Canadian Chamber of Commerce | Chambre de Commerce du Canada

THINK GROWTH.

TAX MATTERS.

A Snapshot of Canada's Tax Competitiveness

This report was prepared by

pwc

Acknowledgements

This report was prepared by PricewaterhouseCoopers, LLP (PwC) at the request of the Canadian Chamber of Commerce (the Canadian Chamber). The Canadian Chamber hopes that this report will further advance a national discussion on tax competitiveness and economic growth.

The Canadian Chamber acknowledges the significant work of the PwC Team, including: Michael Dobner, Olga Lotkin, Kevin Chan, Joseph Lee, Linh Lam and others at PwC for their authorship of the report.

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This report and its research were overseen by Patrick Gill of the Canadian Chamber.

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About the Canadian Chamber of Commerce

The Canadian Chamber helps build businesses that support Canadian families and communities. It does this by influencing government policy, providing services and tools that help Canadian businesses grow and connecting opportunities through a national network of chambers of commerce and boards of trade. The Canadian Chamber brings together a vast network of over 450 chambers of commerce and boards of trade, representing over 200,000 businesses from all regions of the country and sectors of the economy. Securing comprehensive tax reform remains a key policy priority for the Canadian Chamber's network.

Canadian Chamber Foreword[1]

The Canadian Chamber believes that a growing economy means increased tax revenue to support the public services that Canadians use and to pay down debt that has been run up during a time of crisis. As we start to focus on how to pay these bills, we need to ensure that we choose the right solution. Economic growth, not increasing tax burden, is by far the best way to build a stronger future.

In Canada, we've expressed a desire to "build back better"; however, we forget that our global economic peers have said the same. We're now competing against other countries in the global economic reset of our generation. That competition to attract investment, win global market share and create better, more prosperous lives for Canadians will be fierce.

Economic recovery has begun, but a number of obstacles still stand in the way. We urgently need a plan to tackle these challenges and improve the fundamentals of Canada's business climate.

To help us grow from where we are to where we need to be, we must do things differently, including reforming Canada's tax system. In the context of this report, tax reform means making adjustments to spur private sector investments. Canada must do better to make our tax system competitive enough to win the competition for global investment.

Over the past two years, the Canadian Chamber has worked to identify needed changes and innovations to Canada's tax system through its Think Growth project—a review of Canada's tax system powered by Canadian businesses and tax practitioners. We hope this report highlights why we must urgently get the basic business fundamentals right, and why our outdated and inefficient tax system needs to be reformed.

1 This reflects the Canadian Chamber point of view. PwC did not contribute to this element of the report.

Executive summary

Background

PricewaterhouseCoopers, LLP (PwC, we, or us) was engaged by the Canadian Chamber of Commerce (the Canadian Chamber) to perform a comparative analysis of tax competitiveness between the US and Canada in three sectors that are a priority for the Canadian Government: advanced manufacturing, health and biosciences and natural resources.[2] To this end, we modeled the tax burden on an illustrative project for each sector in assumed potential locations in the US and Canada. These projects were selected on the basis of the following criteria:

- high priority for the Government of Canada;
- areas of high potential growth; and
- activities where the US and Canada are competing to attract investment for such projects.

Table 1: Representative projects and jurisdictions

	Advanced manufacturing	Health and biosciences	Natural resources
Project and rationale	Electric vehicle (EV) battery production plant. EV production is expected to grow significantly thanks to increasing focus on reducing carbon emissions in Canada, the US and globally.	Vaccine production plant. COVID-19 has highlighted the importance of domestic production of critical products such as vaccines, resulting in increased investment in this area.	Greenfield investment in a copper mine. Canada and the US are major copper producers, and are expected to benefit from increased demand due to copper's role in construction and many low-carbon technologies.
Potential Canadian location	Windsor, Ontario	Laval, Quebec	Spences Bridge[3], British Columbia
Potential US location	Detroit, Michigan	Durham County, North Carolina	Mitchell Peak, Greenlee County, Arizona

We created a financial model for each project from the perspective of an investor making a new investment. For the purpose of this study, we have assumed that the capital requirements, costs and revenues for each jurisdiction are identical, so the only differences between the two locations are due to taxes. In this regard, we note that while not addressed in this report, competitiveness (of which tax is only one aspect) between Canada and the US is an increasing economic concern, as current US federal policy includes strong "Buy American" provisions.

2 This report is subject to the disclaimer and limitations set forth in Appendices D and E.
Ce rapport est assujetti aux clauses de non-responsabilités et aux limitations présentées aux Annexes D et E.

3 This area is rich in copper with several potential locations appropriate for the development of a copper mine. We note that a change in location would have only a minor impact on the results of our analysis.

Methodology

To carry out the study, we took the following steps:

1. Developed cash flow models, annual balance sheets and income statements for each project and each selected location using assumptions that reflect a typical project size over the full life cycle of the project (i.e. from the development phase through the assumed lifespan of the operation).

2. Calculated the taxes associated with each project in each selected location, arriving at the metrics of Marginal Effective Tax Rate (METR)[4] and the ratio of net present value of taxes over the project assumed lifespan (the Tax NPV Ratio). Our tax calculations included all applicable taxes and levies, which are: federal corporate income tax, provincial/state corporate income tax, municipal tax and other levies and carbon tax and tax credits where applicable.

3. For each project, we also calculated the change in the Canadian federal tax rate that would be required to equalize the tax burden between the US and Canada (Break-Even Point).

Major assumptions

Below is a list of the major assumptions underpinning our analysis:[5]

1. **Cost structure** - for the purposes of this study, we assume that, except for tax and other government levies, all other elements of the selected projects' costs structure are identical between the respective two selected jurisdictions for each project.

