CIBC CAPITAL MARKETS

EQUITY RESEARCH

Dennis Fong, P.Eng.
+1 403-216-3400
Dennis.Fong1@cibc.com

Shaz Merwat
+1 416-956-6428
Shaz.Merwat@cibc.com

Cheryl Wu, CFA
+1 403-216-8518
Cheryl.Wu@cibc.com

Jordan Tracey, P.Eng.
+1 403-221-5854
Jordan.Tracey@cibc.com

Jamie Kubik, CPA, CA
+1 403-216-3405
Jamie.Kubik@cibc.com

Chris Thompson, P.Geo.
+1 403-200-3373
Christopher.Thompson@cibc.com

April 3, 2023 **ESG**

Canada's Carbon Capture Disadvantage

Yet Another Missed Opportunity

Sectors:
Energy, Portfolio Strategy

Our Conclusion

Canada's federal government had an opportunity with the 2023 Budget to crystalize a path to achieving its Paris climate commitment to reduce GHG emissions 40%-45% by 2030 from the 2005 base line. The budget also represented a chance to close the economic shortfall of carbon capture investing in Canada vs. other jurisdictions. We believe the lack of additional incentives for the largest proportion of Canada's emissions to invest in megatonne-scale carbon capture, utilization and storage (CCUS) projects means the country will miss its 2030 emissions reduction target.

In this report, we outline a possible path forward that could help the country achieve a 2035 target as we believe the window has now closed for achieving a 2030 target.

Key Points

Canada does not compete: Fiscal incentives for CCUS in Canada are significantly less attractive relative to other jurisdictions. We estimate an IRR on Pathway's CCUS projects of ~9% in Canada, vs. 20% in the U.S. and 42% in Norway. As incremental incentives were left out of this budget cycle, we believe this presents a risk that Canada falls behind in its capacity to attract green capital (and jobs). If the federal government is unwilling to provide these incentives, the path forward may have to rely on the provinces.

Role of government in facilitating decarbonization investment: We believe policymakers must balance a pursuit of achieving emissions targets without harming economic output. A lack of transparent policy and sufficient fiscal incentives means that industry will find it difficult to move forward with material decarbonization projects. Regulatory policy also needs to be structured in a way that provides better clarity on the timeline to receive project approval. A streamlined process for CCUS is needed if the country wishes to hit its longer-term emissions objectives and timelines.

Need to see the forest through the trees: Canada's approach needs to be focused on its specific strengths. The country's emissions sites are geographically concentrated with material complementary infrastructure in place. The energy industry has a century's worth of knowledge on the geology of our basins. With a more attractive investment climate, Canada could be a global leader for investing in carbon capture technology. By ignoring what should be the most important part of Canada's decarbonization strategy, the federal government risks a Potemkin village.

The path forward: We liked the introduction of contract for differences, which could help lower carbon pricing risks in project economics, but further details are needed. We believe policymakers can and should do more to assist the Canadian oil sands barrel in becoming one of the most decarbonized in the world, while also helping other non-energy industries lower emissions.

All figures in Canadian dollars unless otherwise stated.

For required regulatory disclosures please refer to "Important Disclosures" beginning on page 24.

Executive Summary

Budget 2023 was an opportunity to bridge or at least narrow the gap between the economics of building out new decarbonization projects in Canada vs. other jurisdictions. Given a tight timeline to achieve Canada's 2030 emissions target of 440 MT, we believe this opportunity was missed by the federal government in the 2023 Budget. Canada has all the ingredients to be a go-to destination for green investing, CCUS and other innovation, but lacks the clear policy and attractive fiscal incentives to attract further capital.

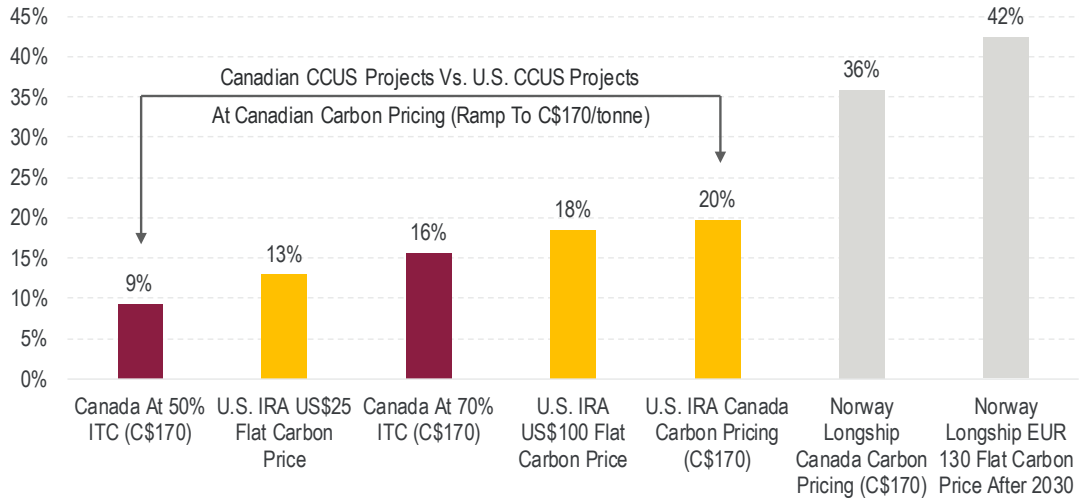
Canadian CCUS Projects Greatly Underperform Global Peers On IRR

Under current fiscal terms, Pathway's CCUS projects in Canada generate an internal rate of return (IRR) of ~9% (see the bar chart in Exhibit 1). This is less than half of the IRR of a comparable project in the U.S. (18% to 20%) and less than one-quarter of the return on Norway's Longship project (42%). Further, there is downside risk to the IRR given the potential for a long drawn-out regulatory process to approve carbon capture infrastructure and uncertainty about the long-term price of carbon.

We estimate the AB government will accumulate ~$760 billion at US$75 WTI in royalties over the life of the proposed CCUS projects, suggesting a compelling case to provide financial incentive to decarbonizing the oil sands.

Alberta has suggested greater collaboration on CCUS if Ottawa secures its consent on climate policies. Post Budget, the Liberals seem unwilling to extend an olive branch, leaving the provinces to be sole provider of incremental fiscal incentives to support CCUS projects. While we are not expecting anything significant before Alberta's Provincial General Election on May 29 (at the latest), we are hopeful the door remains open for companies to be able to move forward with these major projects. As an example, if Alberta topped up the Investment Tax Credit (ITC) to 70%, this increases project IRRs to 16% – a notable improvement.

Exhibit 1: Carbon Capture Economics – Project IRRs Across Various Fiscal Policies



Notes: Economics shown above are based on the following assumptions:
1) Estimates include $1.65 billion per MMtpa (million tonnes per annum) in costs associated with carbon hubs, connecting pipeline to the Cold Lake region and initial setup of a storage reservoir.
2) Carbon pricing modelled off of TIER and federal government carbon price increase to $170/tonne by 2030 ($65/tonne in 2023).
3) 90% utilization/runtime across CCUS projects.
4) Assume 45Q tax credits extend through the life of the project.

Source: Bloomberg, BNEF, company reports and CIBC World Markets Inc.

Canada's Strategy On Decarbonization Should Be Different From The U.S.

Both countries have ambitious 2030 emissions targets, but the nature of each country's challenge is starkly different. As outlined in our report (link), the U.S. is focusing on lowering power emissions whereas Canada's focus should be on partnering with industry to reduce oil and gas emissions. Canada's strategy for decarbonization shouldn't mimic that of the U.S., but policymakers should incorporate the idea that companies must respond to the market's almost laser-focus on the efficient allocation of capital.

To this end, we don't believe that trying to compete with the U.S. is a viable strategy, but Canada has to at least be in "the ballpark" and decarbonization efforts for companies have to compete economically against other projects (in a limited capital environment).

Canada Has Run Out Of Time To Achieve Its 2030 Target

We estimate Canadian emissions were 700 MT last year, a decline of less than 5% relative to our Paris benchmark (2005) and nowhere close to our 2030 target of 440 MT. The impact of another year without material improvement in clarity and support for large CCUS projects suggests Canada will not achieve its 2030 emissions target. A combination of an opaque approval process for new infrastructure and the significant uncertainty in carbon price are the primary culprits of this miss.

Carbon capture requires a streamlined regulatory process. While we are encouraged by the federal government's recognition of the need to improve timelines for approval by applying additional capital towards shepherding projects, we don't believe this alone provides substantial comfort to investors and companies. Canada has a track record of policy missteps that have derailed prior energy infrastructure. As a commodity based business, energy companies are well versed in hedging risk, but an ever-changing regulatory landscape is difficult for investors to maneuver.

On regulatory risk, we believe the 2023 Budget addressed the impacts of changing carbon price by introducing carbon contract for differences. We do not have enough details on the nature of the carbon contract for differences to assess its potential in lowering carbon pricing risk for companies.

The possibility of an emissions cap on the oil and gas industry is also a significant risk. We believe a cap-and-trade system to regulate oil emissions is not needed, as it would take years to set up – taking up time the country simply does not have. Further, the same can be accomplished with a carbon price coupled with carbon contracts for differences.

Pathways Group Has The Financial And Technical Capacity To Build-out World-class, Megatonne-scale Carbon Capture

The Pathways group is advancing engineering and design of these projects, but has to balance efficient capital-allocation policies with the positive impacts of decreasing emissions from its business. More importantly, we believe the consortium also has a desire to fund these projects if the appropriate fiscal environment presents itself. The Western Canadian Sedimentary Basin (WCSB) provides an unparalleled opportunity for megatonne-scale carbon capture, utilization and storage opportunities. We estimate there are fewer than 300 major emissions sources across the five oil sands mines and 13 in situ facilities across the Pathways Initiative companies (see the map in Exhibit 12). This level of geographic concentration is a key advantage for Canada relative to the U.S.

We expect the Pathways group to generate $35 billion in annual free cash flow at long-term US$70 WTI pricing, assuming it proceeds with three phases of carbon abatement projects (capacity of 50 million tonnes). Over the next decade, we estimate Pathways' decarbonization projects could shift at least $54 billion in capital and operating costs away from shareholder return initiatives.

Alberta's Technology Innovation And Emissions Reduction Regulation (TIER) Carbon Credit Market Could Become A Destination Of Choice For Buyers

Not all carbon credits are valued equally. In fact, the majority of credits are viewed with a high degree of skepticism. Credit registries such as Verra and brokers such as South Pole have been increasingly scrutinized as funneling junk credits to buyers. A sequestration credit, in comparison, is a "hard" credit and one that should trade at a notable premium. Canada should market TIER credits to both domestic and international buyers.

The Canadian Carbon Capture Disadvantage

Over the years, Canada's carbon capture policy has struggled to compete with the incentives provided by our southern neighbors. The U.S.'s 45Q carbon capture credit has a long history, devised under the 2008 Energy Improvement and Extension Act, which sets a US$20 per ton credit for projects capturing at minimum half a million tonnes of carbon (tCO_2) per year. A decade later, it was progressively scaled to US$50/ton for storage with capture thresholds dropped to 100,000 tCO_2. A summary of these changes is shown in the table in Exhibit 2.

Exhibit 2: Carbon Capture Tax Credits – Evolution Of U.S. 45Q Tax Credit, 2008 - Present

Legislation	Carbon Capture Permanently Stored	Carbon Capture Used As Injectant/EOR/Utilization
2008 Energy Improvement and Extension Act	● US$20 per metric ton of CO_2 ● Must capture at least 500 Mtpa	● US$10 per metric ton of CO_2 ● Must capture at least 500 Mtpa
2018 Bipartisan Budget Act	● Up to US$50 per metric ton of CO_2 ● Must capture at least 100 Mtpa	● US$35 per metric ton of CO2 ● Must capture at least 500 Mtpa
2022 Inflation Reduction Act	● US$85 per metric ton of CO_2 ● US$180 per metric ton of CO_2 for direct air capture ● Must capture 18.75 Mtpa (power), 12 Mtpa (other), 1 Mtpa (DAC)	● US$60 per metric ton of CO_2 ● US$130 per metric ton of CO_2 for direct air capture

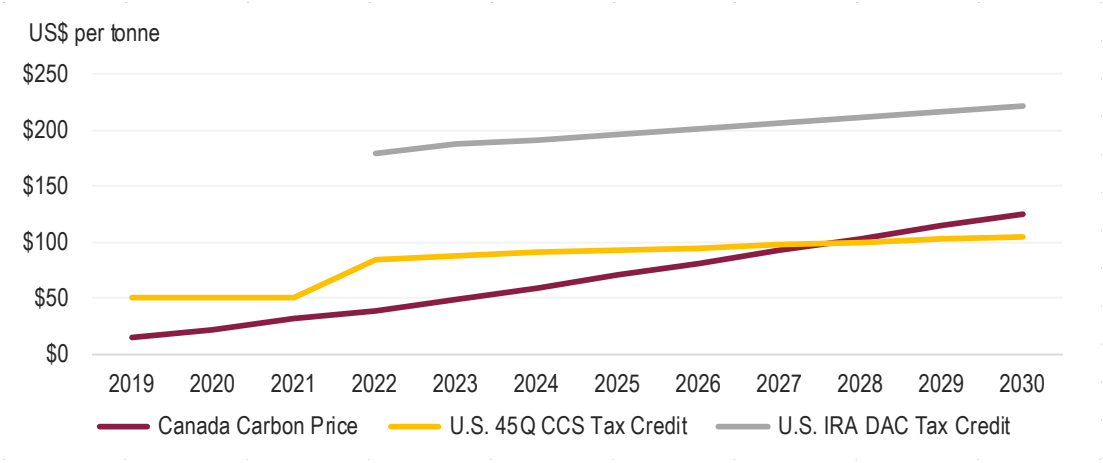
Source: BrownWinick, IEA and CIBC World Markets Inc.

