (specifically, Shell's Quest project) and EOR (including Enhance Energy's Clive project and AlphaBow's Prentiss projects). "Other offsets" includes projects under other quantification protocols.

**Figure 11: Baseline Scenario for 2021-2030 Alberta emission offsets**



Sources: Alberta Carbon Registries (ACR); Alberta Electric System Operator (AESO) Long-Term Outlook (LTO); and Alberta Environment & Parks (AEP) Proposed Electricity Grid Displacement Factor (EGDF)

Notes: [1] 15.9 Mt of active offsets (i.e., not retired, pending retirement or cancelled) issued prior to 2021 in ACR as of August 2022.

[2] Offsets from existing CCUS Projects from estimated annual emission reductions over offset period in respective Project Plan (available in ACR).

[3] Projected wind and solar offsets based on annual MWh renewable generation in AESO LTO at assumed 0.52 t/MWh EGDF for 2023-24 and 0.37 t/MWh thereafter, and 2021 wind generation from facilities contracted for Renewable Energy Credits or participating in Alberta's Renewable Energy Program deducted from eligible generation for offsets.

[4] Other Offsets from estimated annual emission reductions over offset period in respective Project Plan (available in ACR) from, e.g., pneumatic devices, biomass, conservation cropping.

For projected offsets from wind and solar, we use generation projections from AESO's LTO (Clean-Tech Scenario)<sup>30</sup> and assume that renewables create offsets based on the Electricity Grid Displacement Factor (EGDF) for the next two years<sup>31</sup> and thereafter at the TIER High-Performance Benchmark (HPB) for electricity of 0.37 t/MWh.<sup>32</sup>

<sup>30</sup> A significant share of wind generation (approximately 3.7 TWh in 2021) is ineligible for offsets under TIER — either because the respective facilities have otherwise contracted their environmental attributes (i.e., Renewable Energy Credits used in other jurisdictions), participated in AESO's Renewable Electricity Program (REC) or the facility entered operation prior to the present project window for offsets. We have used metered volumes from AESO for these facilities to estimate the 3.7 TWh generation by that offset ineligible capacity in 2021 and removed that amount from the projected wind generation under the AESO's LTO for our estimate of future offset eligible wind generation.

<sup>31</sup> From its present 0.53 tonnes CO<sub>2</sub>e MWh, the updated EGDF will be 0.52 tonnes CO<sub>2</sub>e per MWh starting in 2023 (and assumed to persist until the next two-year review in 2025). The updated EGDF represents an equal weighting of a calculated "operating margin" of 0.80 t/MWh and a "build margin" of 0.23 t/MWh. As background on the EGDF: although other power generation (including hydro and earlier wind and solar) is credited at a High-Performance Benchmark of 0.370 tonnes CO<sub>2</sub>e per MWh, new wind and solar receive offsets for the offset crediting period based on a specified EGDF. The EGDF is intended to reflect emissions reductions through displacement of electricity emissions from both an "operating margin" and a "build margin". The EGDF is reviewed and updated every two years, using a methodology and the three prior years of data to estimate the "operating margin" (as the average emission intensity of marginal generation) and the "build margin" (as the production-weighted average emission intensity of newly built generation). (See: Alberta Environment & Parks. June 2022. Methodology for the electricity displacement factor. Available online: <https://open.alberta.ca/publications/methodology-for-the-electricity-displacement-factor>)

<sup>32</sup> The EGDF should decline significantly as renewable projects comprise a greater share of newly built generation and the emission intensity of marginal generation decreases with the conversion of Alberta's coal-fired power plants to gas-fired generation. These

For the risk of offset/credit oversupply relative to obligations, we consider new CCS as the primary source of additional potential offsets. Building this CCS capacity is important for decarbonizing Alberta's industry and, if offsets and credits exceed obligations under TIER (i.e., an oversupply of offsets and credits), developers would lack financial incentive for CCS build-out.

Figure 12 exhibits the planned CCS capacity in Alberta: planned CCS projects (including 8.5 Mt of CCS announced by the Oil Sands Pathways for Net-Zero consortium, subsequently renamed the Pathways Alliance) could add roughly 65 Mt of new sequestration capacity by 2030. We emphasize that this potential capacity represents an unlikely full build-out case: although we take no position here on the likelihood of any particular project's success or stated in-service date, we highlight that this total aggregates announced projects that may overlap or may not ultimately be constructed.

Notably, this planned CCS capacity significantly exceeds the federal target of at least 15 Mt CCS capacity by 2030,<sup>33</sup> as well as the implied projection in ECCC's ERP for approximately 30 Mt CCS capacity by 2030.<sup>34</sup>

As background on this tabulated CCS capacity, we have compiled the target in-service date and proposed capacity for each project from Alberta's Major Projects Inventory and various company websites/press releases. The map in Figure 13 shows the location of existing and proposed CCUS projects (including CO<sub>2</sub> pipelines), as well as exhibiting the 2019 GHG emissions from oil sands facilities operated by members of the Pathways Alliance and other facilities in Alberta that emitted over 50 kt CO<sub>2</sub>e in 2019.

Notably, certain of these proposed projects may involve overlapping CCS capacity (i.e., targeting capture of GHGs from the same facilities). Specifically, various of these proposed projects in Figure 11 respond to the Alberta government's first request for full project proposal (RFPP) for

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coal-to-gas conversions will greatly reduce the emission intensity of assets operating at the margin: while Alberta's coal generation had emission intensities at around 1 T/MWh, TransAlta expects its conversions to reduce emission intensity by nearly 50% and Capital Power expects that its re-powered Genesee units will achieve 0.36 T/MWh. However, for the duration of their offset crediting period, wind and solar projects will benefit from "lock-in" of the EGDF at the time when the offset project is approved (see section 1.11 of AEP's offset standard).

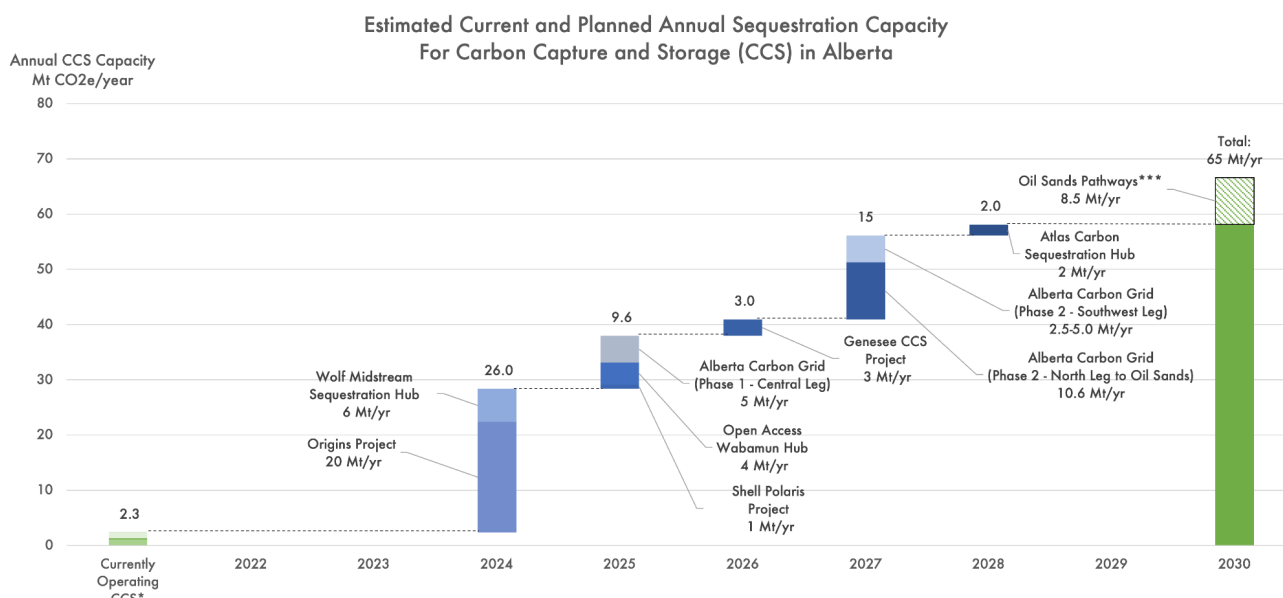
<sup>33</sup> ECCC ERP at page 200. Available online: [https://publications.gc.ca/collections/collection\\_2022/eccc/En4-460-2022-eng.pdf](https://publications.gc.ca/collections/collection_2022/eccc/En4-460-2022-eng.pdf)

<sup>34</sup> ECCC's ERP attributes 12.9% of the 2030 emission reduction to CCS (see page 194) that would equate to approximately 30 Mt of reductions (i.e., applied to the -239 Mt 2005-2030 reduction in the bottom-up analysis on page 193 of ECCC's ERP).

open-access CCS hubs in Alberta's industrial heartland.<sup>35</sup> As well, certain in-service dates may be overly aggressive, and certain projects may not be completed or may achieve less actual sequestration than planned.

Despite emphasizing these caveats, Figure 12 presents the cumulative capacity if projects achieve their proposed capacity and their aspired in-service date. This total capacity of planned CCS projects significantly exceeds the 27 Mt of estimated aggregate annual obligations across TIER-regulated facilities in 2030 in our conservative scenario. Again, assuming baseline offsets and credits of 14 Mt in 2030 (as shown in Figure 9), TIER-regulated facilities' obligations could only absorb roughly 13 Mt of additional offsets (e.g., new CCS) in our conservative scenario with the status quo TIER stringency.<sup>36</sup>

**Figure 12:** Estimated current and planned CCS in Alberta



Sources: Alberta Carbon Registries (ACR); Alberta Major Projects Inventory; Quest annual reports, Oil Sands Pathways to Net Zero and various company webpages/press releases

Notes: \* Assumed annual sequestration by Shell's Quest CCS (1.1 Mt/yr) from 2019 annual report; Enhance Energy's Clive EOR (1.0 Mt/yr) and

AlphaBow's Prentiss EOR (0.2 Mt/yr) estimated from emission offset credits vintage in ACR; WhiteCap's Joffre EOR (0.04 Mt/yr) from company disclosure.

\*\* Certain CCUS projects not included: Rockpoint/Inter Pipeline Sequestration Hub (6.0 Mt/yr) and Meadowbrook Hub Project have not published in-service dates.