2. **R&D tax credits/grants** - we excluded R&D tax credits because our research suggests there are not significant differences in the level of support between Canada and the US.[6]

3. **Carbon taxes** - we have included the impacts of carbon pricing, where relevant, in the selected jurisdictions.

4. **Tax reduction in Canada for zero-emitting technologies** - we assumed the Government of Canada's future commitment to reduce federal corporate tax rates by 50% for manufacturers of zero-emissions technologies will come into effect on January 1, 2022.

5. **Stringency factor** - we took into account Ontario's carbon tax regulations, which imply the EV battery manufacturing plant would pay carbon taxes on 6% and 8% of its total emissions for the years 2021 and 2022, respectively (referred to as the stringency limits). Since there are no clear guidelines regarding future years, we assumed for the purposes of our study that an EV battery manufacturer in Ontario will pay carbon taxes on only 10% of emissions from 2023 onward.

6. **Accelerated depreciation** - we included the temporary accelerated depreciation available on some US assets and the temporary enhanced allowance for manufacturing and processing equipment in Canada, taking into account the currently known planned phase-out timelines for both.

4 Brûlé, A., Mansour, M., McKenzie, K.J. May 1998. "The Calculation of Marginal Effective Tax Rates".; Department of Finance Canada. 2005. "Tax Expenditures and Evaluations".
5 To see a full list of the assumptions used in our analysis, please see Appendix B.
6 OECD data - R&D policy support for business R&D. https://www.oecd.org/sti/rd-tax-stats.htm

7. **Carry-forward losses** - we assumed any carry-forward losses would be used to offset taxes for the same investment rather than transferred to other related corporations. We also assumed the net operating loss would be offset at the rate of 80% of taxable income in the US.[7]

Summary of findings

Our analysis suggests that Canada has a small tax advantage in EV battery manufacturing and vaccine manufacturing and a large tax disadvantage in the copper project. The table below presents the main findings of our study, including METR, the Tax NPV Ratio and Break-Even Point.

Table 2: Summary of tax competitiveness results

	METR comparison		TAX NPV Ratio[8]	Break-Even Point
	METR - Canada	METR - US	NPV CAN Tax/ NPV US Tax	Required increase (decrease) in Canadian federal tax rate (in percentage points)
Advanced manufacturing	19.9%	20.5%	0.99	0.25%
Health and biosciences	16.2%	21.4%	0.94	1.40%
Natural resources	29.2%	22.0%	1.52	-15.0%

In the EV battery manufacturing project, the Canadian tax advantage is immaterial, despite inclusion of the planned tax rate cut for zero-emitting technologies in Canada and our assumption that carbon taxes will effectively apply to only a relatively small portion of emissions. As noted above, any change in the stringency limits and other tax policies would affect these results.

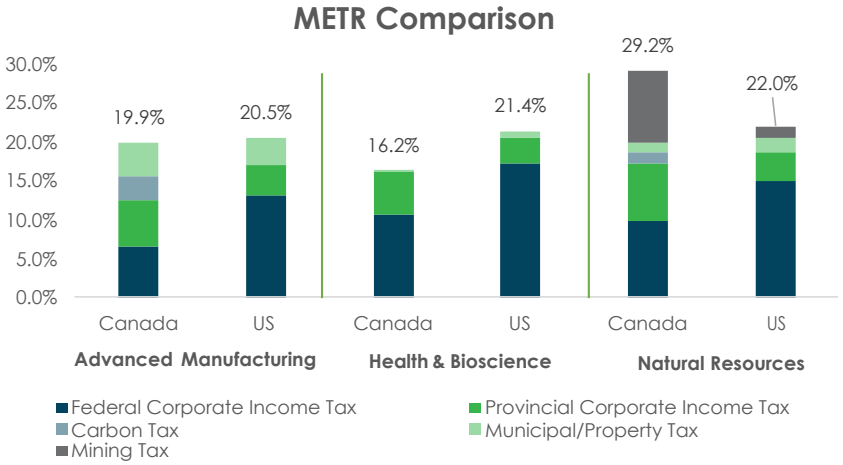
In the vaccine production project, Canada has a higher combined federal/provincial tax rate, which is offset by a longer phase-out of the temporary capital cost allowances and accelerated depreciation. A tax holiday for large investment projects provided by Quebec's government further reduces the tax burden for the Canadian operation. Overall, this gives Canada a small tax advantage compared to the US. However, this tax advantage incorporates a tax holiday in Quebec and excludes potential tax incentives in North Carolina, which are provided on a case-by-case basis.

Canada's large tax disadvantage in the natural resources sector is driven mainly by high mining taxes in Canada (approximately 3% in Arizona compared to approximately 13% in British Columbia) and higher combined provincial/state corporate income tax rates (4.9% and 12% for Arizona and British Columbia, respectively).

7 The Internal Revenue Service. https://www.irs.gov/newsroom/net-operating-losses.
8 NPV of total tax payments by the Canadian project divided by the NPV of total tax payments made by the project in the US.

The chart below shows the results of our analysis, including the decomposition of each location's METR.

Figure 1: METR for representative projects and locations



Our analysis suggests that if the federal government wishes to maintain its small tax advantage in the EV battery manufacturing and vaccine production projects, it does not have significant room for corporate tax increases. Our analysis also suggests that copper production in Canada is at a significant tax disadvantage compared to the US.