America's "carrot" approach to incentivizing CCUS is more attractive than Canada's contrasting "stick" approach.

More recently, the U.S. Inflation Reduction Act of 2022 (IRA) increased the 45Q credit further to US$85/ton, adjusted annually for inflation. The IRA also created enhanced credits for Direct Air Capture (DAC), ranging from US$130/ton ($CO_2$ utilization) to US$180/ton (permanent storage). Finally, quantity thresholds were dropped to as low as 1,000 tonnes per CO_2 capture (DAC). A summary of the IRA changes is also shown in Exhibit 2.

Comparatively, Canada has been unable to match the generosity of the 45Q credits. As previously noted (see link), we valued Canada's carbon capture investment tax credit (ITC) at $35/tonne, which is less than even the old 45Q tax credit (pre IRA). Canada has also taken a punitive approach to manage carbon emissions, unveiling a progressively increasing carbon price to $170/tonne by 2030. The line chart in Exhibit 3 charts the progression of U.S. tax credits ("the carrot") compared to Canada's price on carbon ("the stick").

Exhibit 3: Carbon Pricing – Canada's Carbon Price Vs. U.S. CCS Tax Credits, 2019 - 2030



Note: Chart assumes 2.5% annual inflation for IRA prices. Source: U.S. Inflation Reduction Act of 2022 and CIBC World Markets Inc.

On paper, the ramp to $170/tonne is intended to provide a roadmap for large emitters to address their decarbonization plans with some sense of assurance. This assurance did not occur, as a result of the politically divisive nature of the price on carbon. In the end, Canada has had to take an "in-between" approach; while the Supreme Court approved federal jurisdiction to regulate emissions, Ottawa is still hesitant to encroach on the provinces. This decision has led to varying regulatory approaches with varying carbon prices, ultimately diluting the long-term efficacy of Canadian carbon policy.

Canada's bifurcated carbon pricing policies can be difficult to understand, even for domestic investors.

This has been less of an issue in the U.S. by not taking a "stick" approach and providing generous 45Q tax credits, the U.S. strategy appears more likely to be successful in attracting capital. We note Canada has yet to devise a mechanism to address the rising risk of carbon leakage within our current carbon pricing model.

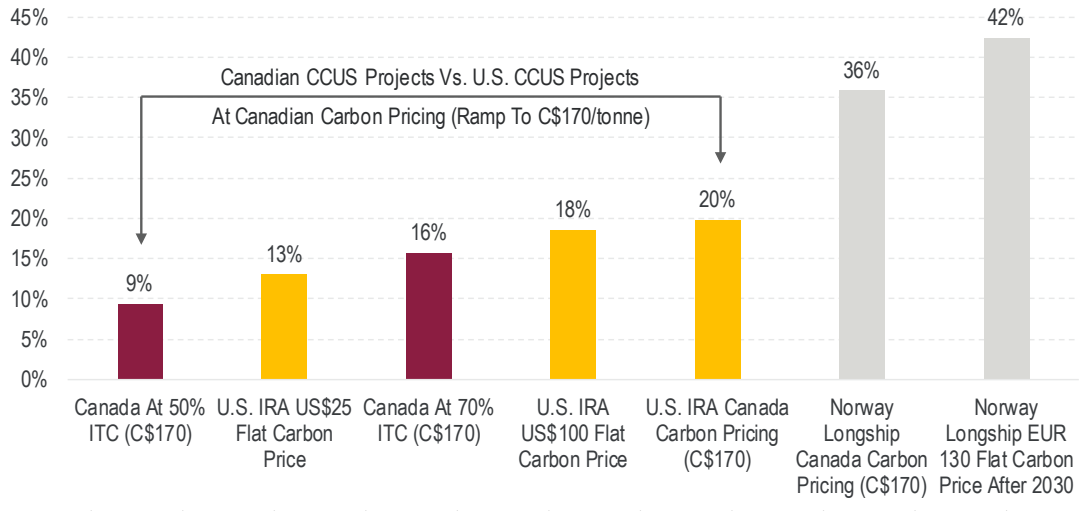
Globally, other countries have also become more competitive in attracting capital to advance decarbonization goals. Our carbon capture economic models suggest that Canada has fallen behind in its ability to both abate existing emissions and cultivate an environment for companies to deploy capital. As Canadian energy companies advance foundational projects to develop CCUS, we believe these projects would have already been approved if fiscal conditions and regulatory policies more closely resembled those in the U.S. or even Norway's Longship framework.

Incorporating Canada's existing 50% carbon capture ITC, we estimate a fiscal incentive of $35 per tonne. This level of government participation is significantly below prior investment levels in an existing megatonne-scale blue hydrogen CCUS project, lower than the old U.S. 45Q regulation (US$50/ton), and far below the revised IRA incentives (US$85/ton).

Increasing the ITC to 70% would go a long way in making Canada more competitive with other jurisdictions.

As a result, Pathways' carbon capture project IRR in Canada greatly underperforms an equivalent in the U.S. under comparable carbon prices (i.e., ramp to $170/tonne); a similar U.S. project generates almost a 20% IRR compared to Canada at 9%. Even at significantly lower domestic U.S. carbon prices (US$25/ton), the IRA incentives are far more attractive than what Canada currently offers at $170/tonne carbon pricing (13% vs 9%). These economics can all be seen in the bar charts in Exhibit 4.

Exhibit 4: Carbon Capture Economics – Project IRRs Across Various Fiscal Policies



Notes: Economics shown above are based on the following assumptions:
1) Estimates include $1.65 billion per MMtpa (million tonnes per annum) in costs associated with carbon hubs, connecting pipeline to the Cold Lake region and initial setup of a storage reservoir.
2) Carbon pricing modelled off of TIER and federal government carbon price increase to $170/tonne by 2030 ($65/tonne in 2023).
3) 90% utilization/runtime across CCUS projects.
4) Assume 45Q tax credits extend through the life of the project.

Source: Bloomberg, BNEF, company reports and CIBC World Markets Inc.

A Roadmap To Achieving Canada's Climate Change Goals

Canada's oil and gas sector has been relatively unsupported by Ottawa in the scale of its decarbonization challenge.

Oil and gas production is the largest proportion of Canada's carbon emissions and still receives a relatively small share of the federal government's climate funding pie. The federal government has announced ~$19 billion in direct oil and gas climate funding or ~11% of the ~$170 billion in total (see the table in Exhibit 5). Canada's strategy needs to be centred around its largest emissions industry (oil and gas). By ignoring what should be the most important part of Canada's decarbonization strategy, the federal government risks a Potemkin village.

Exhibit 5: Canadian Emissions – Total Emissions And Federal Funding By Sector, 2005, 2019, 2020, 2021 And 2030

Emissions (MT) By	Historical			Estimated/Forecast		2030F Vs. 2021E		Federal Funding	
Economic Sector	2005A	2019A	2020A	2021E	2030F	MT	%	$ bln.	%
Oil and Gas	171	203	179	190	110	-80	33%	$19	11%
Transportation	160	185	159	169	143	-26	11%	$70	41%
Buildings	84	92	88	89	53	-36	15%	$19	11%
Heavy Industry	87	77	72	74	52	-22	9%	$6	4%
Agriculture	66	67	69	65	71	7	-3%	$2	1%
Electricity	118	62	56	54	14	-40	17%	$21	12%
Waste & Other	55	52	50	51	29	-22	9%	$26	15%
LULUCF	-17	10	-7	-8	-30	-22	9%	$9	5%
Total	**724**	**748**	**666**	**683**	**443**	**-241**	**100%**	**$173**	**100%**

Note: Federal funding values shown here include direct spend, and not indirect fiscal measures such as the budgeted costs of Canada's suite of investment tax credits, etc.

Source: Canadian Climate Institute, Navius Research and CIBC World Markets Inc.

Budget 2023 was a (small) step in the right direction to help provide additional clarity around a CCUS investment tax credit, but at this juncture industry needs more than just a modest increment of clarity.

We view the investment tax credit structure as appropriate in helping to incentivize carbon capture projects. Economics for allocating capital in Canada to these multi-billion-dollar projects does not compete for capital at current rates of return. Further, projects that make the hurdle rate are not as impactful to achieving Canada's emissions reduction commitments. We estimate an ITC top-up to 70% would cost the government an incremental ~$3.3 billion, but could spur $16.5 billion in spending on a foundational CCUS project as it helps close the gap against other jurisdictions and competing projects with lower emissions reduction impacts.

If sanctioned today, we estimate the Pathways' CCUS project would require at least four years to ramp-up to full capacity. This suggests a regulatory approval process for the pipeline, which must be completed within three years for this project to help Canada achieve its 2030 goal. Canada does not have a good track record of shepherding major projects through the regulatory and approval process. To date, no major energy infrastructure project has moved from initial sanction to onstream in less than 10 years, and there are now further requirements for major project approvals tied to Bill C-69. To this effect, we believe the window for Canada to achieve its 2030 commitments has closed.

We will delve into the two primary concerns companies have when looking to invest in carbon capture projects. These issues need to be resolved before Canada can hope for 2035 as the timeline to achieve its 2030 emissions reduction goals.

1. Clarity around the regulatory approval process
2. Further confirmation and clarity on the price of carbon

Given uncertainty around the potential of changing government policy, some combination of fiscal incentives to deploy capital upfront on major projects and increased (or contracted) certainty around the price of carbon is imperative. We estimate that ~97% of the economics of these decarbonization projects for oil and gas companies in Canada are driven by cost abatement, meaning any change in the progression of the price on carbon renders these projects uneconomic with current fiscal incentives.

Regulatory Risk – A History Of Shooting Ourselves In The Foot

Major infrastructure projects have taken 10+ years to complete (five years longer than initial expectations) and have ballooned in costs by over 100% because of approval delays.

As the world looks to decarbonize at record pace and record scale, there are concerns around regulatory burdens that have historically plagued large energy infrastructure investments. This is an issue in both the U.S. and Canada. In the U.S., clean energy CEOs are backing Senator Joe Manchin's efforts to revamp regulatory approvals (see **link**). The 2023 Federal Budget attempted to address this issue with incremental spending allocated towards the Impact Assessment Agency of Canada, the Canada Energy Regulator, the Canadian Nuclear Safety Commission and 10 other federal departments, which will in aggregate amount to $1.3 billion over six years (starting in 2022-2023).

While it is encouraging to see acknowledgement of issues related to the approval of critical projects, Canada's history has been less than satisfactory. Companies are all too familiar with the story of regulatory processes dragging out timelines and inflating costs to the extent that deploying capital becomes unpalatable and projects are cancelled. The energy industry is reticent of balancing a need to engage relevant stakeholders while staving off ballooning budgets due to a drawn-out regulatory process. Examples of such include Keystone XL, Northern Gateway Pipeline, Trans Mountain Expansion ($31 billion!) and LNG Canada. We contend that LNG Canada is advancing, but Coastal Gaslink pipeline costs are significantly higher than at sanction. The table in Exhibit 6 provides further details on key notable energy projects adversely impacted over the years.

Exhibit 6: Key Energy Infrastructure – Major Project Delayals And Cost Overruns, 2009 - Present

Proposed Project	Capacity	Initial Application	Initial In-service	Original Budget ($MM)	Most Recent In-service	Most Recent Budget ($MM)	Termination
Crude	(MBoe/d)						
Keystone XL	830	2009	2012	$7.2	2023	$11.1	2021
Northern Gateway	525	2010	2015	$6.7	2019	$7.9	2016
Trans Mountain Expansion	590	2013	2017	$5.4	2024	$30.9	
Enbridge Line 3 Replacement	760	2014	2018	$7.9	2019 (Canada) 2021 (U.S.)	$10.4	
Natural Gas	(Bcf/d)						
LNG Canada	2	2012	2019		2025	$40.0	
Coastal Gaslink	2.1	2012	2018+	$4.0	2024 / 2025	$14.5	

Source: Company reports, Canadian Energy Regulator, BC Energy Regulator and CIBC World Markets Inc.

To be fair, this is not to say oil sands companies (or energy, generally) will shy from funding sustainability projects – we view the sector as both resilient and industrious. However, the focus will continue to be on maximizing returns, while mindful of compliance costs. We believe the government can better align its interests with industry.