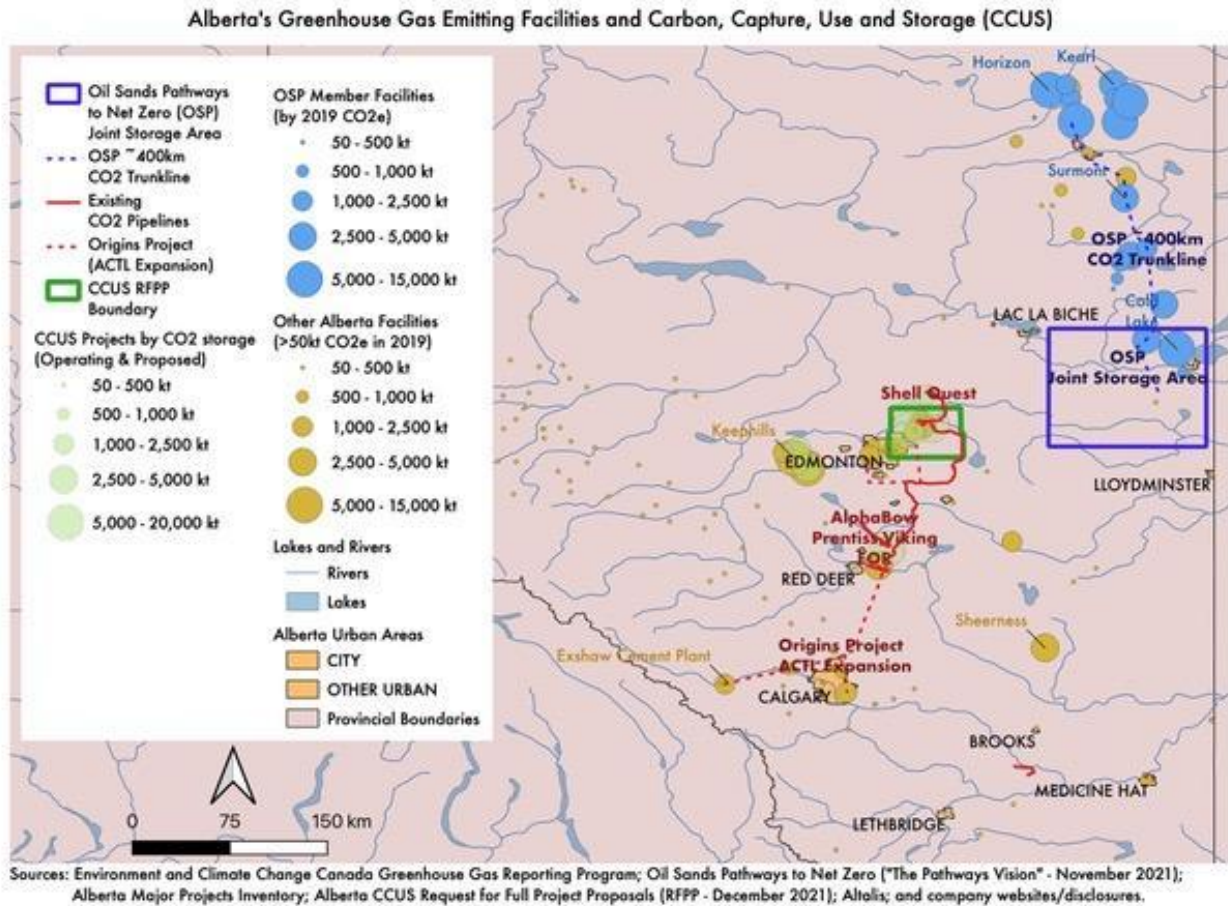
\*\*\* Oil Sands Pathways to Net Zero ("Pathways Vision") does not specify in-service date but assumed by 2030.

<sup>35</sup> See: Government of Alberta. March 2022. Safely reducing emissions in the Industrial Heartland (Press Release). Available online: <https://www.alberta.ca/release.cfm?xID=82247CDC3B56D-F1A4-516F-837019C76FAF75DF>

<sup>36</sup> As discussed above, we assume the elimination of the 60% limit for credit/offset use to satisfy annual obligations.



**Figure 13:** Map of Alberta's large GHG emitters and CCS projects



### 3. Estimated tightening required for TIER equivalence with federal OBPS

The issue of TIER equivalence with the federal OBPS has two critical aspects: first, the tightening of benchmarks under TIER required for equivalence with the total compliance obligation if the OBPS were applied in Alberta (i.e., the “counterfactual” OBPS compliance obligation); and, second, the stringency required for a total compliance obligation under TIER that is likely to exceed potential offsetting projects that would be economic under the carbon price and other incentives.

To evaluate the first aspect of TIER’s likely equivalence with the counterfactual OBPS compliance obligation, we use the conservative “what if” scenario for each sector’s emissions from 2021 to 2030, and estimate:

- 1) the compliance obligation if the OBPS was applied to those GHGs by sector
  - a) with the present OBPS product-based benchmarks, and
  - b) with product-based benchmarks, except for electricity, tightened by 2% annually (as proposed in the OBPS discussion paper); and
- 2) the compliance obligation for key tightening options proposed in the TIER discussion document — specifically:
  - a) tightening the facility-specific benchmarks under TIER at 2% annually, and
  - b) tightening the high-performance benchmark (HPB) for electricity.

A 2% annual tightening for the OBPS starting in 2023 is based on proposed tightening of the product-based benchmarks (excepting that for electricity) in the OBPS discussion paper.<sup>37</sup> From the OBPS discussion paper, the aim of this tightening is to ensure sufficient demand for credits in the OBPS and thereby sustain the marginal carbon price incentive, taking into account expected improvements in response to the carbon price and other supporting measures.

Notably, the OBPS discussion paper proposes to not tighten the electricity benchmarks and instead achieve net-zero electricity generation through other measures. As well, while the OBPS discussion paper proposes a 1% tightening of OBPS benchmarks for certain sectors (e.g., cement,

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<sup>37</sup> Environment & Climate Change Canada. 2021. Review of the OBPS Regulations: Consultation paper at section 3.1.2.1. Available online: <https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/output-based-pricing-system/2022-review-consultation.html>



steel, aluminum), we ignore this potentially distinct tightening because those sectors contribute only a small share of Alberta's GHG emissions.<sup>38</sup>

To compute the counterfactual OBPS compliance obligation, we estimate the net share of GHGs that would be priced after allocations for the given sector. For electricity, we use the projections of generation by fuel type from AESO's LTO (Clean-Tech Scenario) and apply the different benchmarks to the estimated technology and vintage of gas-fired generation.<sup>39</sup> For the oil sands, we expressly use the difference between the 2019 emission intensity for oil sands extraction (i.e., based on ECCC's national GHG inventory and illustrated above in Figure 6) and the product-specific benchmark for bitumen extraction in Schedule 1 of the OBPS regulations to estimate the current counterfactual OBPS compliance obligation — calculated as 27% of current oil sands emissions.<sup>40</sup> For other sectors, based on ECCC's explanation for the formulation of the OBPS benchmarks, we assume that the current counterfactual compliance obligation under the current OBPS is 20% of oil and gas emissions and 10% of emissions of other "Industry" sectors based on the existing allocations under OBPS for the key industries regulated under TIER.<sup>41</sup>

Figure 14 illustrates the comparative obligations under the different OBPS and TIER tightening options alongside overall emissions across TIER-regulated facilities under this conservative scenario. Specifically, alongside counterfactual obligations under the federal OBPS, Figure 14

<sup>38</sup> For example, based on ECCC's GHGRP data for 2020, cement manufacturing facilities in Alberta emitted only 1.4 Mt, and this represents less than 1% of TIER-regulated GHGs in 2020.

<sup>39</sup> Unlike TIER, which applies a single high-performance benchmark to power generation, the federal OBPS applies different benchmarks for gas-fired generation depending on whether the generation is by a facility that: (1) enters service or expands in 2021 or after, (2) was in service prior to 2021, or (3) used coal for generation in 2018 (see: Output-Based Pricing System Regulations, SOR/2019-266, s.36.1, 36.2 and 41(2)). Therefore, our estimate of the counterfactual obligations for Alberta facilities under the OBPS applies these separate benchmarks to the estimated corresponding generation from the AESO LTO (Clean-Tech Scenario) projections. We estimate generation from pre-2021 gas-fired capacity based on historical generation from the AESO's Annual Market Statistics and calculate the generation from new post-2021 gas-fired capacity for future years by deducting the estimated pre-2021 gas-fired generation from the AESO LTO projection of gas-fired generation. We assume that all coal-to-gas generation in the AESO LTO receives credits based on the declining coal-fired generation benchmark under the OBPS.

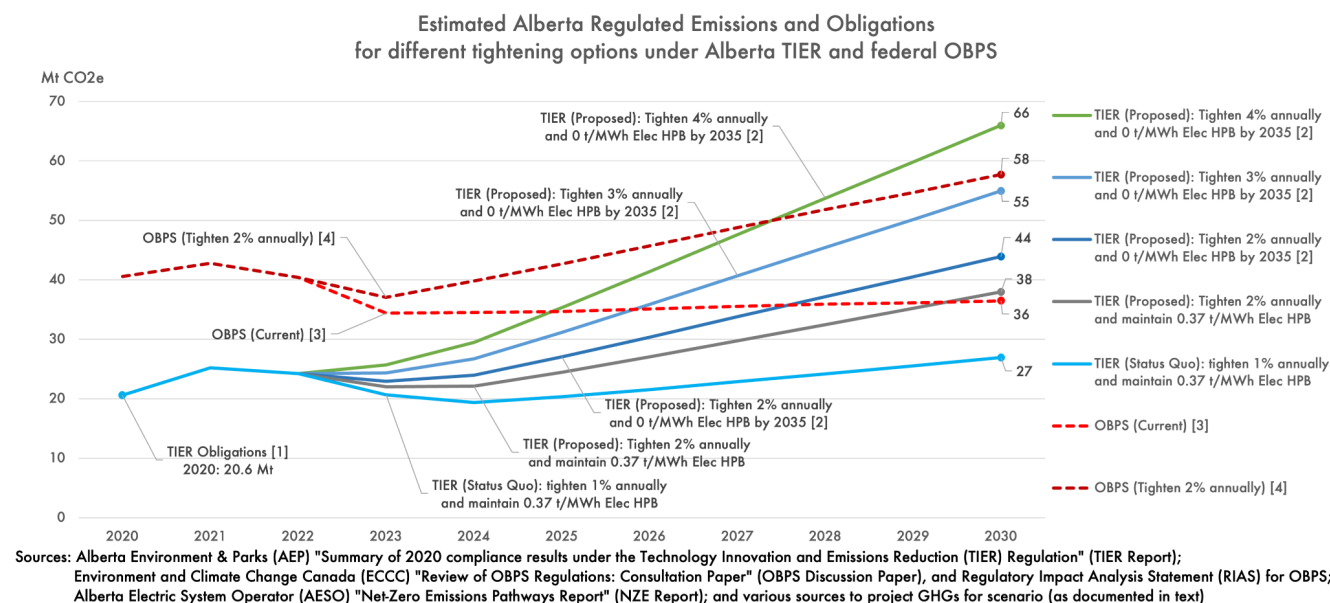
<sup>40</sup> From ECCC's GHG Inventory, the 2019 emission intensity for oil sands extraction is 74 kg CO<sub>2</sub>e/barrel and the benchmark for bitumen extraction is specified at 54.4 kg CO<sub>2</sub>e/barrel in Schedule 1 of the OBPS Regulations. Therefore, the difference is 27% of the current emission intensity (assumed unchanged in 2021 from 2019).