We note that for the Canadian projects our calculations assumed all revenue and expenses would be earned and incurred in Canada by Canadian corporations with no international operations. Accordingly, the proposed global minimum tax (GLoBE)[9] and the global intangible low-taxed income (GILTI) provisions in the US did not have an impact on the calculations. Similarly, our calculations for the US projects assumed the operations are carried on by US-resident corporations owned by US-resident shareholders with no operations or sales outside of the US. As such, the US GILTI rules and the Organisation for Economic Co-operation and Development (OECD) Pillar One (expanded jurisdictional taxing rights) and Pillar Two (global minimum tax) regimes did not have an impact on the calculations.

9 In October 2021, OECD and G20 members released details of a two-pillar solution that, among others, sets a global minimum corporate tax at a rate of 15% to ensure that Multinational Enterprises (MNEs) pay fair taxes regardless of the place of operations. OECD, October 2021. "Two-Pillar Solution to Address the Tax Challenges Arising from the Digitalisation of the Economy".

Contents

Introduction

PricewaterhouseCoopers, LLP (PwC, we, or us) was engaged by the Canadian Chamber of Commerce (the Canadian Chamber) to perform a comparative analysis of tax competitiveness between the US and Canada in three priority business sectors for the Canadian Government: advanced manufacturing, health and biosciences and natural resources. To this end, we model the tax burden on an illustrative project for each sector in assumed potential locations in the US and Canada. These projects were selected on the basis of the following criteria:

- high priority for the Government of Canada;
- areas of high potential growth; and
- activities where the US and Canada are competing to attract investment for such projects.

Table 3 summarizes the representative projects selected for each sector.

Table 3: Representative projects and jurisdictions

	Advanced manufacturing	Health and biosciences	Natural resources
Project and rationale	Electric vehicle (EV) battery production plant. EV production is expected to grow significantly thanks to increasing focus on reducing carbon emissions in Canada, the US and globally.	Vaccine production plant. COVID-19 has highlighted the importance of domestic production of critical products such as vaccines, resulting in increased investment in this area.	Greenfield investment in a copper mine. Canada and the US are major copper producers, and are expected to benefit from increased demand due to copper's role in construction and many low-carbon technologies.
Potential Canadian location	Windsor, Ontario	Laval, Quebec	Spences Bridge,[10] British Columbia
Potential US location	Detroit, Michigan	Durham County, North Carolina	Mitchell Peak, Greenlee County, Arizona

Our approach

We created a financial model for each project from the perspective of an investor making a new investment. We have assumed that the capital requirements, costs and revenues for each jurisdiction are identical, so the only differences between the two locations are due to taxes. In this regard, we note that, while not addressed in this report, competitiveness (of which tax is only one aspect) between Canada and the US is an increasing economic concern, as current US federal policy includes strong "Buy American" provisions.

10 This area is rich in copper with several potential locations appropriate for the development of a copper mine. We note that a change in location would have only a minor impact on the results of our analysis.

Our methodology included the following steps:

1. Developed cash flow models, annual balance sheets and income statements for each project using assumptions that reflect a typical project size over the full life cycle of the project (i.e. from the development phase through the assumed lifespan of the operation).

2. Calculated the taxes associated with the project, arriving at the metrics of Marginal Effective Tax Rate (METR)[11] and the ratio of tax to net present value of taxes to profits over the project (the Tax NPV Ratio). METR includes federal corporate income tax, provincial/state corporate income tax, and carbon tax where applicable.

3. We also calculated the change in the Canadian federal tax rate that would be required to equalize the tax burden between the US and Canada (Break-Even Point).

Unless otherwise specified, dollar values are in Canadian dollars.

Scope of review

In conducting this study, we have reviewed and, where appropriate, relied on external information including the following:

- METR literature including, but not limited to, the studies prepared by the Canadian Department of Finance (DoF);
- financial information of publicly traded companies;
- Statistics Canada;
- consultation with specialists in the PwC network; and
- academic research and other relevant sources.

A full list of sources and articles used for the purpose of this assessment is available in Appendix C: References.

Key authors

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11 Brûlé, A., Mansour, M., McKenzie, K.J. May 1998. "The Calculation of Marginal Effective Tax Rates".; Department of Finance Canada. 2005. "Tax Expenditures and Evaluations".

Advanced manufacturing: electric vehicle battery manufacturing plant

The advanced manufacturing sector is growing rapidly in Canada, but faces disruption from constantly-evolving technology

Advanced manufacturing (AM) applies technological innovations in robotics, additive manufacturing and big data analytics to reach new levels of efficiency in manufacturing. The Canadian manufacturing sector employs approximately 9.3% of Canadian workers[12] and contributes $178 billion to GDP in 2020.[13] The Government of Canada, as part of its ongoing Innovation Superclusters Initiative, has committed $230 million to AM by 2023[14] to support rapidly changing technologies and bolster technology diffusion through the industry. This investment reflects the significance of AM's competitiveness and technological progress to Canada's economy as firms adopt artificial intelligence (AI), machine learning and automation and clean technologies.

Increasing use of additive manufacturing processes is one factor that is expected to drive future AM growth, as the world additive manufacturing market is forecasted to grow at approximately 20% year-over-year into 2024, due in part to lower barriers to innovation and reduced technology costs.[15]

Governments are supporting EV demand and supply as part of the fight against climate change

Transportation equipment manufacturing is the second largest subsector of the Canadian manufacturing sector, accounting for approximately 12.4% of manufacturing GDP,[16] and is mostly concentrated in Ontario.[17] This subsector is expected to undergo a significant transformation with the shift towards EVs. EVs currently account for around 1% of cars globally, but their market share is growing quickly.[18] In 2020, global EV sales increased by 43% compared to 2019, driven by battery electric vehicles (BEVs).[19] In the first half of 2021, global EV sales increased by more than 150% compared to the same period in 2020.[20] Reasons for the surge in global EV demand include:

- decreased cost of production, and consequently prices;
- government incentives to encourage EV purchases in order to reduce greenhouse gas emissions. In 2020, governments worldwide spent approximately US$14 billion on direct purchase incentives and tax deductions;[21] and

12 Statistics Canada, Table 14-10-0023-01 Labour force characteristics by industry, annual, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410002301
13 Statistics Canada, Table 36-10-0434-06 Gross domestic product (GDP) at basic prices, by industry, annual average, industry detail, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610043401
14 https://www.ic.gc.ca/eic/site/093.nsf/eng/00016.html
15 Just Press "Print": Canada's Additive Manufacturing Ecosystem, https://medium.com/digitalthinktankictc/overview-just-press-print-df9019cb5073
16 Ibid.
17 https://www.international.gc.ca/investors-investisseurs/assets/pdfs/download/vp-automotive.pdf
18 https://www.iea.org/reports/global-ev-outlook-2021/trends-and-developments-in-electric-vehicle-markets
19 There are four types of electric cars: Battery Electric Vehicle; Hybrid Electric Vehicle; Plug-in Hybrid Electric Vehicle; Fuel Cell Electric Vehicle
20 https://www.bloomberg.com/news/articles/2021-08-19/surging-lithium-demand-outstrips-forecast-of-major-producer-sqm
21 https://www.iea.org/reports/global-ev-outlook-2021/trends-and-developments-in-electric-vehicle-markets

- net-zero emission commitment - for example, requiring Canadian car and passenger truck sales to be 100% zero-emission by 2035.[22]

To date, Canada has remained competitive in the EV sector due to a strong automotive industry, well-established supply chains (e.g. availability of battery metals) and easy access to trade with the rest of the North American market through the Canadian-United States-Mexico Agreement.[23] Leading automakers have committed billions to invest in EV production capabilities in Ontario.[24,25]

Currently, Canada is the 11th largest vehicle producer in the world,[26] but its continued success in automotive manufacturing will depend on its ability to pivot to EV production along the entire supply chain. This transition is also important to Canada's ability to meet its net-zero emissions commitment.[27] The transport sector accounts for the second-highest level of greenhouse gas emissions in Canada, behind oil and gas.[28]

EV manufacturing is a growing priority for US and Canadian governments, with both jurisdictions imposing policy targets relating to EV sales. The Government of Canada has recently moved its target year for having 100% of new vehicle sales to be electric forward to 2035, five years earlier than the original policy target set out in 2019.[29] Meanwhile, the US Government has committed to a target of 50% of all vehicle sales being electric by 2030.[30] The US is also using EV subsidies, such as the recently passed infrastructure bill, which includes tax credits for US-produced EVs, to incentivize purchases of American-made vehicles.[31]

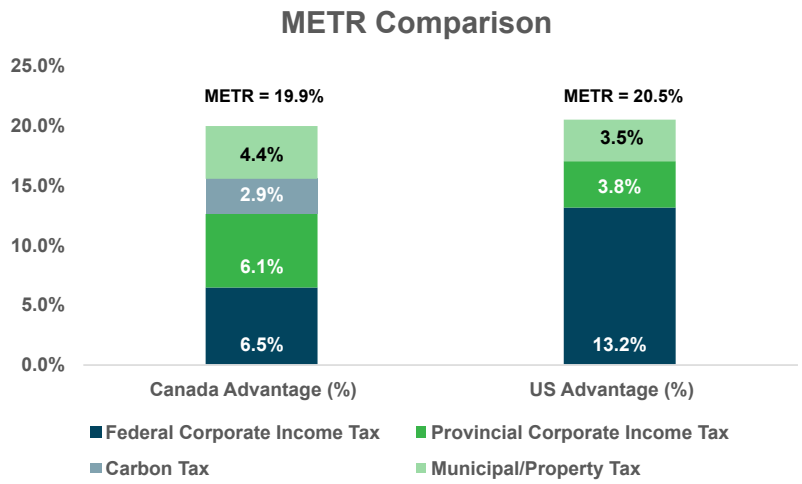
Canada has a small tax advantage in EV battery production thanks to upcoming tax breaks for zero-emissions manufacturing

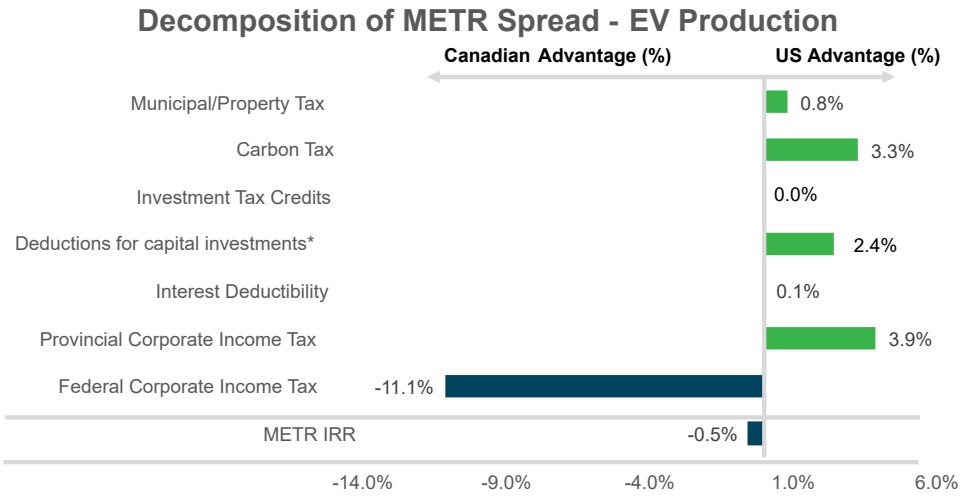
To compare tax competitiveness between Canada and the US, we analyzed a potential investment in greenfield construction of a new EV battery manufacturing plant. This project was selected due to the significance of EV batteries in the EV supply chain and Canada's goal to play a role throughout the entire EV supply chain, from the minerals needed for the EV battery to the final assembly of BEVs. The locations selected for comparison were Windsor, Ontario and Detroit, Michigan. These locations were chosen because of their proximity to major Original Equipment Manufacturers (OEMs) manufacturing plants, presence of tier 1 & 2 suppliers and access to skilled labour.