Current regulatory and fiscal frameworks:

1. Focus too much on penalizing existing operators/sectors through compliance cost avoidance as the driver for abatement (outlined in Exhibit 4's economic scenario);
2. Fall short of providing competitive fiscal incentives for companies to deploy capital on projects accelerating Canada's decarbonization path towards net zero; and,
3. Result in uncertainty regarding inconsistent carbon pricing, arbitrary adjustments to credit expiries, rate of annual tightening, and ever-changing abatement requirements.

In our view, this is resulting in oil sands operators focusing on debottlenecking operations to improve supply costs and furthering technology to lower unit operating costs (and emissions), while returning cash to shareholders – rather than developing large-scale carbon capture projects that could move the decarbonization needle for Canada.

CCUS projects will now have to rely on help from the province to move forward. We believe either a 25% ITC top-up or coverage of ~60% of OPEX for the first 10 years could help projects compete for capital.

The Pathways-backed carbon trunkline is of particular concern. The project is subject to Bill C-69's amended process inviting opposition from almost anywhere in the world, risking approval of the project being irreparably delayed. In our view, pipelines such as Pathways' carbon trunkline require a streamlined regulatory process. Without certainty in the development and timing of the pipeline's completion, companies will be unable and unwilling to build capture projects, putting Canada's 2030 and beyond emissions pledges further at risk. We have yet to see a major pipeline project approval be completed in what most companies would deem a "reasonable" timeline and that could be the largest bottleneck impeding the sanction of projects.

We have run a sensitivity on cost inflation impacts for Pathways' foundational carbon hub and subsequent carbon capture projects to highlight the impact of cost creep as well as how additional help (ITC top-up) or subsidizing opex could help moderate this risk. The data table in Exhibit 7 shows our estimated CCUS project IRR under various levels of principal government contribution. We highlight that as interest rates rise and Pathways companies deleverage, the cost of capital, or the hurdle rate increases significantly. Further, the risk of project cost overrun due to the delay of FID (Final Investment Decision) on a project could mean that the provincial government would need to increase the contribution to allow the project to meet a minimum hurdle rate of ~15% (still below that of U.S. IRA economics).

Exhibit 7: CCUS – Project IRR Under Various Levels Of Provincial Government Contribution

CCUS Project Cost Overrun	Provincial Government Contribution On Capex (ITC)							
	0%	10%	15%	20%	25%	30%	35%	40%
0%	9.3%	11.8%	13.4%	15.6%	18.5%	22.8%	29.5%	42.0%
5%	8.8%	11.2%	12.8%	14.9%	17.7%	21.8%	28.2%	40.3%
10%	8.3%	10.7%	12.2%	14.2%	17.0%	20.9%	27.1%	38.7%
15%	7.9%	10.2%	11.7%	13.6%	16.3%	20.0%	26.0%	37.2%
20%	7.5%	9.7%	11.2%	13.1%	15.6%	19.3%	25.0%	35.9%
25%	7.2%	9.3%	10.7%	12.6%	15.0%	18.5%	24.1%	34.6%
30%	6.8%	8.9%	10.3%	12.1%	14.5%	17.9%	23.3%	33.4%

CCUS Project Cost Overrun	Provincial Government Contribution On OPEX							
	0%	15%	30%	45%	60%	75%	90%	100%
0%	9.3%	11.9%	14.3%	16.5%	18.7%	20.9%	23.0%	24.4%
5%	8.8%	11.3%	13.6%	15.8%	17.9%	20.0%	22.0%	23.4%
10%	8.3%	10.8%	13.0%	15.1%	17.1%	19.1%	21.1%	22.4%
15%	7.9%	10.3%	12.5%	14.5%	16.5%	18.4%	20.2%	21.5%
20%	7.5%	9.8%	11.9%	13.9%	15.8%	17.7%	19.5%	20.7%
25%	7.2%	9.4%	11.5%	13.4%	15.2%	17.0%	18.8%	19.9%
30%	6.8%	9.0%	11.0%	12.9%	14.7%	16.4%	18.1%	19.2%

IRR that meet or exceed hurdle rate

Source: Company reports and CIBC World Markets Inc.

Fiscal Incentives – Making Canada More Competitive On CCS

Industry has highlighted a number of possible incentives to help de-risk capital deployment on megatonne-scale carbon capture projects. Given the federal government's unwillingness to incrementally help lower emissions from the sector, the provinces may have to step up to overcome this oversight. We continue to believe this could involve a combination of further capital spending offsets (ITC top-up), the addition of enhanced oil recovery (EOR) into an ITC framework or offsetting operating costs associated with capturing, transporting and storing carbon. There are global and local examples of these incentives.

The Longship project in Norway offers producers 67% in capital spending incentives while also offsetting operating costs for the first 10 years, resulting in IRRs north of 40% on projected EU carbon pricing (see Exhibit 4). Even Shell Canada's QUEST carbon capture project received a combination of capital cost incentives and offsetting operating expenses. The QUEST project has successfully captured 6 million tCO_2 since inception (2015).

Provincial governments have indicated an interest in providing further incentives, but in participation with the federal government. Given rising costs (including higher costs of capital), we estimate a minimum of ~70% of spending being returned as an investment tax credit could help moderate the risk to companies in deploying capital on carbon capture and that offering some help on operating costs would further incentivize companies.

It's in the province's best interest to help keep oil sands production online. We estimate Alberta could collect $760 billion in royalties alone at US$75 WTI.

If the provincial government is able to provide further assistance, it will help bridge the gap with the U.S., which is already attracting incremental capital as IRA incentives are more generous and broader in scope. For example, the 45Q legislation does not prohibit funding for EOR carbon capture (unlike in Canada). Also, the IRA's hydrogen production tax credit supports zero-carbon fuels on top of lowering transport emissions.

We believe the Federal Liberals are either politically unwilling or unable to increase their contribution to decarbonizing the oil and gas sector. Further assistance will have to come from the provinces. Currently, we see companies only sanctioning projects meeting higher economic hurdle rates such as Suncor's cogeneration (coke-fired boiler replacement) project or Imperial Oil's renewable diesel facility (Strathcona refinery). Spending on larger, multi-billion-dollar CCUS projects has been limited to engineering and design work until there is further clarity around government policy, and a more attractive fiscal environment.

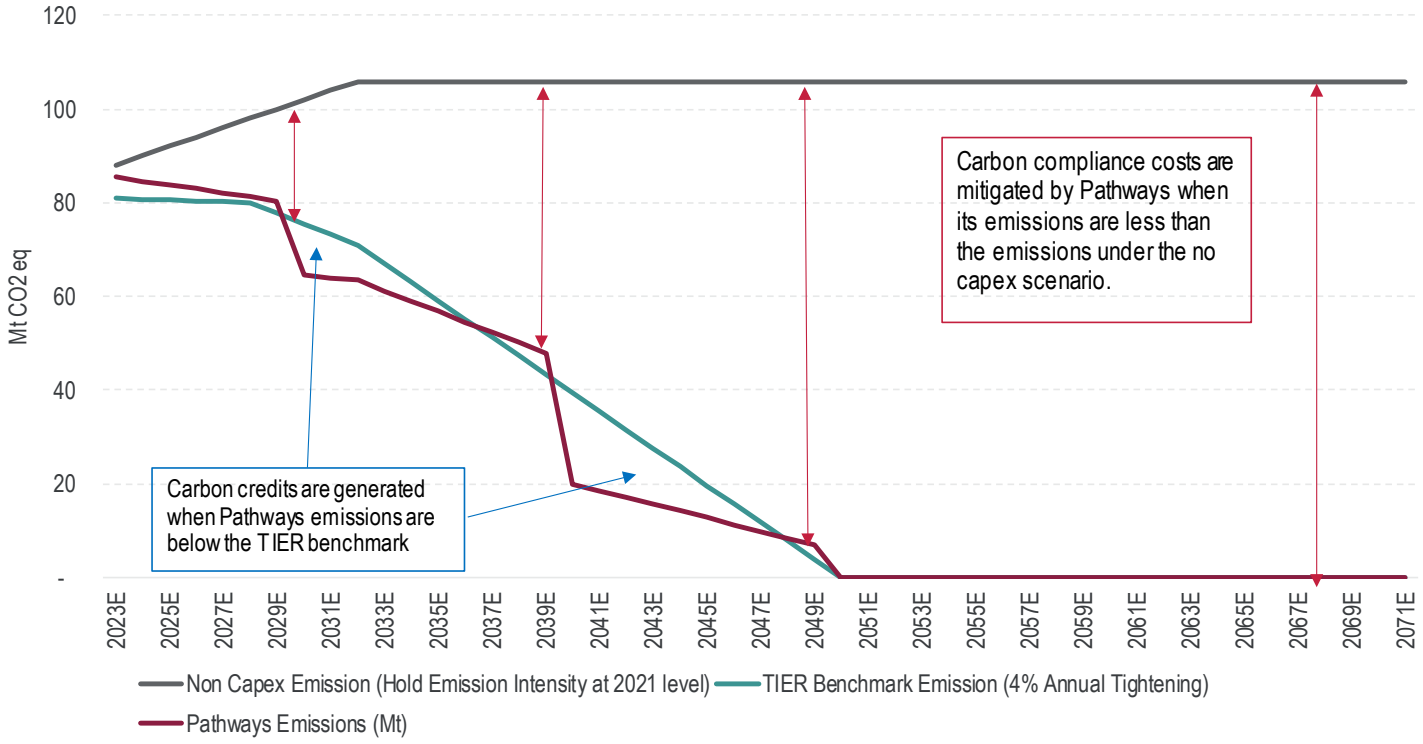
What would the provincial government receive in return? The Pathways Initiative (a consortium of oil sands companies) estimates $75 billion in capital spending is required to achieve net zero from its operated oil sands assets. On strip pricing, we estimate production at current levels could generate ~$17 billion annually in direct government revenues ($5 billion in cash taxes and $12 billion in royalties) from the Pathways companies. If WTI increases to US$85/Bbl and US$100/Bbl, direct government revenue could increase to $22 billion and $43 billion, respectively. Over the life of the CCUS projects, we estimate the ability to continue production from the oil sands could net the province $760 billion in royalties alone at US$75 WTI. This provides a significant potential benefit for the provincial government to ensure oil sands production continues and is a preferred barrel globally.

The Carrot Vs. The Stick: Driving Factors For CCUS Economics

We estimate ~97% of the revenues from deploying capital towards decarbonization stem from cost abatement, with the remainder coming from pockets of carbon credits generated when projects are completed ahead of TIER tightening. Using the Pathways Initiative's estimate of $75 billion in capital costs to build out decarbonization infrastructure and an escalating carbon pricing to $170 per tonne, we estimate ~$220 billion in revenue (cost abatement) is possible for the consortium or a ~9% IRR over the next 40 years with 50% ITC.

The line chart in Exhibit 8 shows emission benchmarks, planned reductions as outlined by Pathways, and the unabated emissions levels.

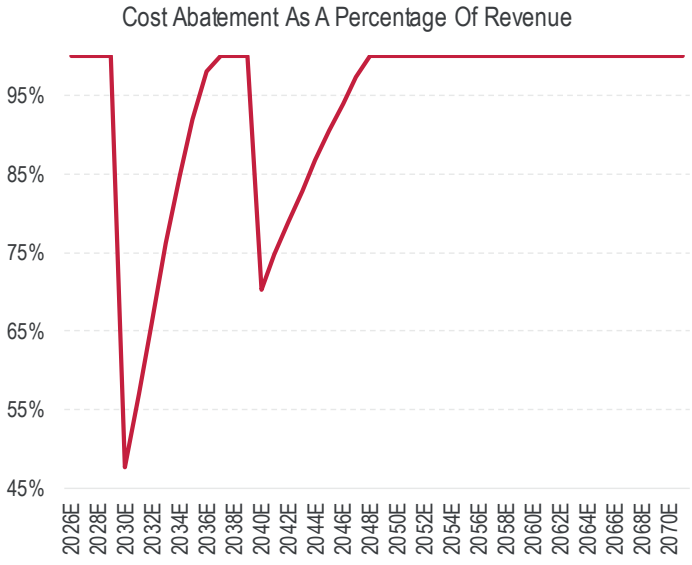
Exhibit 8: Emission Scenarios – Pathways Decarbonization Relative To TIER Stringency, 2023E - 2071E

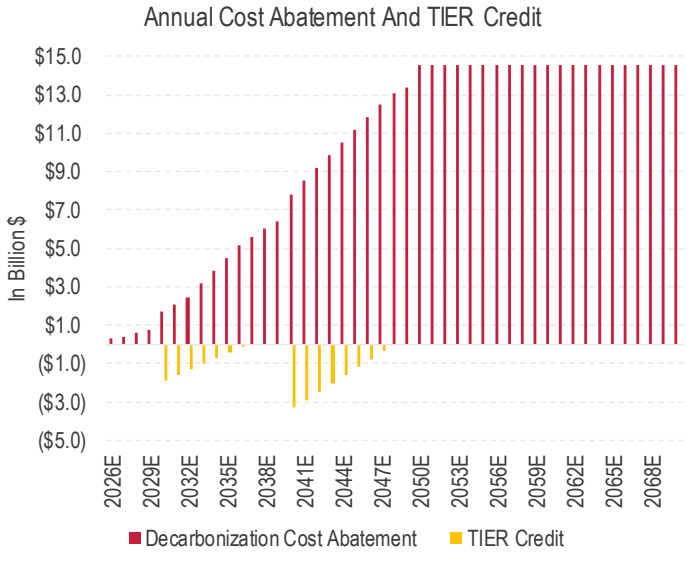


Source: TIER, Pathways, company reports and CIBC World Markets Inc.