<sup>41</sup> This is based on the approach to establishing benchmarks under the OBPS Regulations — specifically, benchmarks are set at 80% of the production-weighted emission intensity for oil and natural gas extraction/processing and 90% of the production-weighted emission intensity for the sectors comprising most of Alberta's TIER-regulated emissions from "Industry" (i.e., petrochemicals, fertilizers, petroleum refineries are set at 90% stringency while cement is 95% and pulp and paper is 80%). See: Regulatory Impact Analysis Statement, Canada Gazette, Part II, vol. 153, No. 14, July 10, 2019, pp. 5387-88 and 5391. Available online:

<https://gazette.gc.ca/rp-pr/p2/2019/2019-07-10/pdf/g2-15314.pdf>

explores different tightening rates for TIER benchmarks and the potential ramp-down of the high-performance benchmark for electricity to zero by 2035.<sup>42</sup>

**Figure 14:** Tightening options under Alberta TIER and federal OBPS



Notes: [1] TIER Obligations for 2020 as reported in AEP's TIER Report. [2] 0 t/MWh for Electricity HPB by 2035 assumed in AESO NZE Report. [3] Estimated obligation under OBPS (Current) based on scenario assumptions by sector, benchmarks for gas-fired generation (i.e., pre/post-2021, coal-to-gas), 54.4 kg/BOE for oil sands (27% below 74.9 kg/BOE oil sands emission intensity from 2019), 20% share of oil and gas GHGs and 10% share of GHGs otherwise assumed (from sector assigned stringency in RIAS). [4] 2% tightening, starting in 2023, assumed for sectors other than electricity, based on OBPS Discussion Paper (see section 3.1.2.1); however, proposed 1% tightening of OBPS benchmarks for certain sectors (e.g., cement, steel) ignored since these sectors comprise small share of Alberta GHGs these sectors (e.g., cement <1% of TIER-regulated GHGs in 2020).

As shown, we estimate obligations under TIER for its status quo stringency are significantly below the counterfactual obligations under the current federal OBPS.

As well, TIER must also be tightened by 2% annually in order to achieve an equivalent obligation in 2030 to the current OBPS stringency. However, although this proposed tightening of TIER benchmarks should bring the annual obligation under TIER approximately in-line with the current OBPS by 2030, Figure 14 also shows that obligations under TIER would remain below those under a current OBPS for the horizon to 2030. That is, the proposed tightening should

<sup>42</sup> AEP's discussion document does not propose a specific path for the electricity high-performance benchmark (HPB) under TIER; however, we explore the option for a ramp-down from the present 370 kg/MWh to zero by 2035 (i.e., as opposed to an earlier year) based on the assumed path for the electricity HPB in AESO's NZE Report (see page 30: <https://www.aeso.ca/assets/AESO-Net-Zero-Emissions-Pathways-Report-July7.pdf>) and the federal target of net zero electricity in 2035 under its proposed "Clean Electricity Standard" (see: <https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/achieving-net-zero-emissions-electricity-generation-discussion-paper.html#toc5>). An option for further increasing obligations under TIER would be to ramp-down the electricity HPB more steeply (i.e., to zero in an earlier year).

make TIER roughly equivalent with the current OBPS by 2030, but TIER would remain less stringent than the current OBPS over the 2023-29 interval.

Figure 14 illustrates the greater annual obligation under TIER with the tightening proposed in AEP's discussion document (i.e., 2% annual tightening and ramp-down of electricity HPB to zero by 2035) compared with that under TIER's status quo stringency. Under the tightened TIER for this conservative scenario, the aggregated annual obligation across TIER-regulated facilities in 2030 would be roughly 44 Mt compared with roughly 27 Mt under TIER's status quo stringency.

This implies that this proposed tightening of TIER stringency would yield an additional roughly 17 Mt of aggregate annual obligations to absorb offsets from off-site CCS and other offsets. Assuming baseline offsets and credits of 14 Mt in 2030 (as shown in Figure 10), TIER-regulated facilities' obligations could absorb 30 Mt new offsets under the tightened TIER in 2030, compared with 13 Mt under the status quo TIER stringency in 2030, for our conservative scenario.

However, if the federal OBPS is tightened as proposed by the federal government (i.e., with product-specific benchmarks tightened by 2% annually starting in 2023), we estimate that the counterfactual obligation under that tightened OBPS for Alberta facilities would be significantly higher than under TIER — even with the stringency of facility-specific benchmarks tightened by 2% annual and the high-performance benchmark for electricity ramped-down to zero by 2035.<sup>43</sup>

We estimate that, alongside the ramp-down of TIER's electricity benchmarks to zero by 2035, tightening TIER benchmarks by 4% annually is required for equivalent obligations as those under a counterfactually tightened federal OBPS.

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<sup>43</sup> Additionally, since the OBPS does not provide credits or offsets for zero-emission power generation, this presentation understates the effective gap between obligations under TIER versus counterfactual tightened OBPS. That is, under TIER, EPCs and offsets from wind, solar and hydro generation would be created and could apply against TIER obligations; however, no such credits would be deducted from the counterfactual OBPS obligations shown here.

## 4. Estimated tightening of TIER required for emissions reductions under ECCC's ERP

Again, we have used a conservative scenario above to show that a 2% tightening, coupled with a zero HPB in electricity by 2035, would allow up to 44 Mt of emissions reductions and offsets to be absorbed in 2030 without impacting the marginal price. However, further tightening would be required to incent the full emissions reductions contemplated by the ERP.

Based on our analysis, we estimate that a 5% tightening of TIER benchmarks and ramp-down of TIER's electricity HPB to zero by 2035 would be required to achieve the reductions of emissions and emission intensities projected in ECCC's ERP while maintaining net positive aggregate annual obligations (i.e., net of credits and offsets from CCS).

This estimate addresses the second aspect of TIER stringency — specifically, the stringency required for a total compliance obligation under TIER that would be consistent with the emissions reductions contemplated under ECCC's ERP. That is, for the reductions of emissions and emission intensities projected in ECCC's ERP, what stringency is required to maintain net positive aggregate annual obligations across TIER-regulated facilities?

Notably, in our conservative scenario used in the previous sections, we assumed that, except for the electricity sector, other sectors' emissions and emission intensities remained constant. However, ECCC's ERP involves both emission reduction across sectors and assumes growth in production — which together mean a reduction in sectors' emission intensities.

Importantly, the emission reductions for each sector in ECCC's ERP impliedly include, along with on-site reductions from process and efficiency improvements, reductions from off-site CCS. Therefore, for all sectors but electricity, we use the emission reductions and production growth projected in ECCC's ERP to estimate changes in sectors' emission intensities and compute the consequent balance in the net aggregate annual obligations across TIER-regulated facilities.<sup>44</sup>

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<sup>44</sup> This "net" approach to compute aggregate annual obligations differs from the presentation in the previous sections (i.e., where obligations were not adjusted for CCS and we investigated how many offsets could be absorbed — including from CCS). This is because off-site CCS is impliedly consolidated in the emission reductions projected for each sector in ECCC's ERP (i.e., CCS reduces the captured emissions of the sector) while, for the present treatment under TIER, CCS creates offsets applicable against a facility's emissions. That is, the projections in ECCC's ERP do not allow off-site CCS to be separated out and considered as offsets that would apply against the obligations across TIER-regulated facilities. Therefore, we have adopted the approach of considering what stringency would produce net positive aggregate annual obligations for the projections in ECCC's ERP. This also has the advantage of being agnostic to whether those reductions occur through on-site process improvements or CCS.

Appendix A explains the calculations for obligations under TIER, based on projected emissions reduction, assumed production growth and the extent of benchmark tightening.<sup>45</sup> For each sector, Table B exhibits the assumed annual production growth and emissions reductions, as well as the implied change in emission intensity, from 2021-30.

Briefly, for petroleum production from oil sands and of oil and natural gas, we use the respective change in production from 2019 to 2030 projected in ECCC's ERP. For "Industry", we assume production grows at 2.5% annually — equivalent to projected annual GDP growth from 2021 to 2030 in ECCC's ERP. For power generation, ECCC's ERP does not provide projections for electricity emissions or generation by province. Therefore, for the evolution of Alberta power generation, we use the "dispatch dominant scenario" from the AESO's Net-Zero Emissions Pathways (NZE) report, and assume this reconciles with the national-level projection for electricity emissions in ECCC's ERP.