22 https://liberal.ca/climate/100-zero-emissions-car-sales-by-2035/
23 https://www.international.gc.ca/trade-commerce/trade-agreements-accords-commerciaux/agr-acc/cusma-aceum/motor-vehicles-vehicules-moteur.aspx?lang=eng
24 https://media.gm.com/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2021/jan/0114-cami.html,
25 https://media.ford.com/content/fordmedia/fna/ca/en/news/2020/09/28/ford-commits-to-investing-1-8-billion.html#:~:text=OAKVILLE%2C%20Ont.%2C%20 Sep.,a%20C%241.8%2Dbillion%20investment.
26 https://www.cvma.ca/industry/facts/
27 https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html
28 https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/sources-sinks-executive-summary-2021.html
29 https://www.canada.ca/en/transport-canada/news/2021/06/building-a-green-economy-government-of-canada-to-require-100-of-car-and-passenger-truck-sales-be-zero-emission-by-2035-in-canada.html
30 https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/
31 https://financialpost.com/news/economy/trudeau-biden-three-amigos-ev-tax-credit-what-happens-now

The charts below show each location's METRs and decomposition by tax component.

Figure 2: Tax competitiveness results for EV battery manufacturing





The results of our METR analysis show a minor tax advantage for Canada, driven mainly by the difference in the federal corporate income tax rates, which range from 7.5% to 15% in Canada (see further details below) compared to 21%[32] in the US.

In its 2021 budget, the Government of Canada proposed reducing the federal corporate tax rates by 50% for manufacturers of zero-emissions technologies, starting January 1, 2022,[33] and in May 2021, the Parliamentary Budget Officer released a legislative costing note[34] confirming the tax rate reduction for ten subsectors.[35] EV battery manufacturing is eligible for this reduction, so we assumed the Canadian applicable federal corporate tax rate will be 7.5% for the years 2022-2028, and then will increase to 9.375% in 2029, 11.25% in 2030, 13.125% in 2031 and 15% in 2032 onwards, in line with the government

32 https://www.irs.gov/publications/p542
33 https://www.budget.gc.ca/2021/report-rapport/p2-en.html#chap5
34 https://distribution-a617274656661637473.pbo-dpb.ca/00bdabc6558bde29d3a29feebef100230fa9954a50985128ba9bb20222622b88
35 These subsectors include manufacturing of: solar, wind or water energy conversion equipment; geothermal energy equipment; equipment for a ground source heat pump system; electrical energy storage equipment used for storage of renewable energy; zero-emission vehicles; batteries and fuel cells for zero-emission vehicles; EV charging systems and hydrogen refuelling stations for vehicles; equipment used for the production of hydrogen by electrolysis of water; production of hydrogen by electrolysis of water; and production of solid, liquid or gaseous fuel from either carbon dioxide or specified waste material.

announcement.[36] This corporate income tax reduction played a significant role in increasing Canada's tax competitiveness in this subsector. We note that in the absence of this reduction, the US METR would have been significantly lower than the Canadian one.

Relative corporate income taxes at the provincial and state level decrease Canada's tax advantage at 6%[37] and 10% for Michigan and Ontario,[38] respectively. We note that we assumed the manufacturing and processing (M&P) rate of 10% would apply to EV battery manufacturing in Ontario.[39]

The Tax NPV Ratio, representing the relative tax burden an investor in each country is facing, is 0.99, meaning that, over the life of the project, taxes for the project in Canada would be 99% of those in the US on an NPV basis. The Break-Even Point is 0.25 percentage points, meaning if Canada increased its federal corporate income tax rate by 0.25 percentage points or more, it would lose its tax advantage to the US.

Table 4: Tax NPV Ratio and Break-Even Point for EV battery manufacturing

	TAX NPV ratio	Break-Even Point
Advanced manufacturing	0.99	0.25%

36 https://distribution-a617274656661637473.pbo-dpb.ca/00bdabc6558bde29d3a29feebef100230fa9954a50985128ba9bb20222622b88; https://www.budget.gc.ca/2021/report-rapport/p2-en.html#chap5
37 https://www.michiganbusiness.org/4a8165/globalassets/documents/reports/fact-sheets/mi-cit.pdf
38 https://www.canada.ca/en/revenue-agency/services/tax/businesses/topics/corporations/provincial-territorial-corporation-tax/ontario-provincial-corporation-tax/ontario-tax-credit-manufacturing-processing.html
39 https://www.fin.gov.on.ca/en/tax/cit/index.html

Health and biosciences: vaccine production plant

Canada has ambitions to grow its health and bioscience sector amid increasing global demand

Canada's health and biosciences sector currently ranks fourth globally, behind the US, the UK and Germany. This sector has become a priority for the federal government as part of the Innovation, Science and Economic Development (ISED) Strategy Tables.[40] This sector is growing rapidly, with Canadian GDP in medical equipment and pharmaceutical manufacturing growing at cumulative rates of 26.4% and 12.5%, respectively, from 2016 to 2020.[41] Further, medical device manufacturing, together with generic and name-brand pharmaceutical manufacturing, represents an approximate $19 billion market in Canada in 2020.[42] The sector is expected to continue to grow, and ISED has set goals for 2025of doubling sector exports to $26 billion and increasing the number of firms to 1,800 in the same year by fostering technological advancements and retaining capital and high-skilled workers.[43]