We provide two charts in Exhibit 9 highlighting the percentage of revenues generated over time by either cost abatement or carbon credit sales, based on the current 4% rate of annual tightening. As shown, the overwhelming revenue driver for carbon capture in Canada is to reduce abatement costs from an increasing carbon price. Very little of the revenue is expected from the sale of carbon credits, as illustrated in the left-hand line chart and right-hand bar chart in Exhibit 9.

Exhibit 9: Pathways Emissions – Revenues Generated From Decarbonization Initiatives Under TIER, 2026E - 2070E





Source: Company reports and CIBC World Markets Inc.

We estimate the Pathways group would be subject to ~$630 billion in cumulative compliance costs assuming carbon pricing escalates to $170/tonne by 2030 (this drops to ~$320 billion at $85/tonne and ~$190 billion at $50/tonne). This range of potential impacts is why the Federal Budget's introduction of a possible Carbon Contracts For Difference (CCfD) is so important to the discussion around the economics of CCUS projects.

With Budget 2023, Ottawa finally unveiled the use of a carbon contract for difference but only in name. No mentions were made as to the mechanism or reference price. In addition, Budget 2023 references a broad-based approach to CCfDs, which would complement CCfDs offered by the Canada Growth Fund. It is unclear as to how either of these mechanisms work, either independently or with one another.

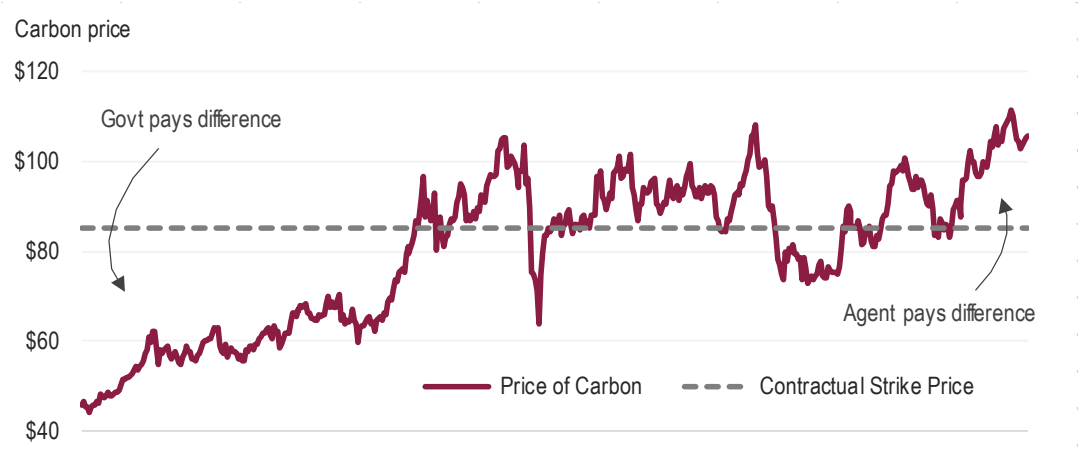
Carbon Price Risk – Carbon Contracts For Difference

Removing bureaucratic red tape is a challenge, but one of the most immediate concerns is the political risk of long-term carbon pricing. The Conservative Party's official line is still to cap carbon prices at $50/tonne, and weeks ago, Federal Party Leader Pierre Poilievre toured Newfoundland with a promise to cut the price on carbon. This is occurring even after Alberta's Technology Innovation and Emissions Reduction (TIER) regulation formally enshrined carbon price increases late last year from $50/tonne to $170/tonne by 2030.

For industry, decarbonization schemes (whether a carbon price, CCUS tax credits or even clean fuel regulations) lacking support from all political parties may stymie capital deployment in critical energy infrastructure. While carbon price risk could conceptually be managed by counterparties through industry-level partnerships, the risk of material changes to future legislation has (thus far) proved too high. As a result, companies cannot, and have not, moved beyond initial engineering work on large sustainability projects. This likely remains the case without assurance of higher carbon pricing from future governments.

The adopted solution has been a carbon contract for difference (carbon CfD, or CCfD). Similar to other contracts for difference, the scheme is a contractual arrangement with a government affiliate and project developer to provide a guaranteed revenue stream (such as delivery of renewable power) with a designated strike price. The strike price inherently protects the project developer from fluctuations in the market price, which can be volatile in nascent markets. When the market price is below the strike price, the developer is paid the difference by government, as seen in the line chart in Exhibit 10, and vice versa.

Exhibit 10: Carbon Contract For Difference – Illustrative Schematic



Source: Bloomberg and CIBC World Markets Inc.

Such an arrangement provides price certainty and encourages more investors to participate in the building of new projects. The CfD is noted for its success in the U.K. under the country's push to increase low-carbon electricity generation (a fantastic explanatory video describing the U.K. contract for difference can be viewed here). It also has a history in Canada as well, namely in Alberta as part of the province's Alberta's Renewable Generation Incentives to similarly increase renewable power generation.

Given the contractual nature of the agreement with a government affiliate, these contracts are essentially unrepealable by future governments without recourse and should help mitigate the risks of changing carbon policy on a political whim. As an example, in Ontario the Doug Ford government notably scrapped green energy projects in Prince Edward County, costing taxpayers $230 million to exit those contracts.

In the table in Exhibit 11, we provide a synopsis of two well-known contract for difference mechanisms in the Netherlands and the U.K. The Dutch SDE++ program covers a host of low-carbon technologies, including carbon capture and storage (CCS). The second involves the U.K.'s push to increase renewable power generation through contract for differences signed with the Low Carbon Contracts Company (LCCC). The mechanism is specific to power generation. For a more fulsome explanation of both countries' CfD mechanisms, see Appendix 1.

Exhibit 11: Contract For Differences (CfDs) – Examples Of Two Well-known Frameworks Using CfDs

Contract For Difference Scheme	Commodity	Designed Capacity	Subsidy?	Reference Price	Strike Price	Allocation
Netherlands SDE++	Carbon capture	8.3 MT / year	Yes	EU carbon price + Dutch carbon tax (if applicable)*	Operating + investment cost (Capture, Transport and Storage costs)	CCS auctioned to lowest bidder until capacity is met
Low Carbon Contracts Company	Low-carbon electricity	Varying	No	U.K. power market price	Varies by producer, determined via auction	Power generation auctioned until capacity is met

Note: The Dutch SDE++ program "reference" price less "strike" price payment differential varies each year so as to cover the uneconomic portion of operating CCS projects.

Source: Dutch Ministry of Economic Affairs and Climate Policy, Bellona UK, Low Carbon Contracts Company and CIBC World Markets Inc.

We propose the federal government offer long-term carbon contract for differences between the current (and escalating) carbon price and the actual CO_2 abatement cost. This is similar to the Netherlands' SDE++ program for Carbon Capture development, where the contract for difference is a subsidy mechanism for the uneconomic cost of CCS development. The policy lowers project risk by stabilizing the revenue (or cost abatement) portion of the venture.

While rare, we believe bipartisan support for the announced carbon contract for difference would meaningfully reduce carbon price risk and help deploy capital to CCS initiatives. The energy industry is a commodity business with frequent, material swings in energy prices. While industry accepts price volatility, this is challenging when such changes are driven primarily by a changing policy and not market fundamentals. This will continue to impact how operators allocate capital towards growth, decarbonization and shareholder initiatives.

Promoting Canada As A Leader In Carbon Capture

Government must balance a capitally intensive shift towards lower carbon economies without adversely impacting economic activity. Recent geopolitical events (Ukraine) have increased global concerns about energy security, while also causing notable price increases on key goods such as food and energy. Canada is in an enviable position. Its energy industry has shown a willingness to allocate capital towards decarbonization and holds a wealth of experience and technical knowledge to drive down abatement costs for the economy.

To date, government policy has hindered industry in deploying capital towards large-scale, decarbonization projects. The oil and gas cap is also still of concern. If Canadian production is curtailed in an environment of energy insecurity, this drives carbon leakage as other regions significantly ramp-up imports from other non-ESG-friendly markets. If Pathways is successful in deploying its net-zero strategy, the emissions intensity of Canadian crude from a wells-to-wheels basis falls in line (or below) the global average. Canada could also be negatively affected given the elevated cost of purchasing refined products consumed by its citizens while doing little to offset the greater issue.

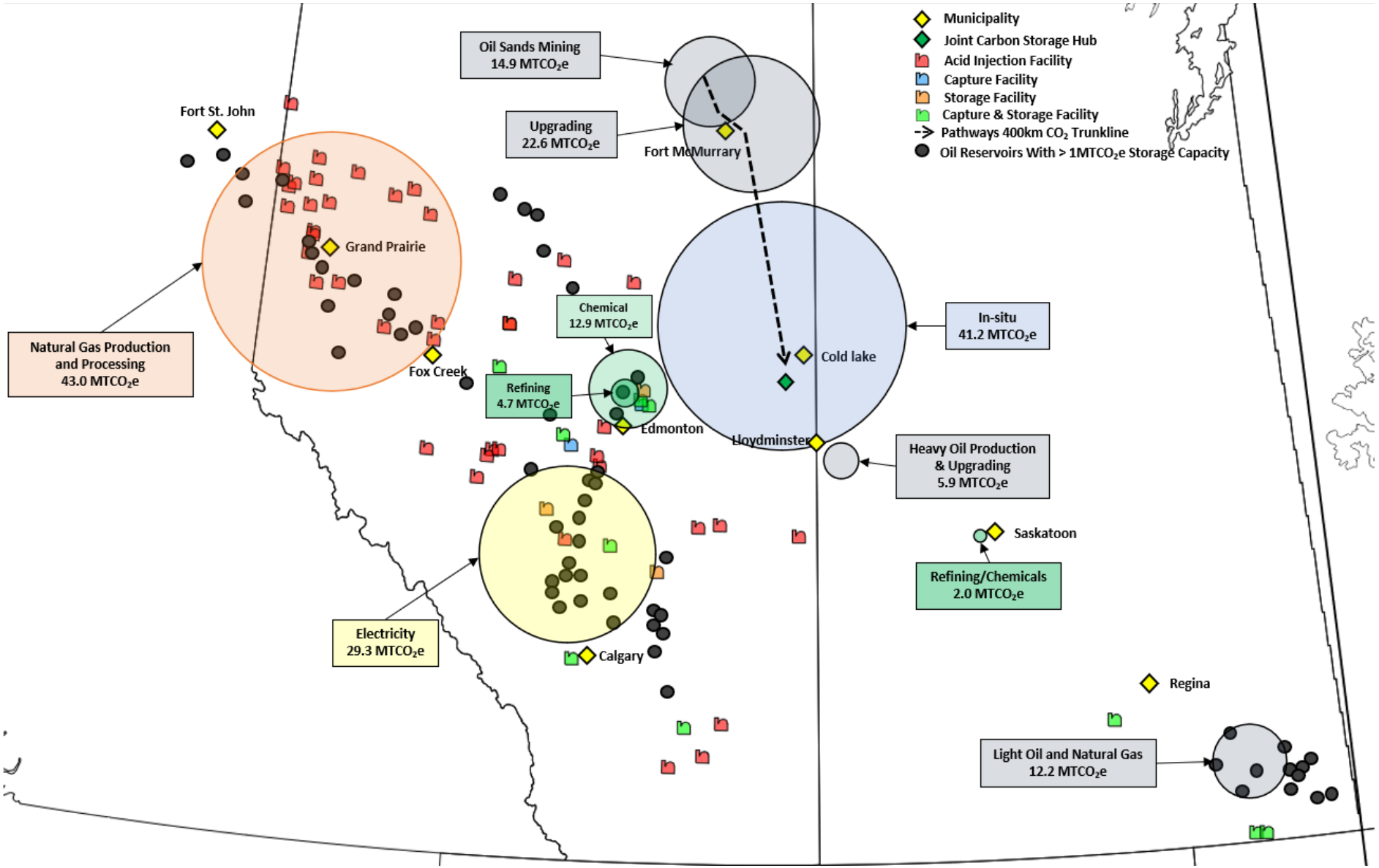
Given this last point, we believe it makes more sense to work with existing producers to establish an appropriate decarbonization goal (similar to that already outlined and agreed upon between the federal government and Pathways) and a competitive funding model that attracts private investment from the space. This could lower government's need to directly develop decarbonization projects and subsequent spiraling, out-of-control costs.