**Table B:** Assumed 2021-30 changes under ECCC's ERP

Assumed changes from 2021 to 2030 under Environment & Climate Change Canada 2030 Emission Reduction Plan				
	Production Y/Y % Chg.	Emissions Y/Y % Chg.	Emission Intensity % Chg.	Assumption for production growth
Industry*	2.5%	-4.9%	-49.0%	GDP growth (ECCC ERP, Table 6.1)
Oil & Gas*	1.6%	-5.8%	-49.5%	Oil and natural gas production (ECCC ERP, Table 6.2)
Oil Sands*	3.0%	-4.6%	-50.0%	Oil sands production (ECCC ERP, Table 6.2)
Power Generation*	1.4%	-14.4%	-78.3%	Dispatch dominant scenario generation (AESO NZE)

Sources: \* Environment & Climate Change Canada (ECCC) 2030 Emissions Reduction Plan (ERP); and  
 \*\* Alberta Electric System Operator (AESO) Net-Zero Emissions Pathways (NZE) report

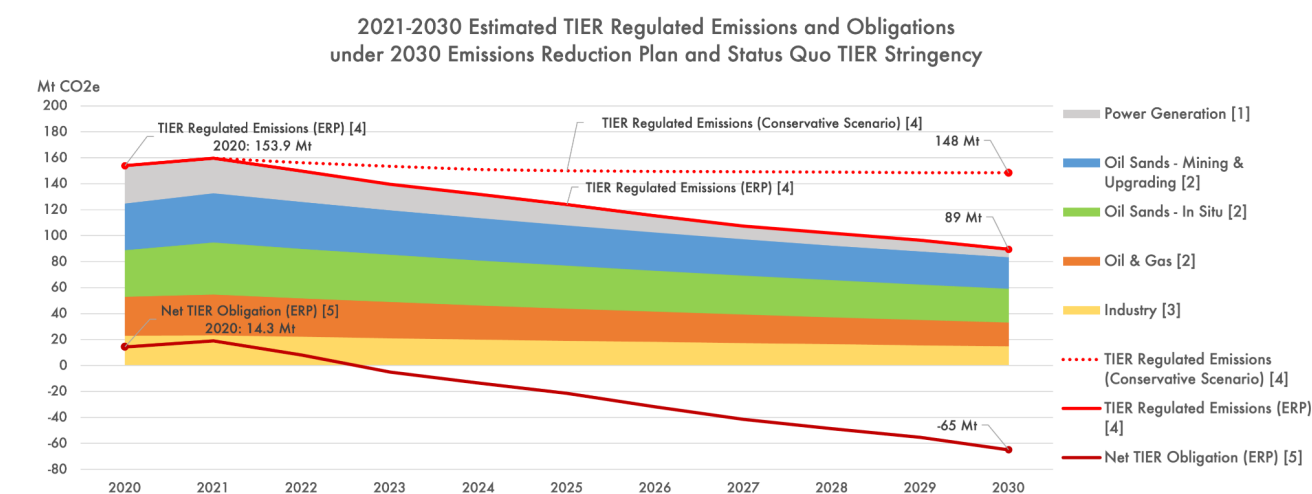
Using the estimated emissions and reduced emission intensity for each sector in a given year, computed based on ECCC's ERP (and, for electricity, AESO's NZE Report), we then estimate the obligations under TIER for the particular stringency.

Figure 15 illustrates the estimated TIER-regulated emissions and the net aggregate annual obligations for the status quo TIER stringency. For comparison, Figure 15 also shows TIER-regulated emissions under our conservative scenario, exhibiting the much deeper reductions projected in ECCC's ERP — with 89 Mt estimated across TIER-regulated facilities in 2030 under ECCC's ERP compared with 148 Mt under our conservative scenario.

<sup>45</sup> As noted above, since Alberta does not report the benchmarks applicable to each facility (i.e., whether facility-specific or opted into the respective high performance benchmark for a given product), we make the simplifying assumption throughout the modelling in this report that the facility-specific benchmarks determine the compliance obligations for any sector.

Figure 15 shows that, for the reductions of emissions and emission intensities projected in ECCC's ERP, the net aggregate annual obligations under TIER's status quo stringency would be negative from 2023 onwards.<sup>46</sup> That is, for the emissions reductions and production growth projected in ECCC's ERP, available offsets and EPCs would be oversupplied relative to obligations across TIER-regulated facilities under TIER's status quo stringency.

**Figure 15:** Estimated TIER regulated emissions and obligations under ECCC's ERP and status quo stringency



Sources: Alberta Environment & Parks (AEP) "Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation" (TIER Report); Technology Innovation and Emissions Reduction Regulation, Alta Reg 133/2019 (TIER Reg.); "TIER Standard for Developing Benchmarks, Version 2.1" (Benchmark Standard); Environment and Climate Change Canada (ECCC) "Greenhouse Gas Reporting Program", "Greenhouse Gas National Inventory" and "2030 Emissions Reduction Plan" (ERP); and Alberta Electric System Operator (AESO) "Net-Zero Emissions Pathways"

Notes: [1] Power Generation GHGs from "Dispatch Dominant Scenario" from AESO Net-Zero Emissions Pathways.  
[2] Oil Sands and Oil & Gas GHGs (including Aggregated Oil & Gas, Gas Plant and Pipeline) based on respective avg. ann. percentage GHG reductions from 2019-30 from ECCC ERP.  
[3] "Industry" includes regulated emissions of all other sectors in AEP TIER Report and based on average annual percentage GHG reductions from 2019-30 from ECCC ERP.  
[4] TIER Regulated Emissions aggregates estimated regulated emissions of each sector.  
[5] Net TIER Obligation estimated using annual benchmark stringency by sector (Benchmark Standard, p.41) and High-Performance Benchmark for power generation (incl. cogen), assuming reduction in emission intensity for given sector based on ECCC ERP - specifically, 2019-30 changes in GHGs and production (Industry assumed as GDP growth - i.e., 2.5% Y/Y) - and, in contrast with earlier figures, obligations shown here on "net" basis (i.e., deducting EPCs created in given year and net of off-site offsets from CCS that reduce facilities' GHGs).

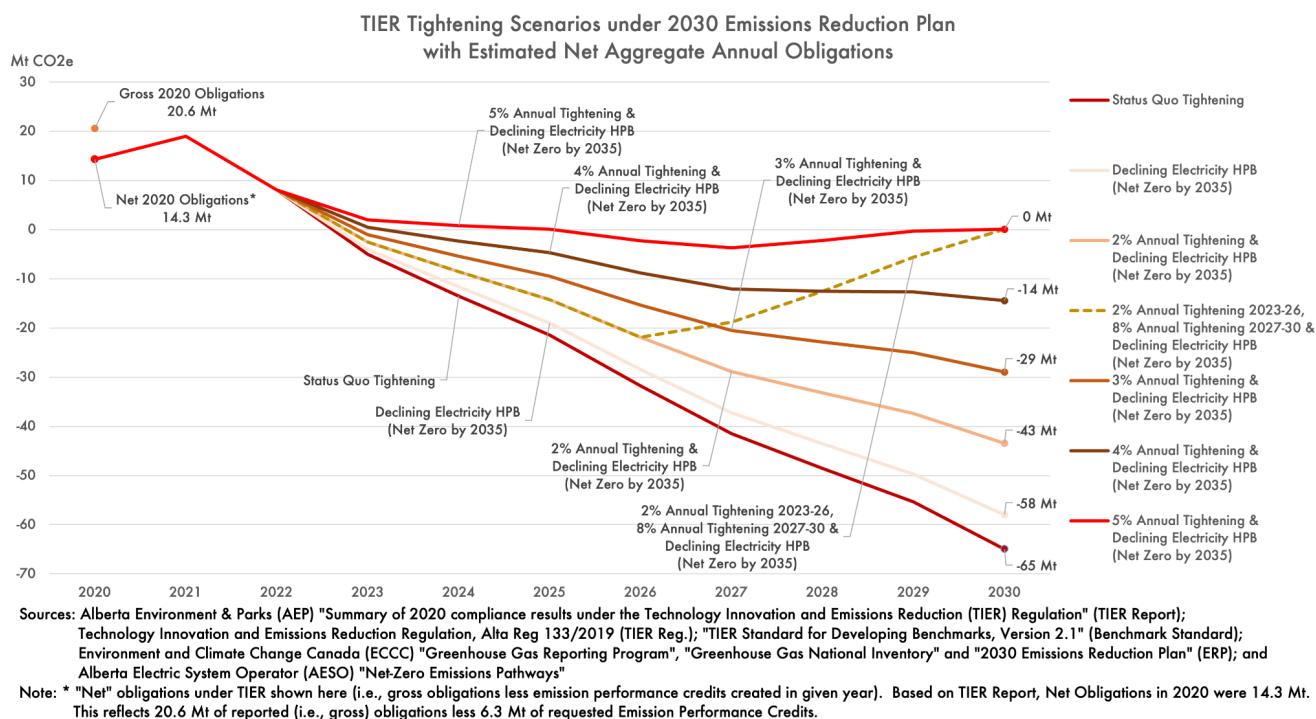
Therefore, since TIER's status quo stringency would not maintain net positive aggregate annual obligations under the projections in ECCC's ERP, we estimate the required tightening of TIER stringency to avoid an oversupply of offsets relative to obligations under ECCC's ERP. The different options for progressively tightening TIER are shown in Figure 16, illustrating the evolution of net aggregate annual obligations under each option. In Figure 16, a net negative

<sup>46</sup> Note that the obligations in this section are presented on a "net" basis — that is deducting estimated EPCs from estimated obligations (as well as future CCS that would store captured GHGs). This is reflected in the net obligations of 14.3 Mt for 2020, reflecting the reported obligations of 20.6 Mt under TIER in 2020 less the 6.3 Mt of requested EPCs (see: <https://open.alberta.ca/dataset/alberta-industrial-greenhouse-gas-compliance/resource/3a2316ec-07df-4f07-a3e1-b3ac3c5f32cf>).



aggregate obligation corresponds to an oversupply of EPCs relative to obligations while a net positive aggregate obligation is required for obligations to exceed EPCs.

**Figure 16:** TIER tightening scenarios under ECCC's ERP



Therefore, Figure 16 shows that, among the tightening options for TIER, a 5% annual tightening of TIER benchmarks and a ramp-down of the electricity benchmark to zero by 2035 would be required to maintain net positive aggregate annual obligations across TIER-regulated facilities. That is, to achieve the reductions of emissions and emission intensities projected in ECCC's ERP while sustaining the marginal price signal under TIER, we estimate that TIER stringency must be tightened by 5% annually from 2023 onwards alongside the ramp-down of the electricity benchmark.

Assuming the reductions in emissions and emission intensities projected in ECCC's ERP, Table C provides the break-out of estimated obligations by sector for this option alongside those estimated for the proposed TIER tightening in AEP's discussion document (i.e., 2% annually and ramp-down of the electricity benchmark) and the status quo TIER stringency.

**Table C:** Estimated obligations by sector in 2030 for selected TIER tightening options

Estimated 2030 net obligations by sector and TIER tightening options based on projections in 2030 Emissions Reduction Plan (ERP)					
Sector	Net Obligations in 2030 (Mt)			2021-2030 Emissions Reduction (based on ERP)	
	Status Quo Tightening	2% Annual Tightening & Declining Electricity HPB (Net Zero by 2035)	5% Annual Tightening & Declining Electricity HPB (Net Zero by 2035)	Percent Change	Reduced Emissions (Mt)
Industry	-11	-8	-0.7	-36%	-8
Oil & Gas	-12	-9	0.3	-42%	-13
Oil Sands	-36	-27	0.1	-35%	-27
Power Plants	-7	0	0.3	-35%	-22
<b>TOTAL*</b>	-65	-43	0	-44%	-70

\* Total for TIER-Regulated Facilities in 2030, based on projections for reduced emissions and emission intensities by sector

Additionally, in Figure 16, we illustrate that, assuming the reductions of emissions and emission intensities projected in ECCC's ERP and only a 2% tightening of TIER benchmarks from 2023-26 (along with a ramp-down of the electricity HPB by 2035), an 8% tightening of TIER benchmarks from 2027-30 would be required to restore net positive aggregate annual obligations by 2030. That is, if emissions and emission intensities improve as projected in ECCC's ERP, tightening for TIER benchmarks would need to be significantly accelerated after 2026 from what is proposed in AEP's discussion document for this TIER review.