Growth in the Canadian health and biosciences sector can also be attributed to the entry of innovative players in the digital health space and producers of other emerging technologies such as artificial intelligence, data analytics, 3D printing, robotics and nanotechnologies.[44]

The pandemic has highlighted limitations in domestic vaccine production capacity

The emergence of COVID-19 demonstrated that globally the life sciences sector was vulnerable to supply chain disruptions. For many governments, the pandemic also emphasized the need for domestic production of pharmaceuticals and vaccines as a means to secure reliable supplies.[45] In particular, Canada was reliant on imports for its supply of COVID-19 vaccines, with domestic production expected to begin in 2022.[46] This situation has led the Government of Canada to invest in domestic facilities for pharmaceutical and vaccine production in order to improve Canada's preparedness for future health crises. Notably, the Government of Canada has invested $1.2 billion to revamp Canada's vaccine and biomanufacturing capacity.[47] This investment includes $126 million to enhance pandemic preparedness, which enabled the National Research Council (NRC) of Canada to develop the Biologics Manufacturing Centre in Montréal. This facility will act as the new headquarters of Novavax, which will produce Canadian-manufactured COVID-19 vaccines.[48] In addition, $105.2 million was provided to the University of Saskatchewan's Vaccine and Infectious Disease Organization to bolster its biomanufacturing capacity.[49] The Government of Canada also, as part of the 2021 budget,

40 https://www.ic.gc.ca/eic/site/098.nsf/eng/h_00020.html
41 https://www.investcanada.ca/industries/life-sciences
42 PwC Analysis, IBISWorld Industry Reports
43 https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISEDC_HealthBioscience.pdf/$file/ISEDC_HealthBioscience.pdf
44 https://www.canada.ca/en/health-canada/corporate/about-health-canada/legislation-guidelines/acts-regulations/targeted-regulatory-reviews/health-biosciences-sector-regulatory-review/roadmap.html
45 https://www2.deloitte.com/global/en/pages/life-sciences-and-healthcare/articles/global-life-sciences-sector-outlook.html
46 https://www.canada.ca/en/public-services-procurement/services/procuring-vaccines-covid19.html
47 https://www.canada.ca/en/innovation-science-economic-development/news/2021/07/the-government-of-canada-announces-biomanufacturing-and-life-sciences-strategy.html
48 https://www.ic.gc.ca/eic/site/151.nsf/eng/00019.html
49 Ibid.

introduced the biomanufacturing and life sciences strategy. This plan consists of a $2.2 billion investment over seven years to strengthen the competitiveness of the Canadian life sciences sector, improve biomanufacturing capabilities and build secure pandemic infrastructure.[50]

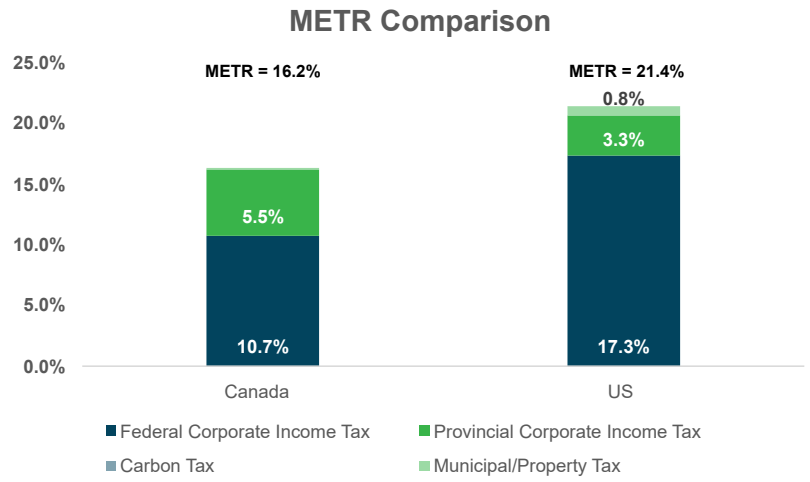
By comparison, US facilities manufactured several of the major vaccines. Near the onset of the COVID-19 pandemic, the US Government recognized the importance of shoring up supply chain vulnerabilities with respect to pharmaceuticals, and commissioned a supply chain study as part of the Coronavirus Aid, Relief, and Economic Security (CARES) Act to assess dependence on non-domestically produced pharmaceuticals.[51] Further to this, the US Government has committed US$60 million as part of a public-private sector plan to bolster onshoring of critical medicines and active pharmaceutical ingredients and limit reliance on international supply chains.[52]

Canada has a small tax advantage in vaccine manufacturing despite higher provincial taxes