Canada can be a leader, but political knuckle-dragging may cause irreparable damage as the country seeks to encourage future development and decarbonization: Canada has many unique advantages promoting the country as a favoured destination for CCUS capital, including:

- **Geographic concentration of point sources of emissions:** The concentration of emissions from industrial complexes or oil and gas extraction sites provides cost efficiencies in building out carbon-gathering hubs and trunk lines. We estimate less than 300 major emissions sources from boilers, co-gens, Heat Recovery Steam Generators (HRSGs) and Once-through Steam Generator (OTSGs) across the five oil sands mines and 13 in situ facilities across the Pathways Initiative companies.
- **Good understanding of geology from decades of experience developing the WCSB:** The oil and gas industry has years of experience injecting CO_2 into geological formations and millions of tonnes of CO_2 are already injected annually in Canada. Given the long history of developing oil and gas within the WCSB, we believe industry has a large dataset from which to identify and evaluate reservoirs for potential CO_2 sequestration (see the map in Exhibit 12).
- **Prior experience with CCS in general:** We highlight two projects that have captured and stored carbon successfully at a commercial scale: Shell Canada's pre-combustion project and the Quest and SaskPower post-combustion project at Boundary Dam. Meanwhile, Entropy has developed and is testing a proprietary design and solvent for low-capital, modular CCUS.
- **Building out infrastructure helps lower costs of new tech deployment:** If new technology is burdened with capital spending on greenfield infrastructure, economic thresholds will be even harder to reach. Many of the technologies for extracting low concentrations of CO_2 at megatonne-scale from exhaust streams still need work to drive down costs. Building and subsidizing the greenfield infrastructure could help and encourage deployment of new decarbonization technology.
- **Adoption of CCUS can help other industrial point sources:** Alberta is an ideal region for the development of CCUS projects. The creation of hubs connecting various energy and industrial emissions sites helps decarbonize economic sectors outside of energy. The map in Exhibit 12 shows several regions of relatively concentrated industrial activity, oil reservoirs with significant potential storage capacity, and existing CCS projects.

Other jurisdictions are providing more attractive opportunities for companies with jurisdictional flexibility in capital deployment. Losing the ability to develop initial greenfield infrastructure means more intensive (expensive) technologies can no longer be deployed economically.

Exhibit 12: Energy – 2020 Emissions By Source, Acid Injection, & CCS Facilities



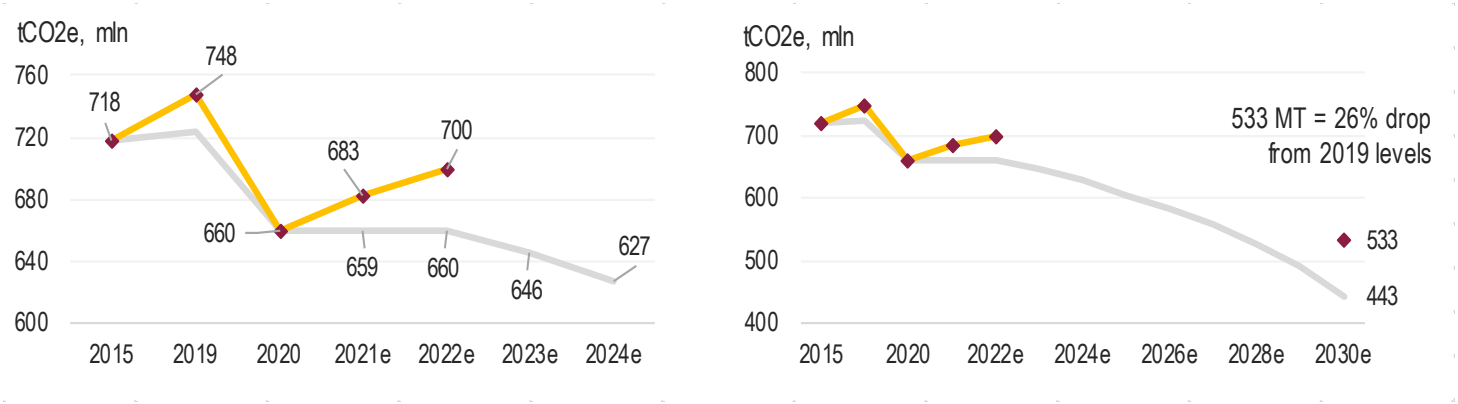
Source: Environment and Natural Resources Canada, National Energy Technology Laboratory, GeoSCOUT and CIBC World Markets Inc.

The Oil And Gas Cap – The Massive Elephant In The Room

There are still question marks for the future of CCS given the lurking elephant in the room – the oil and gas emissions cap. As part of the Liberal electoral campaign in 2021, Prime Minister Trudeau pledged to cap oil and gas emissions "in line with the country's climate ambitions and commitments outlined in the 2030 Emissions Reduction Plan (ERP)."

Canada's 2030 climate targets are ambitious. As shown in the line charts in Exhibit 13, Canada is targeting national emissions of about 440 million tonnes by 2030 compared to an unofficial 683 million tonnes (MT) at the end of 2021 (right-hand chart). On the oil and gas side, unofficial emissions at the end of 2021 were over 40% higher than the 2030 ERP target (190 MT vs. 110 MT). We estimate Canadian emissions were 700 MT in 2022, already 17% off the ERP.

Exhibit 13: Canadian Emissions – Historical Emissions Relative To Canada Emission Reduction Plan, 2015 - 2030



Notes: Canadian official GHG reporting as of 2020. 2021 unofficial estimates as per Canadian Climate Institute. 2022 GHG emissions estimated by CIBC. 2030 emissions estimate as per Canadian Climate Institute and Navius Research's "Developing Policy" scenario. 2019 data revised upwards in official GHG numbers, but not yet updated in 2030 ERP.
Source: Canadian Climate Institute, Navius Research and CIBC World Markets Inc.

Canada will not meet its 2030 climate targets. Devising an oil and gas emissions cap around an overarching target widely accepted as unachievable is unlikely to be sustainable legislation. Rather, in our view, the country should focus on 2050 and chart a sustainable emissions path to net zero, as is enshrined by law (the Canadian Net-Zero Emissions Accountability Act).

So the question becomes what does an oil and gas cap look like? The federal government has confirmed the oil and gas cap emissions will take one of two routes, either the:

1. Development of a new cap-and-trade system, or the
2. Modification of existing carbon pollution pricing systems

The key differentiating factor revolves around price certainty vs. quantity certainty. At first blush, given the underlying objective is to reduce oil and gas emissions *aligned with a defined emissions target* implies policymakers likely prefer the explicit nature of a "hard" cap-and-trade system. This is the path the EU has taken (Emissions Trading Scheme, or ETS), and the bloc has been the best performing of any major region in keeping pace with its stated emissions pledges.

It is important to note, however, these mechanisms are not mutually exclusive and can replicate one another when coupled with additional policy designs. For example, the use of a carbon contract for difference, as stated already, can help improve the long-term price transparency within a cap-and-trade system. In the table in Exhibit 14, we provide a list of key pros and cons, comparing and contrasting a cap-and-trade system with an amended carbon price, as it permits to Canada's stated oil and gas emissions cap.

Looking at the balance of issues, the modification of the carbon price method is, in our view, the best positioned to deal with current Canadian realities. While Exhibit 14 mentions a

number of considerations, we believe the most important variable for government to consider is **time**. The U.S. IRA has already unleashed billions of deployed capital and Canada cannot afford to implement additional policies that delay investments. The creation of an oil and gas cap-and-trade system could unnecessarily complicate carbon policy, given the same effect can be matched with carbon pricing – it just depends how stringent Ottawa wants to be.

Exhibit 14: Canada Oil And Gas Emissions Cap – Key Considerations Across Considered Design Schemes

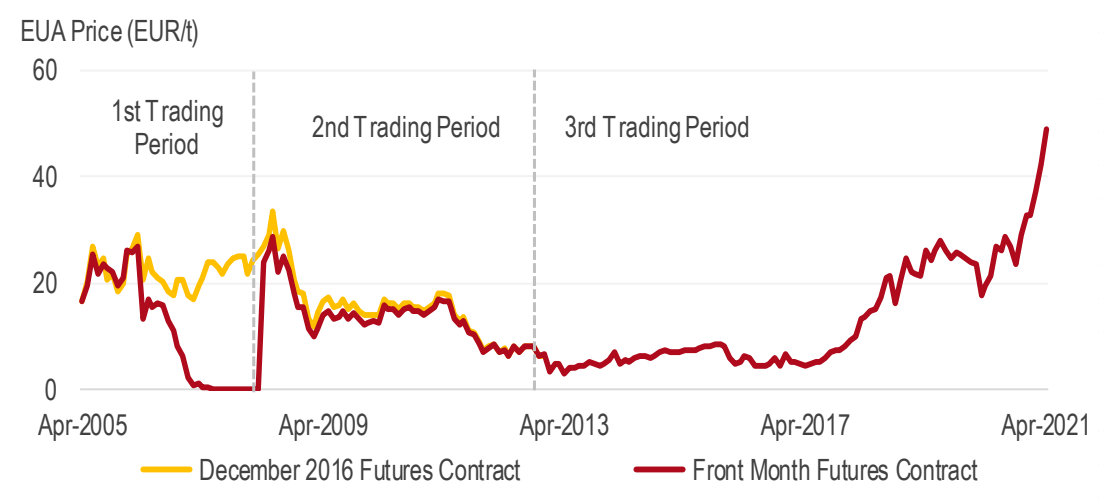
Scorecard	Preferred Method	Cap-and-trade	Modification Of Price On Carbon
Emissions Quantity vs. Emissions Price	Cap-and-trade	A cap-and-trade system designates an explicit quantity (cap) of allowable emissions and lets the market dictate the price of emissions.	A price on carbon sets an explicit price on emissions, providing price certainty at the expense of an explicit quantity of allowable emissions.
Time To Implement	Price On Carbon	Given it is a new system, it likely takes longer to implement.	Carbon pricing (tax) already well established in Canada at both federal and provincial levels.
Integration With Existing Policies	Price On Carbon	How would the cap integrate with existing regulations, such as clean fuel standards, methane targets, and federal carbon price?	Carbon pricing is the foundation of Canada's climate strategy, with other existing mandates already built on top of it.
Political Divisiveness/ Constitutionality Challenges	Price On Carbon	A hard cap on emissions likely invites Constitutional challenges, only further adding to political uncertainty around long-term carbon policy.	Both the federal and Alberta's provincial TIER regulation can be easily amended for required price increases.
Productivity (Winners Vs. Losers)	Price On Carbon	Differential treatment of a specific sector reallocates capital and labour through the economy, moving production inputs away from their most productive use. The implementation of a hard cap likely exacerbates this risk relative to an amended carbon price.	
First Nations Exposure	Price On Carbon	During consultations with experts and Parliament's Standing Committee on Natural Resources, concerns on how an oil and gas cap could impact First Nation communities were addressed, but there is little to suggest substantive research has been done on the topic. Conversely, carbon pricing in Alberta has been in place since 2015.	
Investment Considerations	Push	Investors prefer price certainty on long-dated, multi-billion-dollar projects. This is better addressed under an explicit, guaranteed carbon price mechanism, but to be fair, a contract for difference can mitigate price fluctuations within a cap-and-trade system as well.	
Carbon Leakage	Push	Addressing carbon leakage is a challenge under both scenarios. Canada has not yet built in an international counter-balance to address the likelihood of greater compliance costs on Canadian oil and gas producers relative to their global counterparts.	

Source: CIBC World Markets Inc.

First, the setup of a new policy mechanism, especially one as overarching as a hard cap-and-trade system, is more time-consuming. Canada already has differing carbon prices across provincial and federal regulation, and we would expect pricing to be even further bifurcated with a sector carve-out. In addition, how would the cap interact with existing policies such as the federal carbon price, methane regulations and the clean fuel standard? It adds administrative complexity for government and compliance burden for firms.

Second, a cap-and-trade system is not as "hard" as one may think. The schemes ultimately have price controls built in, to ensure prices do not slump or ramp too quickly. Early on in the EU Emissions Trading System, credits from Phase 1 could not be transferred over to Phase 2, which essentially took the price of carbon allowances to zero, as shown in the line chart in Exhibit 15. The bloc also had to create a Market Reserve fund to purchase surplus carbon credits in 2015 as a result of a slump in pricing driven by depressed economic activity (and hence demand for carbon allowances) from the Global Financial Crisis.

Exhibit 15: Carbon Prices – EU Emissions Trading System Pricing, 2005 - 2021



Source: Bloomberg and CIBC World Markets Inc.

In both instances, the market required intervention from policymakers to ensure the functioning of the market met desired objectives. If an oil and gas cap-and-trade system resulted in prices getting too high too quickly, the government would likely have to inject more credits (borrow credits from the future) to reduce price pressure, as it makes no sense to overly penalize industries. At that point, a cap-and-trade system functionally becomes very similar to a direct carbon price system.