## 5. Proposal for “adaptive” TIER tightening

The analysis in this report has used two “book-end” scenarios to estimate obligations under TIER for the horizon to 2030. At one end, our “conservative” scenario assumes no reduction in emissions or emission intensities for TIER-regulated facilities, except for power generation. At the other end, ECCC’s ERP projects significant reductions in emissions across all sectors by 2030 — but there are reports that ECCC staff have doubts about these projections<sup>47</sup> and oil sands producers have characterized them as unachievable.<sup>48</sup>

We recognize that no scenario is likely to accurately predict the future. However, our aim in this report has not been to project emissions under TIER but, using the two book-end scenarios, to demonstrate the required tightening of TIER benchmarks to maintain a balance of obligations under TIER with offsets and credits. Based on our analysis using these scenarios, we have shown that TIER benchmarks must be tightened significantly under either scenario in order to maintain net positive obligations — and thereby, the marginal incentive from the carbon price.

Nonetheless, we suggest that rather than being predicated on any single projection for the future, a more appropriate design for TIER benchmark stringency would be an “adaptive” approach under which the extent of tightening is calibrated to ensure a minimum threshold for net positive obligations.

A commitment by Alberta to such an adaptive approach would have the advantages of anchoring expectations for net positive obligations under TIER while responding flexibly to a variety of future conditions. Indeed, reductions in emissions and emission intensities are unlikely to be achieved smoothly — as, for example, we modelled for the scenario under ECCC’s ERP in this report.

To implement such an adaptive approach, a rule could be that TIER benchmarks would be tightened in the next year to the extent that net obligations as a share of TIER-regulated emissions deviated below some threshold (e.g., 10%).

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<sup>47</sup> See, e.g.: Marieke Walsh. June 14, 2022. “Canada’s 2030 climate targets for oil and gas industry not feasible, government analysis says,” The Globe & Mail. Available online:

<https://www.theglobeandmail.com/politics/article-ottawa-was-told-2030-climate-targets-not-viable/>

<sup>48</sup> Kendall Dilling. August 21, 2022. “Ottawa’s unrealistic emissions plan could drive away investment,” The Globe & Mail. Available online:

<https://www.theglobeandmail.com/business/commentary/article-ottawas-unrealistic-emissions-plan-could-drive-away-investment/>

Figure 17 provides a stylized example in which the adaptive tightening (i.e., the addition to the target reduction in the next year) is a minimum of 1% or otherwise determined by the extent that the net obligations as a share of total emissions deviates below the adaptive threshold of 10%. In the example, overall emission intensity declines unpredictably, with its percentage year-over-year decline varying between years.<sup>49</sup>

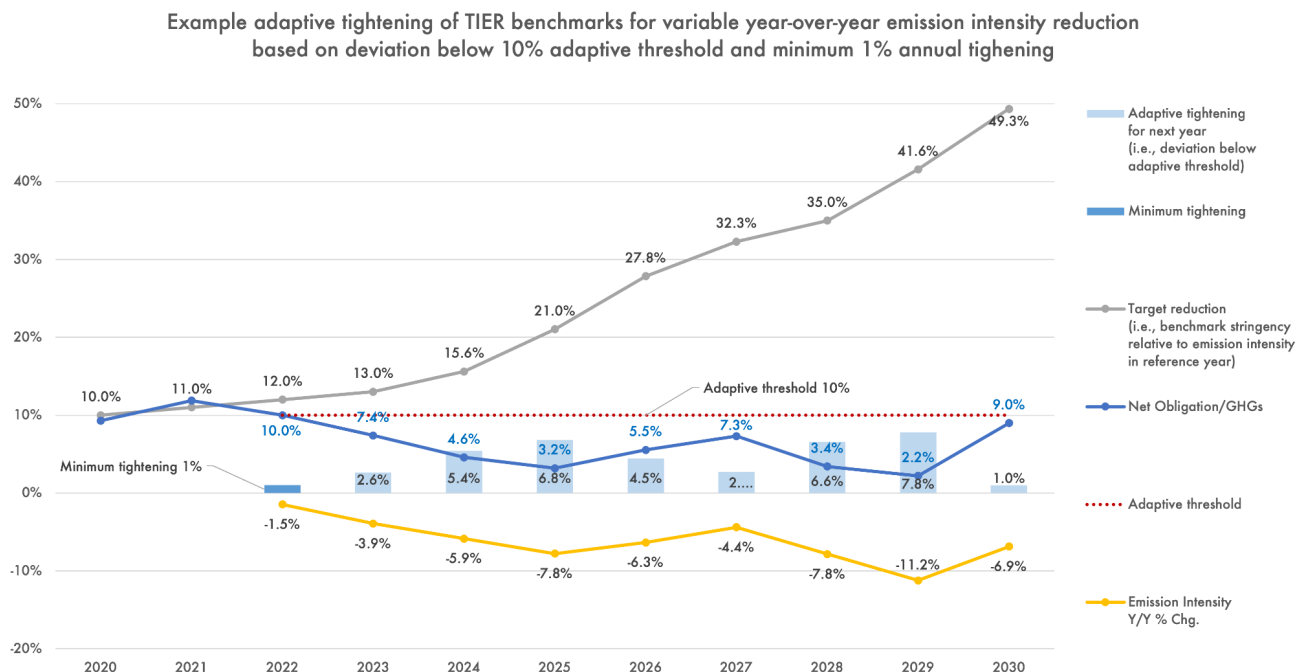
As elaborated in Appendix A, the net obligation share of total emissions will be a function of the benchmark stringency and the actual emission intensity in the given year. Therefore, as emission intensity declines, the benchmark stringency must “keep up” in order to maintain a net positive obligation (and sustain the marginal carbon price incentive). By calibrating tightening to the last year’s deviation of net obligations as a share of total emissions below the adaptive threshold (here, 10%), the rule provides a buffer.

As a brief explanation of this stylized example, consider the 3.9% emission intensity reduction for 2023. With only a 1% increase in the target reduction from 2022 to 2023 (i.e., from 12% to 13%), the resultant net obligations will only be 7.4% of the emissions in 2023. However, the adaptive rule requires that an increase in the target reduction for the next year by 2.6% (i.e., the 10% adaptive threshold minus 7.4%) and the target reduction in 2024 will therefore be 15.6%.

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<sup>49</sup> For simplified illustration, this example portrays percentage year-over-year declines in overall emission intensity across all sectors. Of course, calculating a facility’s emission intensity for emissions from a given product involves a distinct denominator, expressed in the relevant units of production. Indeed, TIER-regulated facilities may produce a variety of products, each with a distinct emission intensity and subject to different benchmarks under TIER. Again, to illustrate the concept of an adaptive tightening, we have presented the decline in a notional overall emission intensity across all facilities — effectively presenting TIER-regulated facilities as one aggregated sector and overall emission intensity computed based on some common denominator (e.g., real output based on a chain-weighted price index).

**Figure 17:** Stylized example for adaptive tightening of TIER benchmarks



This rule should underpin market participants' confidence that, even if one year witnesses an accelerated decline in emission intensity that produces a negative net obligation for the given year, the benchmark stringency will be adaptively tightened to compensate. That is, any deviation of net obligations as a share of emissions below the adaptive threshold will boost the extent of tightening in the next year, ultimately restoring net positive obligations.<sup>50</sup>

A final note is that, to successfully implement this adaptive approach, any individual participant must be incapable of significantly influencing the decline in aggregate emission intensity.<sup>51</sup> If no participant can influence the degree of tightening for the next year, every participant has a strong incentive to accelerate and maximize its own annual reductions in emission intensity.

<sup>50</sup> Some may recognize possible inspiration for this approach from the well-known "Taylor Rule" to guide central bank policy for a targeted inflation rate.

<sup>51</sup> This also requires no coordination between market participants that would limit reductions in aggregate emission intensity. Any such collusion would presumably contravene the criminal conspiracy provisions of Canada's Competition Act.

## 6. Competitiveness considerations

Significant tightening of TIER benchmarks is required to maintain net positive obligations (i.e., obligations exceeding credits and offsets) and thereby sustain the marginal carbon price signal — particularly for the emission reductions projected in ECCC's ERP. Therefore, such tightening is required to attract investments in decarbonization projects like CCS, which would suffer a reduced incentive (and likely a price collapse) if the market for TIER EPCs and offsets is oversupplied. However, tightening benchmarks means that emitters will face higher costs for either abatement or compliance.

This reveals an inherent tension in output-based carbon pricing systems: The aim of this output-based design is maintaining a low average cost of carbon for producers to mitigate carbon leakage while sustaining the full incentive of the marginal carbon price. However, as participants reduce emission intensity, stringency must increase to maintain net positive obligations across the system, and therefore higher average costs — either compliance payments or abatement — are unavoidable. Relative to competitors in jurisdictions that do not price carbon or impose other emissions standards, producers will face a disadvantage with those higher average costs.

In Appendix B, we provide estimates of the maximum compliance/abatement costs for the 5% per year tightening of TIER benchmarks — that is, the tightening we estimate is required to maintain net positive obligations while achieving the reductions in emissions and emission intensities projected in ECCC's ERP. Based on a \$170/tonne carbon price (and emphasizing that this is a theoretical maximum and *not* a projection), we estimate the upper bound for compliance payments or abatement costs at \$13 billion in 2030. In considering costs, it is worth highlighting that a large share of the compliance payments from TIER are invested back into the sector to support decarbonization. TIER also features a Compliance Cost Containment Program that provides time-limited financial relief to facilities where TIER costs exceed 3% of sales or 10% of profit.

Additionally in Appendix B, to illustrate the potential impact on competitiveness for oil sands producers, we show that a 5% annual tightening and \$170/tonne carbon price would result in maximum additional costs of \$6 per barrel for TIER compliance. For context, we estimate average TIER compliance costs across oil sands facilities of \$0.20 per barrel in 2021 and, based on Alberta's oil sands royalty data, we calculate production costs (including operating and capital expenditures) in 2021 at an average of \$30 per barrel.