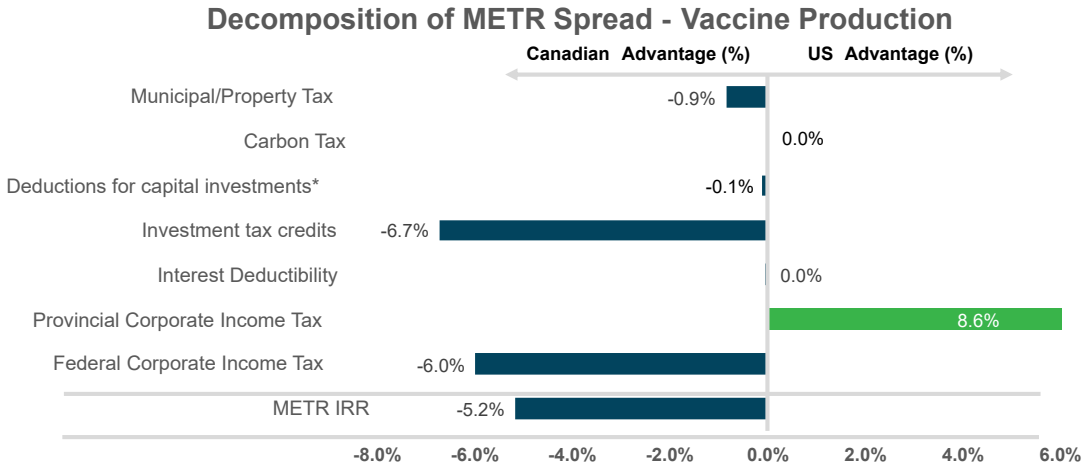
We selected a vaccine production plant as an illustrative project for the health and biosciences sector due to its high priority for the Canadian Government. The jurisdictions selected for the project were Laval, Quebec (in light of the recent investment and construction of a vaccine production plant in the area),[53] and Durham County, North Carolina (the "Research Triangle" is well-known as a hub of biomedical and technological research in the US).[54]

The charts below show the results of our analysis, including each country's METR decomposition and relative advantage by main components.

Figure 3: Tax competitiveness results for vaccine production



50 https://www.canada.ca/en/innovation-science-economic-development/news/2021/07/the-government-of-canada-announces-biomanufacturing-and-life-sciences-strategy.html
51 https://www.pharmamanufacturing.com/articles/2020/the-growing-benefits-to-reshoring-pharma-operations/
52 https://www.whitehouse.gov/briefing-room/statements-releases/2021/06/08/fact-sheet-biden-harris-administration-announces-supply-chain-disruptions-task-force-to-address-short-term-supply-chain-discontinuities/
53 https://nationalpost.com/news/politics/construction-finished-on-126m-vaccine-plant-in-montreal-but-production-still-months-away
54 https://www.researchtriangle.org/counties/rtp/



For the vaccine production project, the Canadian federal income headline tax rate advantage (15% vs. 21% for Canada and the US, respectively) is reversed by high provincial income headline tax rates: the provincial/state corporate income tax rate is 11.5% in Quebec and approximately 3% in North Carolina (a 2.5% state tax rate plus franchise tax),[55] resulting in total combined corporate tax rates of 26.5% for Canada and 24% for the US.

Despite the higher combined federal/provincial tax rate in Canada, the currently more favourable accelerated depreciation provisions, as they apply to vaccine manufacturing, act to reduce the overall tax burden for Canada compared to the US.

The major capital investment in vaccine manufacturing relates to buildings and equipment and machinery. In Canada, both buildings and equipment and machinery are eligible for the Accelerated Investment Incentive, resulting in accelerated capital cost allowance (CCA) in the year the asset is available for use. A phase-out period begins for property that becomes available for use after 2023 and ends by 2028. Furthermore, equipment and machinery that is used primarily for manufacturing and processing and becomes available for use before 2028 is eligible for an enhanced allowance. The enhanced allowance initially provides a 100% deduction of CCA for additions in the year, with a phase-out for property that becomes available for use after 2023 (75% deduction for 2024 and 2025; 55% deduction for 2026 and 2027).

In contrast to Canada, in the US buildings are not eligible for accelerated (bonus) depreciation, and the bonus depreciation for other property, plant and equipment starts to phase-out after December 31, 2022 and will be completely eliminated after December 31, 2026.[56]

Additionally, in Canada, interest expenses are fully deductible for income tax purposes (assuming they were incurred domestically with a third party); however, in the US interest expenses are deductible only up to 30% of adjusted taxable income (ATI) and interest income. For taxable years beginning after 2021, deductions for depreciation, depletion or amortization are not taken into account in calculating ATI, which increases the US METR.

55 Franchise tax at $1.50 per $1,000 of the corporation's net worth, $200 minimum. https://www.ncleg.gov/EnactedLegislation/Statutes/PDF/BySection/Chapter_105/GS_105-130.3.pdf; https://www.ncleg.gov/EnactedLegislation/Statutes/PDF/BySection/Chapter_105/GS_105-122.pdf
56 https://www.law.cornell.edu/uscode/text/26/168

In Quebec, income earned in this project was assumed to be eligible for the tax holiday for large investment projects. In North Carolina, incentives are generally negotiated with the government on a case-by-case basis, and hence were not taken into account in our analysis. Therefore, our analysis may overestimate the US taxes in this scenario.

The Tax NPV Ratio in the vaccine production project indicates that NPV of taxes in Canada is 94% of NPV of taxes in the US over the project lifetime. The Break-Even Point means that an increase in the federal corporate income tax rate of 1.4 percentage points or more would eliminate Canada's tax advantage for this project.

Table 5: Tax NPV Ratio and Break-Even Point for vaccine production

	TAX NPV ratio	Break-Even Point
Health and biosciences	0.94	1.40%

Natural resources: copper mines

Global demand for copper is expected to increase due to uses in construction and low-emissions technologies

Canada has the world's fourth-largest natural resource base, and is the world's tenth-largest producer of copper.[57] As a result, the mining sector plays a significant role in Canada's economy, contributing $33.2 billion to total direct GDP in 2020.[58] Further, the sector provides approximately 392,000 direct jobs and supports downstream activities such as refining and manufacturing, facilitating an additional 328,000 jobs.[59] Producing over 60 different metals and minerals, Canada is a key player in the supply chains of clean technologies such as solar cells, high density batteries and wind turbines.[60] It is expected that by 2022, the global clean technologies market will be worth approximately $2.5 trillion[61] and ISED has set targets for Canada to triple clean technology exports to $20 billion and become one of the top five exporters of clean technology by 2025.[62] ISED also highlights the role of Canada's natural resources in the global shift towards a low-carbon economy, and has set an overall target to increase natural resource exports to $350 billion by 2025, a 40% increase from 2017 levels.[63]