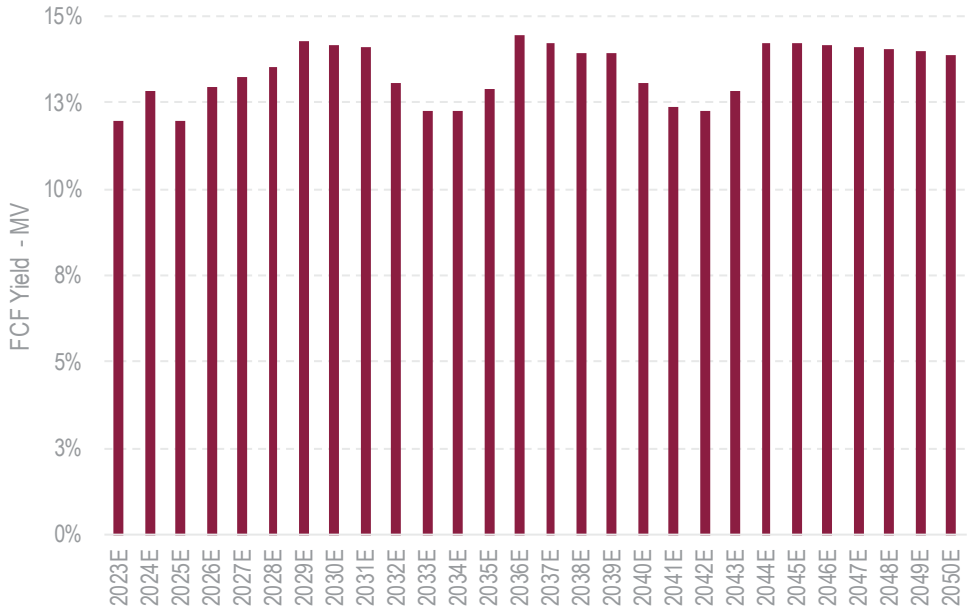
Capex associated with Pathways' CCUS plans will not meaningfully impact free cash flow yield, but would, over the next 10 years, redirect ~$54 billion in cash flow away from shareholder return initiatives.

Finally, the implementation of a federal cap-and-trade system likely only adds to political division within Canada. It likely would be challenged in court, and creates further instability at a time when investors and businesses most need stable, long-term policy.

Impact Of Pathways Spending On FCF Generation

We expect the Pathways group to generate $35 billion in free cash flow each year at long-term US$70 WTI pricing, with the assumption that it proceeds with three phases of carbon abatement projects with total capture capacity of 50 Mt CO_2. Over the next 10 years, we estimate costs associated with Pathways' decarbonization projects will shift $54 billion (at least) away from shareholder return initiatives, including capital costs to build out projects and the operating costs to capture and store CO_2. The bar chart in Exhibit 16 illustrates our estimates of Pathways' FCF yield based on the market cap of the companies through 2050.

Exhibit 16: Pathways Group – FCF Yield (Based On Market Value), 2023E - 2050E



Source: CIBC World Markets Inc.

Alberta's New (And Improved) TIER

In late December, Alberta made key changes to its TIER (Technology Innovation and Emissions Reduction) regulation to better align with the proposed hikes in the federal carbon price to $170/tonne, namely:

1. Increasing the TIER carbon price from $50/tonne in 2022 to $170/tonne by 2030;
2. Increasing the annual level of emissions tightening (benchmark stringency) to 2% per year, from 1% prior. Oil sands emissions stringency increases further to 4% in 2029 and 2030; and,
3. Allowing for greater percentages of carbon credits to be used to offset compliance emissions, i.e., 60% in 2023, 70% in 2024, 80% in 2025 and 90% thereafter.

Late last year, Alberta's TIER emission regulation adopted increasing carbon pricing to $170/tonne by 2030.

In this section we provide additional colour on the carbon credit market in Alberta under the TIER program and provide an outlook for the supply and demand for TIER carbon credits for the remainder of this decade.

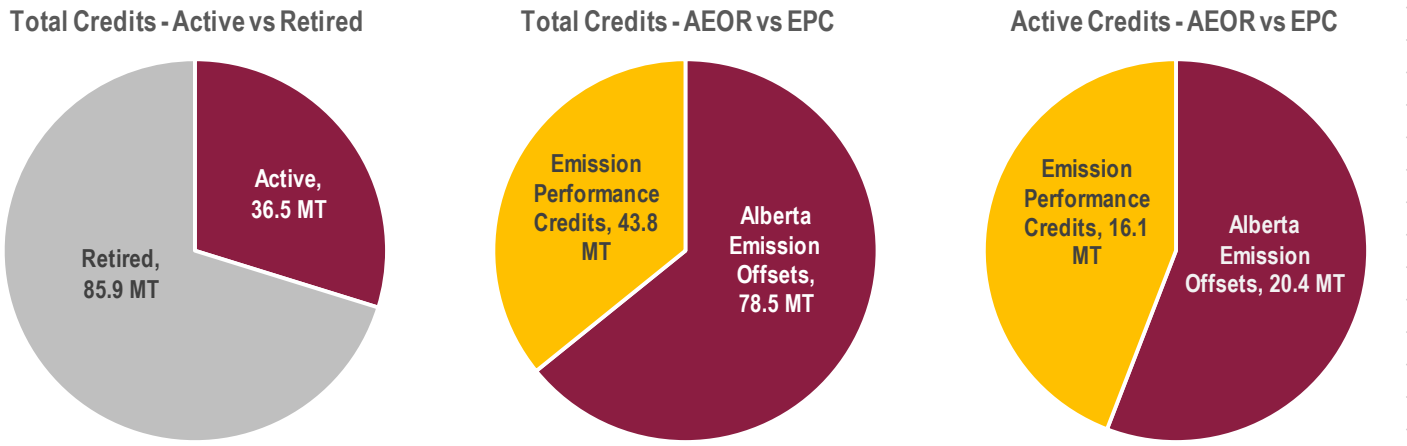
As shown in the pie charts in Exhibit 17, there have been over 120 million tonnes of carbon credits generated in Alberta since 2002. Currently, there are just over 36 million active credits in the Alberta market, with about 86 million tonnes having been already retired.

Under TIER, the market for tradable carbon credits is split into two credit types, namely:

1. Alberta Emission Offsets – "traditional" carbon credits that either remove or reduce the rate/level of emissions (e.g., renewable energy projects, carbon sequestration); and,
2. Emission Performance Credits – credits generated by facilities emitting less than their prescribed allowance under TIER's facility benchmarking scheme

The majority of generated and active credits are Alberta Emission Offsets ("traditional" offsets). Within the active category specifically (36 million active credits), about 20 million are Alberta Emission Offsets (AEOR) and 16 million are Emission Performance Credits (EPC).

Exhibit 17: Alberta Carbon Registry – Snapshot Of Available/Retired Carbon Credits By Credit Type

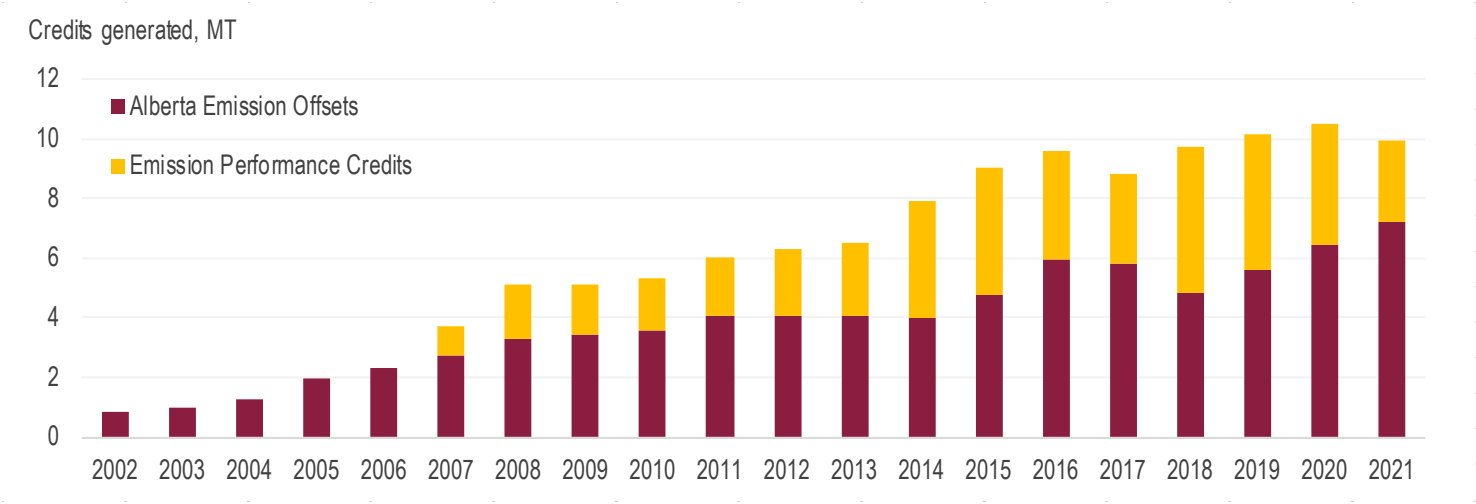


Note: AEOR stands for Alberta Emission Offset Registry credits and EPC stands for Emission Performance Credits. Source: CSA Registries and CIBC World Markets Inc.

About 36 million carbon credits currently active under the TIER system.

In the bar chart in Exhibit 18, we show a time series of carbon credits generated by vintage across both sets of carbon credit classes. Since 2014, the province has generated between eight million to 10 million carbon credits per year, largely split evenly across the two credit types. However, we note a decreasing proportion of EPCs in the last four years, likely reflecting the increasing stringency over time. In 2021, 70% of total generated carbon credits were Alberta Emission Offsets.

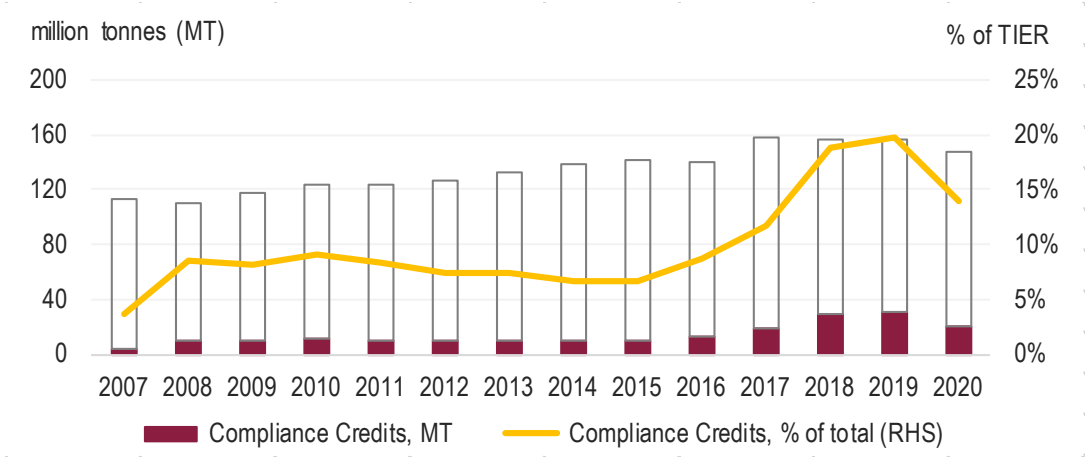
Exhibit 18: Alberta Carbon Registry – Historical Creation Of Carbon Credits By Credit Type, 2002 - 2021



Source: CSA Registries and CIBC World Markets Inc.

Historically, the creation of these two carbon credit classes has been enough supply for the market to meet TIER's emissions compliance. This largely was a result of Alberta's compliance thresholds likely being set too low from 2008 to 2015. As shown in the bar and line chart in Exhibit 19, between 5% to 10% of regulated emissions fell outside of allowable thresholds and were subject to compliance (or, compliance emissions). This percentage has steadily increased over the years to between 15% and 20% (most recent official data point as of 2020).