Again, stressing that these are estimates of the theoretical *maximum* compliance costs, we provide these upper-bound estimates to illustrate the significant costs that producers could face, underscoring the need to consider how to mitigate reduced competitiveness as benchmarks tighten.

Border carbon adjustments (BCAs) are an alternative measure that might be considered. BCAs involve tariffs on imported products based on their carbon intensity and, potentially, rebates to exports based on the carbon price levied on the domestic producer.

While a full discussion of BCAs is outside the scope of this report, implementing BCAs in Canada would be complicated by Canada's federal-provincial division of powers and the constraints of international trade law. Briefly, provincial governments could not implement BCAs given the constitution's provision for free movement of goods across the federation<sup>52</sup> and the exclusive federal jurisdiction over international trade.<sup>53</sup> While the federal government would have constitutional jurisdiction to impose BCAs, Canada would violate its commitments under the General Agreement on Tariffs and Trade (GATT) — specifically, the “national treatment” requirement — unless an equivalent cost is imposed on domestic producers.<sup>54</sup> That is, different emission intensity benchmarks and divergent costs per tonne of emissions facing different producers of the same products across provinces would be inconsistent with a uniform price for carbon at the border. The federal government requires provincial and territorial pricing systems to be evaluated and deemed equivalent to the federal output-based pricing system. The federal government would likely use this equivalency criteria in the federal carbon pricing benchmark to argue that prices for carbon across the country are functionally equivalent. However, this claim is likely vulnerable to being disputed at the WTO and it is unclear whether the WTO would accept Canada's argument. For this reason, it is quite possible that the federal government will need to

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<sup>52</sup> The Constitution Act, 1867, 30 & 31 Vict, c 3, s.121.

<sup>53</sup> The Constitution Act, 1867, 30 & 31 Vict, c 3, s.91(2).

<sup>54</sup> See, e.g., discussion by Maria Panezi. November 2015. When CO2 Goes to Geneva: Taxing Carbon across Borders — Without Violating WTO Obligations. CIGI Paper No. 83. Available online: <https://www.cigionline.org/publications/when-co2-goes-geneva-taxing-carbon-across-borders-without-violating-wto-obligations/> Also see Neil Campbell, William Pellerin and Tayler Farrell. June 10, 2022. “A Roadmap for Trade Law Compliant Border Carbon Adjustments,” C.D. Howe Institute Intelligence Memo. Available online: <https://www.cdhowe.org/intelligence-memos/campbell-pellerin-farrell-roadmap-trade-law-compliant-border-carbon-adjustments>

further harmonize sub-national industrial pricing systems or even replace them with a unified national system across the country.<sup>55</sup>

Again, while full discussion of BCAs is beyond our scope here, the resulting costs from TIER tightening highlight competitiveness implications from carbon pricing that might be better addressed by BCAs (alongside a complementary shift to truly nation-wide carbon pricing).

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<sup>55</sup> There may be other ways to address a potential dispute at the WTO. For example, to comply with the national treatment rules under GATT, an alternative to nation-wide harmonization might be to implement a complex regime of output-based carbon pricing for imports, with the benchmark for any given product set at the maximum benchmark for that product across provinces.

## 7. Recommendations

The analysis in this report yields three recommendations:

1. **Alberta should adopt an “adaptive” approach for tightening the stringency of benchmarks under TIER** that gives market participants confidence that demand for credits and offsets will consistently exceed supply (i.e., net positive obligations). For example, Alberta might implement a rule to tighten benchmarks by the degree to which obligations as a share of TIER-regulated emissions deviated below a specified threshold (e.g., 10%) in the prior year.
2. **The federal government should evaluate TIER design under an ERP-consistent scenario.** To ensure equivalency with the federal carbon pricing benchmark, the federal government should require that all output-based pricing systems — including TIER — will credibly maintain net positive obligations (i.e., no oversupply of credits and offsets). Otherwise, credit prices will fall well below the carbon price, which would violate the federal benchmark’s criterion that the marginal carbon price signal be maintained in all compliance periods. We specifically recommend that the federal government model scenarios consistent with the emissions reductions forecast in the ERP, as we have done in this paper.
3. **Alberta should work with the federal government and other provinces to address the impact of tightened TIER benchmarks on the competitiveness of emission-intensive, trade-exposed (EITE) sectors.** Tightened benchmarks will impose significantly higher costs for compliance and abatement. Measures to protect EITE sectors from unfair competition — like border carbon adjustments — may be needed to avoid carbon leakage. However, given the constraints of Canada’s federal-provincial division of powers and international trade law, such measures may require further harmonization of provincial output-based pricing systems or even a phase-out of such systems.

## 8. Conclusion

In this report, we have shown the need to significantly tighten benchmarks under TIER in order to maintain equivalence with the federal OBPS and sustain TIER's marginal price signal to achieve ongoing emission reductions.

Under a conservative scenario for emission reductions, our analysis shows that Alberta must tighten TIER benchmarks by 2% annually from 2023 onwards and ramp-down the electricity HPB to zero by 2035 just to bring aggregate obligations under TIER in line with the current federal OBPS by 2030. We estimate that such tightening would result in obligations across TIER-regulated facilities that could absorb 30 Mt of new offsets (e.g., from CCS) in 2030, compared with just 13 Mt under the status quo TIER stringency, based on our conservative scenario and baseline offset projection.

However, to achieve the more ambitious reductions in emissions and emission intensities projected in ECCC's ERP, we estimate that maintaining net positive aggregate annual obligations under TIER — and thereby sustaining the marginal price signal — would require tightening benchmarks by at least 5% annually from 2023 onwards and ramping down the electricity HPB to zero by 2035. That's the increase in benchmark tightening that would be required in order to sustain the 70 Mt reduction of emissions across TIER-regulated facilities implied by the ERP — to 89 Mt in 2030 from an estimated 160 Mt in 2021. Without net positive obligations across TIER-regulated facilities, the marginal price signal under TIER would likely be depressed by an oversupply of credits and offsets relative to obligations.

Uncertainty surrounds any future projections of emissions and emission reductions across the Alberta economy. Given this uncertainty, we contend that a more appropriate approach for setting annual benchmarks for TIER would be “adaptive” tightening. Under an adaptive approach, benchmarks for the next year could be tightened by the extent to which net obligations (i.e., obligations less credits) as a share of TIER-regulated emissions deviated below a specified threshold (e.g., 10%) in a given year. Such a rule would respond flexibly to the inherent year-to-year variability in the degree of emission intensity reduction while also anchoring expectations that aggregate net positive obligations would be maintained under TIER.

Finally, we recognize that the degree of benchmark tightening contemplated in this report implies higher costs for Alberta industry and could present concerns about competitiveness and carbon leakage. But if Canada is to achieve a 40% reduction in emissions by 2030, industrial



carbon pricing systems must be strengthened significantly. Federal and provincial policymakers should try to reconcile the potential tensions between ambitious decarbonization and business competitiveness. An ideal way to do this is to begin working immediately on more robust competitiveness protections — such as implementing border carbon adjustments.

## Appendix A: Calculation of obligations under ECCC ERP

We lack granular emission intensity data for each TIER-regulated facility from which to estimate net aggregate annual obligations. However, leveraging sector-level reporting of past obligations under TIER, we use projected emission reductions, assumed production growth and the extent of benchmark tightening to estimate each sector's net obligation in future years.

Specifically, considering the interval from 2021 to 2030: for a given year,  $i$  (defined as the number of years since the 2021 base-year), each sector's net obligation,  $O_i$ , will be defined by its emissions,  $E_i$ , minus its allocation,  $A_i$ , such that:

$$O_i = E_i - A_i$$

In turn, the allocation,  $A_i$ , is computed according to that year's benchmark,  $b_i$ , multiplied by the annual production,  $Y_i$ , such that:

$$A_i = b_i Y_i$$

As well, annual emission intensity,  $e_i$ , will be equal to the annual emissions,  $E_i$ , divided by annual production,  $Y_i$ , such that:

$$e_i = \frac{E_i}{Y_i}$$

And therefore:

$$Y_i = \frac{E_i}{e_i}$$

And consequently:

$$A_i = b_i \left( \frac{E_i}{e_i} \right)$$

So therefore, for a given year,  $i$ , the net obligation can then be expressed in term of annual emissions, the year's benchmark and emission intensity as follows:

$$O_i = E_i - b_i \left( \frac{E_i}{e_i} \right)$$

And:

$$O_i = E_i \left( 1 - \frac{b_i}{e_i} \right)$$

We assume, for the 2021-30 interval, that each sector's emissions decline at some annual emission reduction rate,  $r$ , from emissions in the base-year (i.e., 2021),  $E_0$ , and that production grows at some annual growth rate,  $g$ , from production in the base-year,  $Y_0$ , such that emission intensity in a given year can be expressed as:

$$e_i = \frac{E_0(1+r)^i}{Y_0(1+g)^i}$$

And so:

$$e_i = e_0 \frac{(1+r)^i}{(1+g)^i}$$

Additionally, for Alberta's TIER system, the benchmark is initially set at initial stringency,  $s$ , which is a proportion of the historical emission intensity — assumed as the sector's reference emission intensity,  $e_R$ . The benchmark also evolves with an annual tightening amount,  $t$ , such that the year's benchmark,  $b_i$ , is given by:

$$b_i = e_R(1 - (s + it))$$

For example, if the initial stringency is 11% and the tightening amount is 1%, the benchmark will be 87% of the reference emission intensity in 2023 (i.e., two years after the 2021 base-year).