Exhibit 19: Alberta Emissions Regulation – Percent Of Emissions Subject To Compliance, 2007 - 2020

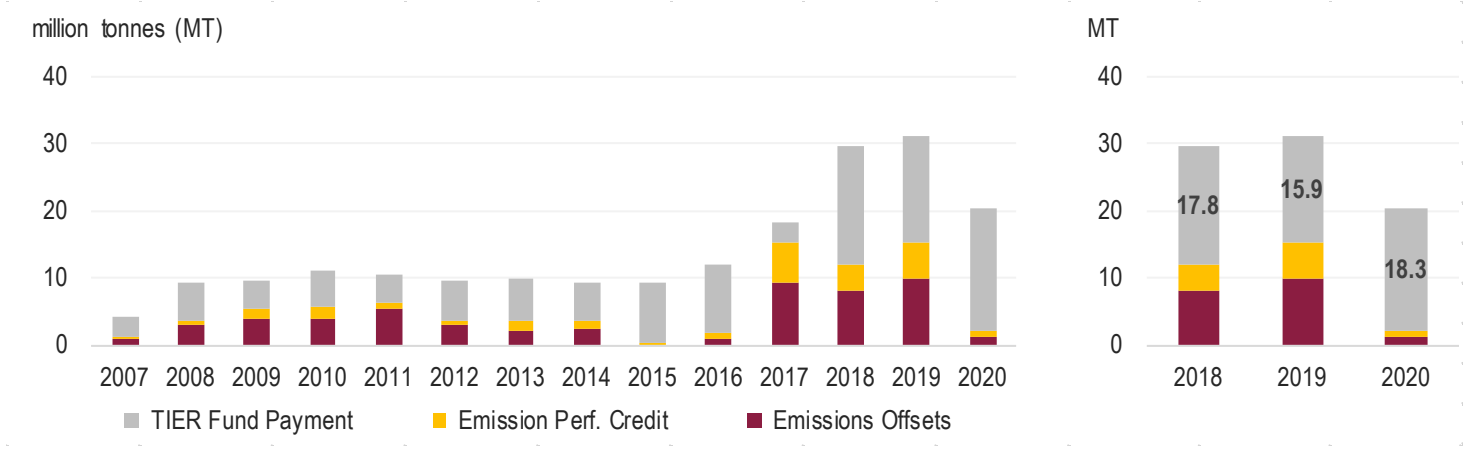


Note: 2020 most recent published data. Source: Alberta Environment and Parks and CIBC World Markets Inc.

Of compliance credits, 90% were paid into the TIER fund in 2020.

If we look closer at compliance payment options, operators have increasingly paid into the compliance fund (i.e., pay the compliance fee, or stated carbon price) to offset compliance emissions. This is shown in greater detail in the Exhibit 20 bar charts. This has been the case especially over the last three years, which could be a reflection of operators holding/banking credits to use in future periods or if credit prices get too high (in anticipation of next year's higher carbon price). In the last year of reported data (2020), about 90% of compliance credits were TIER fund payments (right-hand chart).

Exhibit 20: Alberta Compliance Emissions – Compliance Payments By Type, 2007 - 2020

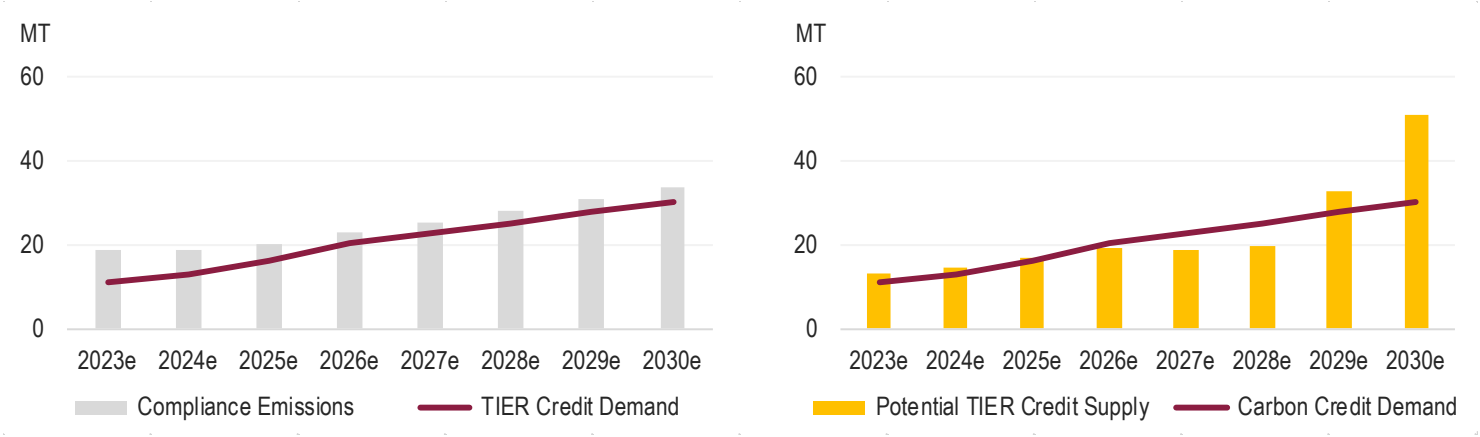


Source: Alberta Environment and Parks and CIBC World Markets Inc.

Based on TIER's revised tightening schedule highlighted earlier (increased to 2%, and then 4% in 2029/2030 for the oil sands), we believe TIER compliance emissions increase to 33 million tonnes by the end of this decade, relative to total TIER regulated emissions of about 145 million tonnes currently (estimate). This is shown in the left-hand chart of Exhibit 21. We note TIER's 2030 stringency of 33 million tonnes would be much higher if not offset by the phase-out of carbon power in Alberta by 2030. This represented about 20 million tonnes in 2020.

With run-rate offset supply of about eight million credits a year, coupled with an active inventory of 36 million tonnes per year, we estimate the market should have enough credits to balance TIER over the next three to four years. This is shown in the right-hand chart in Exhibit 21. Our near-term estimates include current offset projects along with forecasted additional renewable (wind and solar) capacity from the Alberta Electric Systems Operations (AESO)'s long-term power forecast.

Exhibit 21: Alberta Emission Credits – Supply And Demand In Optimistic CCS Build-out Scenario, 2023E - 2030E



Source: Alberta Environment and Parks, Alberta Electric Systems Operations, CSA Registry and CIBC World Markets Inc.

Longer term, the market needs carbon capture to come online as the existing inventory of credits is depleted. In Exhibit 21, we assume major carbon capture projects do not come online until 2029, with the two most notable projects being the Origins project and the AB Carbon Grid project, both with quoted capacities of 20 million tonnes per year. Origins has a quoted service date as early as 2024, with AB Carbon Grid as early as 2025.

There are two major takeaways, in our view:

1. While the market looks balanced in the near term (2023-2026), this results largely from an existing inventory of TIER credits; and,
2. In the absence of carbon capture coming online this decade, TIER is in a meaningful shortfall of credits, likely starting in 2027.

Without carbon capture, TIER will be undersupplied with credits to meet compliance demand.

In the absence of enough credits to supply the market, operators would then have to pay into the TIER fund. This suggests carbon credit prices in TIER follow the scheduled ramp in pricing from $65/tonne to $170/tonne from 2023-2030. Of note, our forecast for a renewable projects is based on the AESO forecast, and does not reflect recent ITCs unveiled in the Fall Fiscal 2022 Update / Budget 2023.

At the end of the day, we believe Alberta has great potential within carbon markets. The sequestration of carbon is a "hard" credit. Given concerns about the quality of carbon credits (global broker South Pole is now being investigated, see **link**), a TIER sequestration credit would be highly attractive to credit buyers. While TIER is currently a landlocked compliance market, it could one day supply high-quality carbon credits domestically and internationally.

Appendix 1: Examples Of Contracts For Difference

Contracts for Difference (CfDs) can be difficult to understand. In this appendix, we provide examples of two well-known CfDs mechanisms in the Netherlands and the U.K.

Netherlands SDE++ Carbon Capture Program

The SDE++ framework involves a combination of both carrot and stick approaches. Under the EU Emissions Trading System (a cap-and-trade carbon market), industrial emitters are granted emission allowances per year. By capturing carbon, emitters effectively retain their allowances, which they can sell into the carbon market. This is how an emitter can monetize carbon capture – sell their prescribed allowances.

An illustration is shown in the table in Exhibit 22. Assume Emitter ABC generates run-rate emissions of two million tonnes annually. Allowances under the EU ETS in Year 1 (e.g., 2026) start at two million tonnes per year, declining by 10% thereafter for the next five years until 2030. Over the next five years, Emitter ABC faces cumulative compliance emissions of two million tonnes if it invests in no decarbonization initiatives (the "no carbon capture scenario").

Exhibit 22: SDE++ Framework – Emissions Compliance Costs Under No Carbon Capture Scenario For Emitter ABC

SDE++ Framework	2025	2026	2027	2028	2029	2030	2026-2030
No Carbon Capture Scenario	Emissions	Emissions	Emissions	Emissions	Emissions	Emissions	Cumulative
Run-rate Emissions, tCO2e	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	10,000,000
EU ETS Emissions Allocations, tCO2e		2,000,000	1,800,000	1,600,000	1,400,000	1,200,000	8,000,000
Carbon Credit Shortfall		**0**	**-200,000**	**-400,000**	**-600,000**	**-800,000**	**-2,000,000**
EU Carbon Price, EUR/tonne		EUR 100.00	EUR 105.00	EUR 110.00	EUR 115.00	EUR 120.00	
Dutch Carbon Tax, EUR/tonne		EUR 82.78	EUR 93.33	EUR 103.89	EUR 114.44	EUR 125.00	
Effective Carbon Price, EUR/tonne		**EUR 100.00**	**EUR 105.00**	**EUR 110.00**	**EUR 115.00**	**EUR 125.00**	
Carbon Credit Expense, EUR million		EUR 0	EUR -21	EUR -44	EUR -69	EUR -100	
Cumulative Expense, EUR million							**EUR -234**

Source: Dutch Ministry of Economic Affairs and Climate Policy, Bellona UK and CIBC World Markets Inc.

In a rising carbon credit price environment, Emitter ABC is facing a cumulative EUR 234 million in compliance costs. Note, the effective carbon price shown in Exhibit 22 incorporates the Dutch carbon tax, which serves as a floor price if EU carbon prices slump. Under the modeled scenario, in 2030 we assume EU carbon prices are less than the Dutch carbon tax simply to show how the mechanism works.

In such a scenario, the Dutch emitter would have to pay 120 EUR a tonne to acquire carbon credits within the EU Emission Trading scheme, plus an additional 5 EUR per tonne paid to the Dutch government under the country's carbon tax. This carbon tax element is the "stick" of the SDE++ carrot and stick approach.

The table in Exhibit 23 depicts an alternative scenario in which Emitter ABC implements carbon capture starting 2027. In this case, Emitter ABC is able to retain six million tonnes of unused emissions allocations (credits). Selling these credits into the market at the designated carbon price nets Emitter ABC revenues of EUR 676 million, a swing of EUR 910 million over the five-year period from 2026-2030.

Exhibit 23: SDE++ Framework – Emissions Compliance Costs Under Carbon Capture Scenario For Emitter ABC

SDE++ Framework	2025	2026	2027	2028	2029	2030	2026-2030
Carbon Capture Scenario	Emissions	Emissions	Emissions	Emissions	Emissions	Emissions	Cumulative
Run-rate Emissions, tCO2e	2,000,000	2,000,000	0	0	0	0	2,000,000
EU ETS Emissions Allocations, tCO2e		2,000,000	1,800,000	1,600,000	1,400,000	1,200,000	8,000,000
Carbon Credit Surplus		**0**	**1,800,000**	**1,600,000**	**1,400,000**	**1,200,000**	**6,000,000**
EU Carbon Price, EUR/tonne		EUR 100.00	EUR 105.00	EUR 110.00	EUR 115.00	EUR 120.00	
Dutch Carbon Tax, EUR/tonne		EUR 82.78	EUR 93.33	EUR 103.89	EUR 114.44	EUR 125.00	
Effective Carbon Price, EUR/tonne		**EUR 100.00**	**EUR 105.00**	**EUR 110.00**	**EUR 115.00**	**EUR 125.00**	
Carbon Credit Revenues, EUR million		0 EUR	189 EUR	176 EUR	161 EUR	151 EUR	
Cumulative Revenues, EUR million							**676 EUR**

Source: Dutch Ministry of Economic Affairs and Climate Policy, Bellona UK and CIBC World Markets Inc.

As per the nature of the carbon contract for difference mechanism, the SDE++ sets both a strike price and the reference price, designated as the "base rate" and the "correction amount." The base rate (strike price) is the cost of investment and operation of CCS, which covers the cost capture, transport and store carbon. The base rate remains unchanged over the contract period, but the correction amount is adjusted annually. The correction amount for CCS is the average EU ETS carbon price for the respective year.

As such, the contract for difference under SDE++ covers the uneconomic portion of carbon capture operations, and acts as a contractual subsidy mechanism. Under the framework, CCS project operators bid their strike prices (operational + investment costs), with lowest-cost operators chosen until capacity is achieved.

U.K. Low-carbon Renewable Electricity Program

The Low Carbon Contracts Company (LCCC) contract for difference (CfD) is a support scheme to incentivize new renewable energy projects in the United Kingdom, where the Union plans to increase the proportion of renewable energy to 80% by 2050.

The U.K. Department of Business, Energy and Industrial Strategy (BEIS) defines a determined amount of low-carbon power generation to bring on in any given year, likely subject to either a capacity cap or budget cap. Power generators then submit sealed bids containing their bid price ("strike price") for any given technology and producing year. Once the capacity or budget cap is reached, the last bid accepted sets the strike price for all bidders.