To simplify, we assume the sector's emission intensity in the base-year is some share,  $\theta$ , of the reference emission intensity (i.e., reflecting the sector's reduced emission intensity from the reference emission intensity that has already occurred by the base-year) such that:

$$e_0 = \theta e_R$$

And therefore:

$$b_i = \frac{e_0}{\theta}(1 - (s + it))$$

Substituting these equations into that for the net obligation in a given year yields:

$$O_i = E_i \left( 1 - \frac{\frac{e_0}{\theta}(1-(s+it))}{e_0 \frac{(1+r)^i}{(1+g)^i}} \right)$$

Therefore, even without an explicit emission intensity for the sector, the obligation in a given year can then also be expressed in terms of the year's emissions ( $E_i$ ), the emission reduction rate ( $r$ ), the production growth rate ( $g$ ), the initial stringency ( $s$ ), the tightening amount ( $t$ ) and base-year share of reference emission intensity ( $\theta$ ) as follows:

$$O_i = E_i \left( 1 - \frac{(1+g)^i (1-(s+it))}{\theta(1+r)^i} \right)$$

Additionally, although we lack direct values for each sector's reference emission intensity, we know the obligations, emissions and stringency relative to the reference emission intensity (i.e., value for initial stringency,  $s$ ) in the base-year. Therefore, we can calculate  $\theta$  from the ratio between emissions and obligations according to the following relationship (from the above equations):

$$\frac{O_i}{E_i} = 1 - \frac{e_R}{e_i} (1 - (s + it))$$

So, in the base year,  $i=0$ , this relationship yields:

$$\frac{O_0}{E_0} = 1 - \frac{e_R}{e_0} (1 - s)$$

And therefore:

$$\theta = \frac{1-s}{1-\frac{O_0}{E_0}}$$

As an example for estimating  $\theta$  for a sector,<sup>56</sup> where obligations are 4.5% of emissions in the base-year and initial stringency is 11%:

$$\theta = \frac{1-11\%}{1-4.5\%} = \sim 93\%$$

As an example for estimating a sector's net obligation, consider a sector with an emission reduction rate of -1% and growth rate of 1% (i.e., emission intensity declining by roughly 2%

<sup>56</sup> The 2021 "initial" stringency of 11% is presented here since we define 2021 as the base-year. However, we have calculated  $\theta$  from the observed data for 2020 (with the 10% initial stringency), reported in the TIER summary for 2020. As explained in the first section of this paper, we have estimated the emissions in 2021 from data on output for 2021, holding all sectors' emission intensities constant (except for electricity) from 2020. Therefore,  $\theta$  is the same for 2021 and, since we apply the growth rates and emission reductions from the ERP over 2021-30, we have simplified this explanation by referring to 2021 as the base-year.

annually). As well, assume that the initial stringency is 11%, tightens by 1% annually and that  $\theta$  is 99%. Therefore, in the ninth year (i.e., 2030), the net obligation will be defined by:

$$O_i = E_i \left( 1 - \frac{(1+1\%)^9 (1-(11\%+9 \times 1\%))}{(99\%)(1-1\%)^9} \right) = E_i (\sim 3\%)$$

That is, the net obligation will be roughly 3% of the annual emissions in that ninth year.

In contrast, assuming the same initial stringency, tightening rate and  $\theta$  of 99%, for a sector with an emission reduction rate of -5% and growth rate of 3% (i.e., emission intensity declining by roughly 8% annually), the obligation will be -67% of the emissions (i.e., credits equal to 67% of the emissions). The calculation is as follows:

$$O_i = E_i \left( 1 - \frac{(1+3\%)^9 (1-(11\%+9 \times 1\%))}{(93\%)(1-5\%)^9} \right) = E_i (\sim -67\%)$$

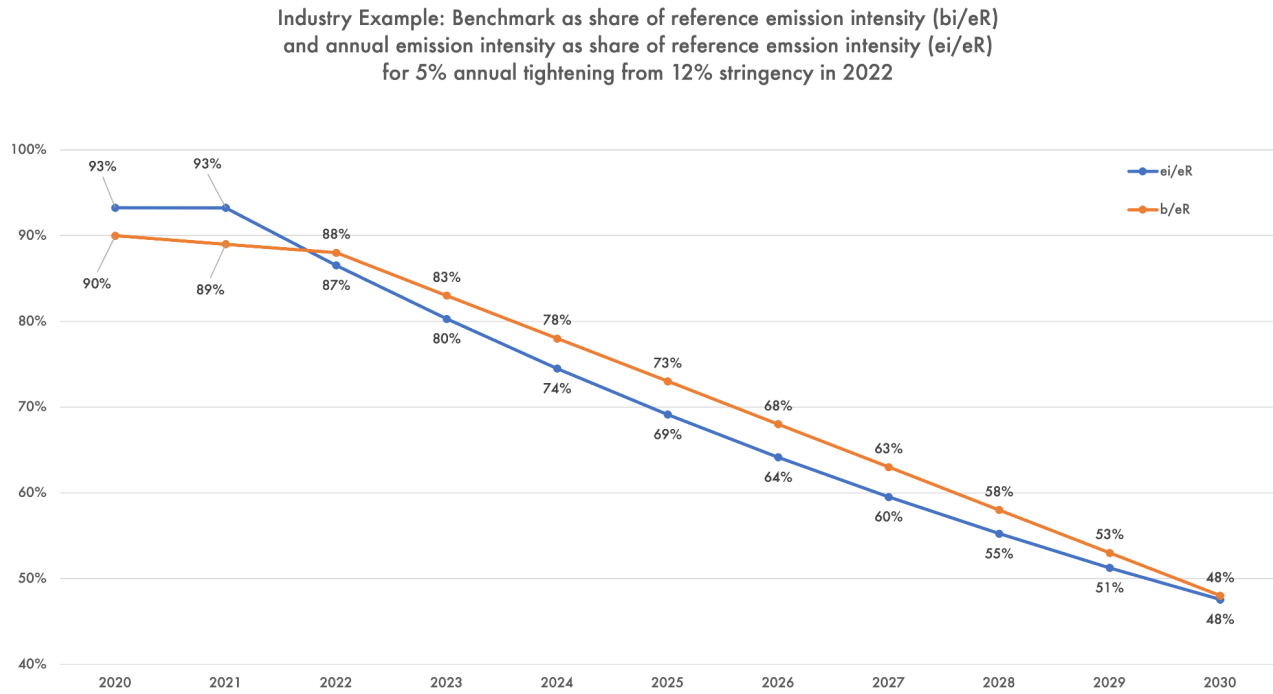
Therefore, we use the assumed 2021-2030 annual growth rates and emission reduction rates for sectors from ECCC's ERP, and, with our estimate of each sector's TIER-regulated emissions, we can then estimate each sector's obligation in the given year, adjusting for the sector's evolving emission intensity leveraging these derived relationships.

Figure 18 provides an example for the "Industry" sector under the 5% tightening (from 2023 onwards) and emission intensity declining by 7.2% (from 2022 onwards), assuming 2.5% annual output growth and 4.9% annual emissions reductions (over 2021-2030) based on the projections from ECCC's ERP. Figure 18 shows how, relative to this sector's reference emission intensity, this sector's emission intensity ( $e_i/e_R$ ) and the benchmark ( $b_i/e_R$ ) would evolve to 2030.<sup>57</sup>

In this example, Industry has a net positive obligation in 2021 but, with  $e_i/e_R$  less than  $b_i/e_R$  from 2022-29, will have a net negative obligation (i.e., credits/offsets exceeding obligations) over that interval. In this example,  $e_i/e_R$  converges with  $b_i/e_R$  in 2030, with the result of an effectively nil net obligation in 2030.

<sup>57</sup> Note that in our modelling, because emission intensity is based on rates of change (i.e., an annual output growth rate and an annual emission reduction rate),  $e_i/e_R$  evolves geometrically while, because the tightening of the benchmark is by specified percentage points each year (here, 5 percentage points annually),  $b_i/e_R$  evolves arithmetically over the 2021-30 interval.

**Figure 18:** Illustration of benchmark tightening and improving emission intensity for industry



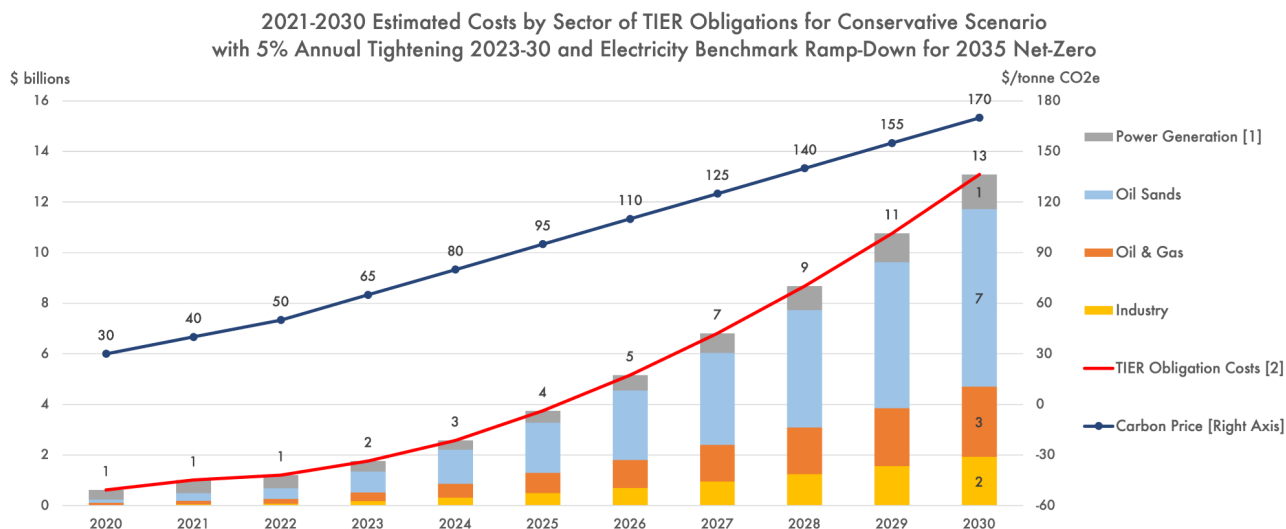
## **Appendix B: Estimated cost impacts of tightened TIER stringency**

To provide an upper-limit estimate of compliance costs for the 5% tightening of TIER benchmarks, we return to our earlier “conservative” scenario, which assumes no reductions in emissions or emission intensities, excepting for power generation. Figure 19 illustrates this evolution of estimated costs for the TIER obligations, with oil sands bearing most of the net costs for obligations.

Conceptually, applying the 5% tightening to estimate obligations under our earlier conservative scenario should provide an upper limit for the compliance costs of such a tightening. That is, since obligations under TIER follow from the difference between actual emission intensity and the respective benchmark, any reductions in emissions and emission intensities would result in obligations lower than those in this conservative scenario (in which, excepting for power generation, emissions and emission intensities are held constant at 2021 levels).

As shown in Figure 19, compliance costs in our conservative scenario for this 5% tightening, along with the ramp-down of the electricity HPB to 0 by 2035, would total an estimated \$13 billion in 2030

**Figure 19: TIER obligation costs for conservative scenario with 5% tightening and zero electricity HPB by 2035**



Sources: Alberta Environment & Parks (AEP) "Summary of 2020 compliance results under the Technology Innovation and Emissions Reduction (TIER) Regulation" (TIER Report); Technology Innovation and Emissions Reduction Regulation, Alta Reg 133/2019 (TIER Reg.); "TIER Standard for Developing Benchmarks, Version 2.1" (Benchmark Standard); Environment and Climate Change Canada (ECCC) "Greenhouse Gas Reporting Program", "Greenhouse Gas National Inventory" and "2030 Emissions Reduction Plan" (ERP); and Alberta Electric System Operator (AESO) "Net-Zero Emissions Pathways"

Notes: [1] Power Generation GHGs from "Clean-Tech Scenario" from AESO LTO.

[2] TIER Obligation Costs estimated by multiplying carbon price in given year by annual Net TIER Obligation.

TIER Obligation estimated using annual benchmark stringency by sector (Benchmark Standard, p.41) and High-Performance Benchmark for power generation (incl. cogen), assuming no reduction in emission intensity for given sector, except for power generation (based on AESO LTO).

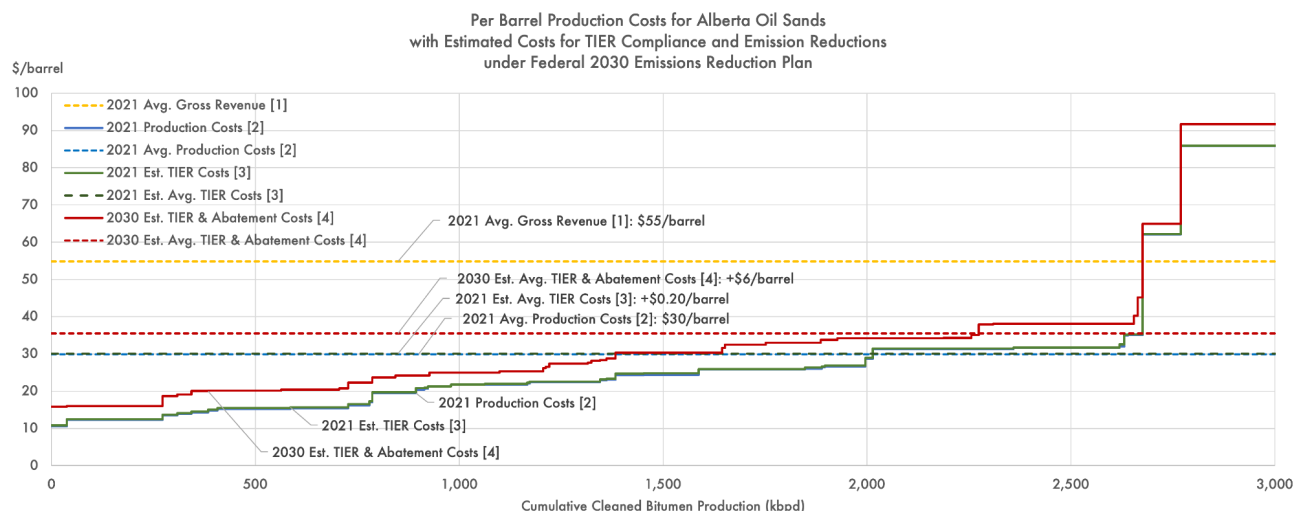
Additionally, to provide insight on the cost/competitiveness impacts for the oil sands, we estimate the cost per barrel across oil sands facilities for complying with TIER benchmarks that are tightened by 5% annually. Figure 20 shows the estimated costs per barrel for compliance with TIER in 2021 and compliance/abatement in 2030, based on the oil sands emission intensity in ECCC's ERP. For context, leveraging data collected and published by the Alberta government for costs and revenues of oil sands projects in 2021 under the Oil Sands Royalty Regulation,<sup>58</sup> Figure 20 also presents the average gross revenue and average production costs per barrel across oil sands production, as well as facility-specific production costs per barrel.

Figure 20 illustrates our estimate for average TIER compliance costs across oil sands facilities of \$0.20/barrel in 2021 and our estimate of TIER compliance/abatement costs of \$6/barrel in 2030.

<sup>58</sup> Government of Alberta. August 2022. 2021 Oil sands project data as of May 9, 2022 (published in August 2022). Available online: <https://open.alberta.ca/opendata/alberta-oil-sands-royalty-data1>



**Figure 20:** Estimated impact of tightened TIER stringency on oil sands costs



Sources: Environment and Climate Change Canada (ECCC) Greenhouse Gas Reporting Program (GHGRP), National Greenhouse Gas Inventory (NIR), and Emissions Reduction Plan (ERP); Alberta Energy Regulator (AER) Statistical Reports ST-3, ST-39 and ST-53; 2021 Alberta Oil Sands Project Data under Oil Sands Royalty Regulation (OSR); and Alberta Environment & Parks (AEP) Summary of 2020 TIER Compliance

**Notes:**

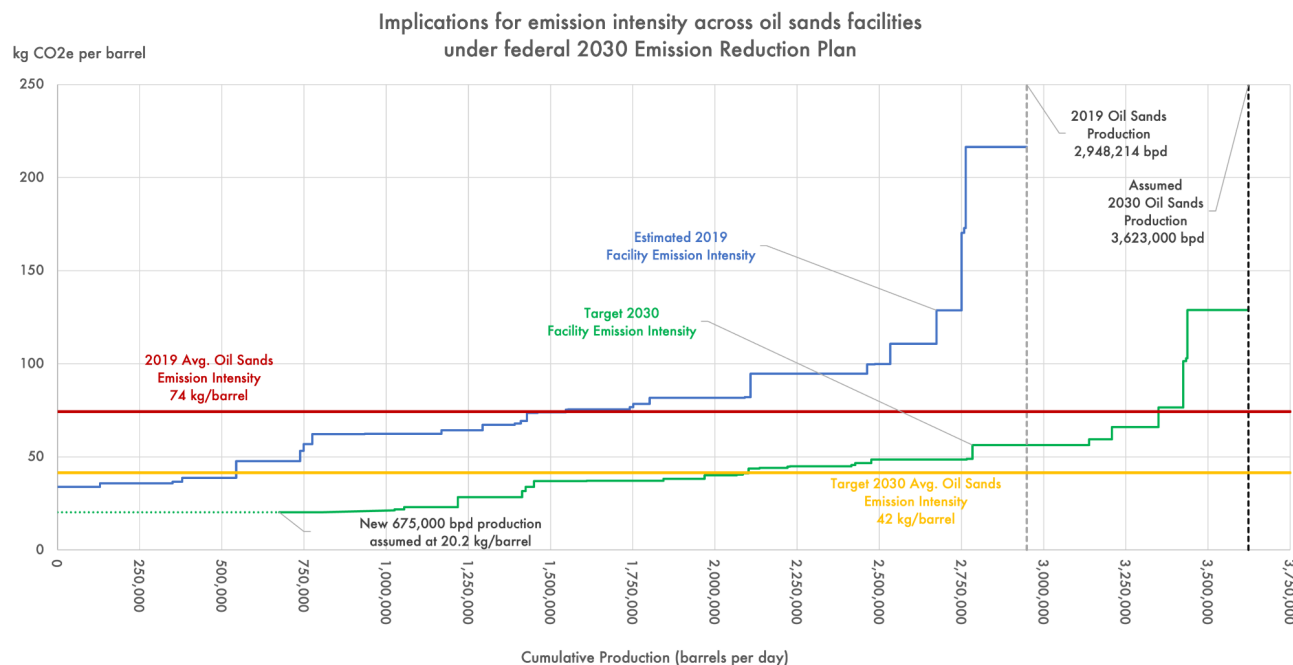
- [1] Average \$/barrel gross revenue for 2021 calculated from OSR data as total gross revenue divided by total barrels of cleaned bitumen across all reporting projects.
- [2] Production costs for 2021 calculated from OSR data as total of operating, capital and other costs divided by barrels of cleaned bitumen for given project or, for average, across all projects.
- [3] 2021 TIER Costs calculated from 2019 emission intensity (EI) for given project (estimated from GHGRP and AER data), 74 kg/barrel oil sands EI, \$40/tonne carbon price, and assumed net TIER obligation as 6% share of GHGs (estimated based on 2020 TIER net obligation share of GHGs and 2021 TIER stringencies: 11% for in situ and 17% for mining).
- [4] Estimated TIER and abatement costs for 2030 calculated from targeted reduction of existing facility EI under ERP, assumed \$170/tonne for both carbon price and abatement cost, and reduction to 42 kg/barrel oil sands EI (from 74 kg/barrel).

This estimate of an additional average \$6/barrel cost in 2030 assumes costs of \$170/tonne for TIER compliance and/or abatement<sup>59</sup> alongside reductions in oil sands emission intensity implied by ECCC's ERP by 2030 and an annual 5% tightening of the TIER benchmarks for oil sands. As detailed above in Table C, if emission intensity for the oil sands is reduced in-line with the projections in ECCC's ERP, oil sands would only face negligible obligations in 2030 under TIER benchmarks tightened by 5% annually. However, if TIER benchmarks are tightened by 5% but oil sands facilities do not achieve the target reductions in emission intensity, the oil sands sector would alternatively face TIER compliance costs on its obligations up to an average \$6/barrel.

<sup>59</sup> For this estimate, we assume that \$170/tonne would be the ceiling for abatement costs for any expenditure on emission reduction in 2030. Economically, if reducing emission intensity would exceed \$170/tonne, the given facility would not spend on abatement and instead incur the alternative cost for compliance under TIER. However, as noted in the overview at the beginning of this report, we recognize that the federal government has proposed a Canada-wide cap on oil and gas emissions and, depending on whether and how this cap is implemented, oil sands facilities might incur significantly higher costs for abatement (and compliance with that policy). Nonetheless, that proposed oil and gas cap is beyond the scope of this report.

For further context, Figure 21 exhibits estimated facility-level emission intensities across oil sands facilities in 2019 and the reduced oil sands emission intensity in 2030 implied by the projections of oil sands emissions and production in ECCC's ERP.<sup>60</sup>

**Figure 21:** Emission intensity implications for target 2030 oil sands emissions in ECCC's ERP



Sources: Environment and Climate Change Canada (ECCC) Greenhouse Gas Reporting Program, National Greenhouse Gas Inventory, and 2030 Emissions Reduction Plan (ERP); and Alberta Energy Regulator (AER) Statistical Reports ST-3, ST-39 and ST-53

The facility-level emission intensities shown in Figure 21 have been used to estimate the TIER compliance/abatement costs shown in Figure 20. The target 2030 emission intensities illustrate the facility-level reductions required to achieve the reduced overall 2030 emission intensity for the oil sands implied by ECCC's ERP.

<sup>60</sup> See Tables 6.2 and 6.7 of Annex 5 of ECCC's ERP. Available online:

<https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030/plan/annex-5.html>