The Low Carbon Contracts Company (LCCC) as counterparty then signs 15-year contracts with successful bidders. Once producing, generators receive payments between the market reference price (U.K. power market price) and the strike price in any given month.

If the market reference price is below the strike price, generators receive top-up payments from the LCCC (and vice versa). This payment scheme is the same as illustrated in Exhibit 10. The LCC sets a levy on suppliers, which funds the payments to power generators. Hence, the scheme is ultimately funded by consumers.

Important Disclosures

Analyst Certification: Each CIBC World Markets Inc. research analyst named on the front page of this research report, or at the beginning of any subsection hereof, hereby certifies that (i) the recommendations and opinions expressed herein accurately reflect such research analyst's personal views about the company and securities that are the subject of this report and all other companies and securities mentioned in this report that are covered by such research analyst and (ii) no part of the research analyst's compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed by such research analyst in this report.

Potential Conflicts of Interest: Equity research analysts employed by CIBC World Markets Inc. are compensated from revenues generated by various CIBC World Markets Inc. businesses, including the CIBC World Markets Investment Banking Department. Research analysts do not receive compensation based upon revenues from specific investment banking transactions. CIBC World Markets Inc. generally prohibits any research analyst and any member of his or her household from executing trades in the securities of a company that such research analyst covers. Additionally, CIBC World Markets Inc. generally prohibits any research analyst from serving as an officer, director or advisory board member of a company that such analyst covers.

In addition to 1% ownership positions in covered companies that are required to be specifically disclosed in this report, CIBC World Markets Inc. may have a long position of less than 1% or a short position or deal as principal in the securities discussed herein, related securities or in options, futures or other derivative instruments based thereon.

Recipients of this report are advised that any or all of the foregoing arrangements, as well as more specific disclosures set forth below, may at times give rise to potential conflicts of interest.

CIBC World Markets Inc. does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that CIBC World Markets Inc. may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

Analysts employed outside the U.S. are not registered as research analysts with FINRA. These analysts may not be associated persons of CIBC World Markets Corp. and therefore may not be subject to FINRA Rule 2241 restrictions on communications with a subject company, public appearances and trading securities held by a research analyst account.

CIBC World Markets Inc. Stock Rating System

Stock Ratings	Abbreviation	Description
Outperformer	OP	Stock is expected to outperform similar stocks in the coverage universe during the next 12-18 months.
Neutral	NT	Stock is expected to perform in line with similar stocks in the coverage universe during the next 12-18 months.
Underperformer	UN	Stock is expected to underperform similar stocks in the coverage universe during the next 12-18 months.
Tender	TR	Shareholders are advised to tender shares to a specific offer as we do not believe a superior offer will materialize.
Not Rated	NR	CIBC World Markets does not maintain an investment recommendation on the stock.
Restricted	R	CIBC World Markets is restricted (due to potential conflict of interest) from rating the stock.

Sector Ratings	Abbreviation	Description
Overweight	O	Sector is expected to outperform the broader market averages.
Marketweight	M	Sector is expected to equal the performance of the broader market averages.
Underweight	U	Sector is expected to underperform the broader market averages.
None	NA	Sector rating is not applicable.

Note: Broader market averages refer to S&P 500 in the U.S. and S&P/TSX Composite in Canada.

CIBC World Markets Inc. Price Chart

For price and performance charts, please visit CIBC on the web at https://researchcentral.cibccm.com/#/disclaimer-central-new or write to CIBC World Markets Inc., 161 Bay Street, 4th Floor, Toronto, ON M5H 2S8, Attn: Research Disclosure Chart Request.

Important Disclosure Footnotes

For important disclosure footnotes for companies mentioned in this report that are covered by CIBC World Markets Inc., click here: CIBC Disclaimers & Disclosures

Ratings Distribution*: CIBC World Markets Inc. Coverage Universe

(as of 03 Apr 2023)	Count	Percent	Inv. Banking Relationships	Count	Percent
Outperformer	147	49%	Outperformer	147	100%
Neutral	131	44%	Neutral	130	99%
Underperformer	7	2%	Underperformer	6	86%
Tender	2	1%	Tender	2	100%
Restricted	11	4%	Restricted	11	100%

Important disclosures for each issuer can be found by visiting the Research Central website at https://researchcentral.cibccm.com/#/disclaimer-central-new and then entering the issuer name. Access to our research dissemination policy can be found on the same website at https://researchcentral.cibccm.com/#/dissemination-policy. These important disclosures can also be obtained by writing to CIBC World Markets Inc., 161 Bay Street, 4th Floor, Toronto, ON M5H 2S8, Attention: Research Disclosures Request.

Access to CIBC Equity Research

Clients may access CIBC Equity Research online at Research Central at https://researchcentral.cibccm.com/, or at the following research aggregators: Bloomberg, Refinitiv, Capital IQ, and FactSet.

Legal Disclaimer

This report is issued by CIBC Capital Markets.

CIBC Capital Markets is a trademark brand name under which Canadian Imperial Bank of Commerce ("CIBC"), its subsidiaries and affiliates (including, without limitation, CIBC World Markets Inc., CIBC World Markets Corp. and CIBC Capital Markets (Europe) S.A.) provide different products and services to our customers around the world. Products and/or services offered by CIBC include corporate lending services, foreign exchange, money market instruments, structured notes, interest rate products and OTC derivatives. CIBC's Foreign Exchange Disclosure Statement relating to guidelines contained in the FX Global Code can be found at **https://cibccm.com/en/disclosures/fx-disclosure-statement/**. Other products and services, such as exchange-traded equity and equity options, fixed income securities and futures execution of Canadian securities, are offered through directly or indirectly held subsidiaries of CIBC as indicated below.

CIBC World Markets Inc. is a member of the Canadian Investor Protection Fund and the Investment Industry Regulatory Organization of Canada. In the United States, CIBC World Markets Corp. is a member of the Financial Industry Regulatory Authority and the Securities Investor Protection Fund. In Luxembourg. CIBC Capital Markets (Europe) S.A. (RCS Luxembourg: B236326) is authorised by the European Central Bank (the "ECB") and supervised by the Luxembourg Financial Supervisory Authority (Commission de Surveillance du Secteur Financier) under the oversight of the ECB. CIBC Australia Ltd (AFSL No: 240603) is regulated by the Australian Securities and Investment Commission ("ASIC"). CIBC World Markets (Japan) Inc. is a member of the Japanese Securities Dealer Association. CIBC (TSX/NYSE: CM) is a bank chartered under the Bank Act (Canada) having its registered office in Toronto, Ontario, Canada, and regulated by the Office of the Superintendent of Financial Institutions. CIBC New York Branch is licensed and supervised by the New York State Department of Financial Services. In the United Kingdom, CIBC London Branch is authorised by the Prudential Regulation Authority and subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority. Canadian Imperial Bank of Commerce, Sydney Branch (ABN: 33 608 235 847) is an authorised foreign bank branch regulated by the Australian Prudential Regulation Authority (APRA). Canadian Imperial Bank of Commerce, Hong Kong Branch is a registered institution under the Securities and Futures Ordinance, Cap 571, and a limited liability foreign company registered with the Hong Kong Companies Registry. Canadian Imperial Bank of Commerce, Singapore Branch is a wholesale bank licensed and regulated by the Monetary Authority of Singapore.

This report is issued and approved for distribution by (a) in Canada, CIBC World Markets Inc., a member of the Investment Industry Regulatory Organization of Canada ("IIROC"), the Toronto Stock Exchange, the TSX Venture Exchange and a Member of the Canadian Investor Protection Fund and (b) in the United States either by (i) CIBC World Markets Inc. for distribution only to U.S. Major Institutional Investors ("MII") (as such term is defined in SEC Rule 15a-6) or (ii) CIBC World Markets Corp., a member of the Financial Industry Regulatory Authority ("FINRA"). U.S. MIIs receiving this report from CIBC World Markets Inc. (the Canadian broker-dealer) are required to effect transactions (other than negotiating their terms) in securities discussed in the report through CIBC World Markets Corp. (the U.S. broker-dealer). CIBC World Markets Corp. accepts responsibility for the content of this research report.

Distribution to Institutional Customers Only

Canada

This report is provided, for informational purposes only, to institutional investor and retail clients of CIBC World Markets Inc. in Canada, and does not constitute an offer or solicitation to buy or sell any securities discussed herein in any jurisdiction where such offer or solicitation would be prohibited.

Legal Disclaimer (Continued)

United States

This report is provided, for informational purposes only, to Major US Institutional Investor clients of CIBC World Markets Corp. in the United States, and does not constitute an offer or solicitation to buy or sell any securities discussed herein in any jurisdiction where such offer or solicitation would be prohibited.

United Kingdom

The distribution of this report in the United Kingdom is being made only to, or directed only at, persons falling within one or more of the exemptions from the financial promotion regime in section 21 of the UK Financial Services and Markets Act 2000 (as amended) ("FSMA") including, without limitation, to the following:

- authorised firms under FSMA and certain other investment professionals falling within article 19 of the FSMA (Financial Promotion) Order 2005 ("**FPO**") and directors, officers and employees acting for such entities in relation to investment;
- high value entities falling within article 49 FPO and directors, officers and employees acting for such entities in relation to investment; and
- persons who receive this presentation outside the United Kingdom.

The distribution of this report to any other person in the United Kingdom is unauthorised and may contravene FSMA. No person falling outside such categories should treat this report as constituting a promotion to them or rely or act on it for any purposes whatsoever.

This report is distributed solely to eligible counterparties or professional clients and not retail clients as defined in point (8) of Article 2 of Regulation (EU) No 2017/565 as it forms part of UK domestic law by virtue of the European Union (Withdrawal) Act 2018.

All other jurisdictions

This report is distributed solely to institutional clients and not retail clients as defined by the applicable securities legislation and regulation to which CIBC Capital Markets may be subject in any jurisdiction, and only in compliance with all applicable laws and regulations.

The securities mentioned in this report may not be suitable for all types of investors. This report does not take into account the investment objectives, financial situation or specific needs of any particular client of CIBC World Markets. Recipients should consider this report as only a single factor in making an investment decision and should not rely solely on investment recommendations contained herein, if any, as a substitution for the exercise of independent judgment of the merits and risks of investments. The analyst writing the report is not a person or company with actual, implied or apparent authority to act on behalf of any issuer mentioned in the report. Before making an investment decision with respect to any security recommended in this report, the recipient should consider whether such recommendation is appropriate given the recipient's particular investment needs, objectives and financial circumstances. CIBC World Markets suggests that, prior to acting on any of the recommendations herein, Canadian retail clients of CIBC World Markets contact one of our client advisers in your jurisdiction to discuss your particular circumstances. Non-client recipients of this report who are not institutional investor clients of CIBC World Markets should consult with an independent financial advisor prior to making any investment decision based on this report or for any necessary explanation of its contents. CIBC World Markets will not treat non-client recipients as its clients solely by virtue of their receiving this report.

Legal Disclaimer (Continued)

Past performance is not a guarantee of future results, and no representation or warranty, express or implied, is made regarding future performance of any security mentioned in this report. The price of the securities mentioned in this report and the income they produce may fluctuate and/or be adversely affected by exchange rates, and investors may realize losses on investments in such securities, including the loss of investment principal. CIBC World Markets accepts no liability for any loss arising from the use of information contained in this report, except to the extent that liability may arise under specific statutes or regulations applicable to CIBC World Markets.

Information, opinions and statistical data contained in this report were obtained or derived from sources believed to be reliable, but CIBC World Markets does not represent that any such information, opinion or statistical data is accurate or complete (with the exception of information contained in the Important Disclosures section of this report provided by CIBC World Markets or individual research analysts), and they should not be relied upon as such. All estimates, opinions and recommendations expressed herein constitute judgments as of the date of this report and are subject to change without notice.

Nothing in this report constitutes legal, accounting or tax advice. Since the levels and bases of taxation can change, any reference in this report to the impact of taxation should not be construed as offering tax advice on the tax consequences of investments. As with any investment having potential tax implications, clients should consult with their own independent tax adviser.

This report may provide addresses of, or contain hyperlinks to, Internet web sites. CIBC World Markets has not reviewed the linked Internet web site of any third party and takes no responsibility for the contents thereof. Each such address or hyperlink is provided solely for the recipient's convenience and information, and the content of linked third party web sites is not in any way incorporated into this document. Recipients who choose to access such third-party web sites or follow such hyperlinks do so at their own risk.

Although each company issuing this report is a wholly owned subsidiary of CIBC, each is solely responsible for its contractual obligations and commitments, and any securities products offered or recommended to or purchased or sold in any client accounts (i) will not be insured by the Federal Deposit Insurance Corporation (“FDIC”), the Canada Deposit Insurance Corporation or other similar deposit insurance, (ii) will not be deposits or other obligations of CIBC, (iii) will not be endorsed or guaranteed by CIBC, and (iv) will be subject to investment risks, including possible loss of the principal invested. CIBC Capital Markets and the CIBC Logo Design are trademarks of CIBC, used under license.