Recognizing the importance of the mining sector, the Government of Canada has developed the Canadian Minerals and Metals Plan (CMMP) to bolster sector competitiveness and position Canada as a global leader in mining.[64] As part of the CMMP, Natural Resources Canada has published a list of 31 metals and minerals that are considered critical for the transition to a low-carbon and digitized economy.[65]

In 2020, as part of the CMMP, the Government of Canada invested $100 million to renew significant geoscience programs, including the Geological Survey of Canada, the Geo-Mapping for Energy and Minerals program and the Targeted Geoscience Initiative. These programs support exploration and opportunity identification of currently untapped resources in Northern Canada as well as deep mineral deposits across the country.[66]

Additional investments include a commitment of $40 million to an initiative to develop the Mining Innovation Commercialization Accelerator Network, intended to spur development, commercialization and the adoption of new technologies that enhance productivity and sustainability of the mining and metals sector.[67]

Similar to Canada, the US Government has developed a Critical Minerals and Materials Strategy, which details the government's plan to strengthen supply chains of critical minerals and materials, foster innovation and ensure long-term sustainability of the sector over the next 10 years.[68] Part of this strategy

57 ic.gc.ca/eic/site/098.nsf/eng/00026.html
58 Statistics Canada, Table 36-10-0434-06, Gross domestic product (GDP) at basic prices, by industry, annual average, industry detail; https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610043403
59 https://mining.ca/documents/facts-figures-2020/
60 https://www.nrcan.gc.ca/our-natural-resources/minerals-mining/minerals-metals-facts/minerals-and-the-economy/20529
61 https://www.smartprosperity.ca/content/308
62 https://www.ic.gc.ca/eic/site/098.nsf/eng/00023.html
63 https://www.ic.gc.ca/eic/site/098.nsf/eng/00026.html
64 https://www.nrcan.gc.ca/our-natural-resources/minerals-mining/critical-minerals/23414
65 Ibid.
66 https://www.nrcan.gc.ca/earth-sciences/earth-sciences-resources/earth-sciences-federal-programs/targeted-geoscience-initiative-tgi/10907; https://www.nrcan.gc.ca/earth-sciences/resources/federal-programs/geomapping-energy-minerals/18215
67 https://www.canada.ca/en/innovation-science-economic-development/news/2021/07/government-invests-to-helpaccelerate-innovation-in-canadas-mining-industry.htm
68 https://www.energy.gov/downloads/critical-minerals-and-materials

includes US$122 million in funding made available by the US Department of Energy (DOE) for the Carbon Ore, Rare Earth and Critical Minerals Initiative to provide support for regional innovation centres and focus on geological, geographical and policy issues relating to the extraction of rare earth metals from US basins.[69] Further, the DOE has invested US$19 million to support 13 projects relating to rare earth metal production,[70] and US$20 million to support scientific research focusing on efficient and sustainable extraction of rare earth metals.[71]

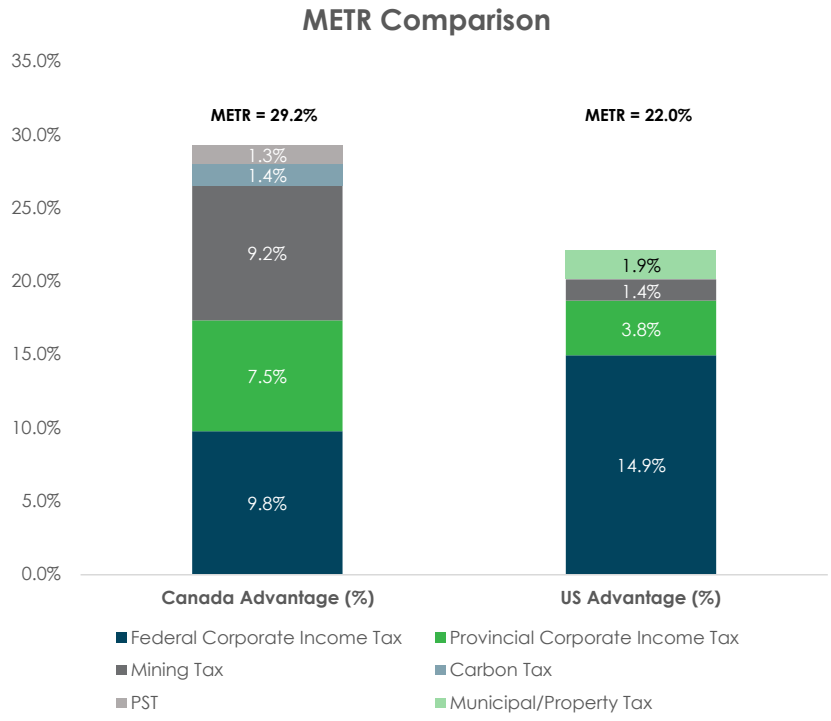
Lower mining and sales taxes contribute to US tax advantage in copper mining

We selected a copper mine as an illustrative project due to growing global demand and substantial production volumes in both Canada and the US. Copper plays a significant role in contributing to overall mining output due to clean technologies, smelting copper alloys, wiring and other intermediate construction goods. Copper represents 9% and 27% of the value of total mining production in Canada and the US, respectively.[72] As a result of improving global economic conditions, demand for copper is expected to rise, driven by the construction and manufacturing sectors. Construction demand is expected to grow as emerging markets continue to urbanize and construction projects continue across North America.[73] Increased production of clean technologies will also contribute to an increase in the demand for copper.[74]

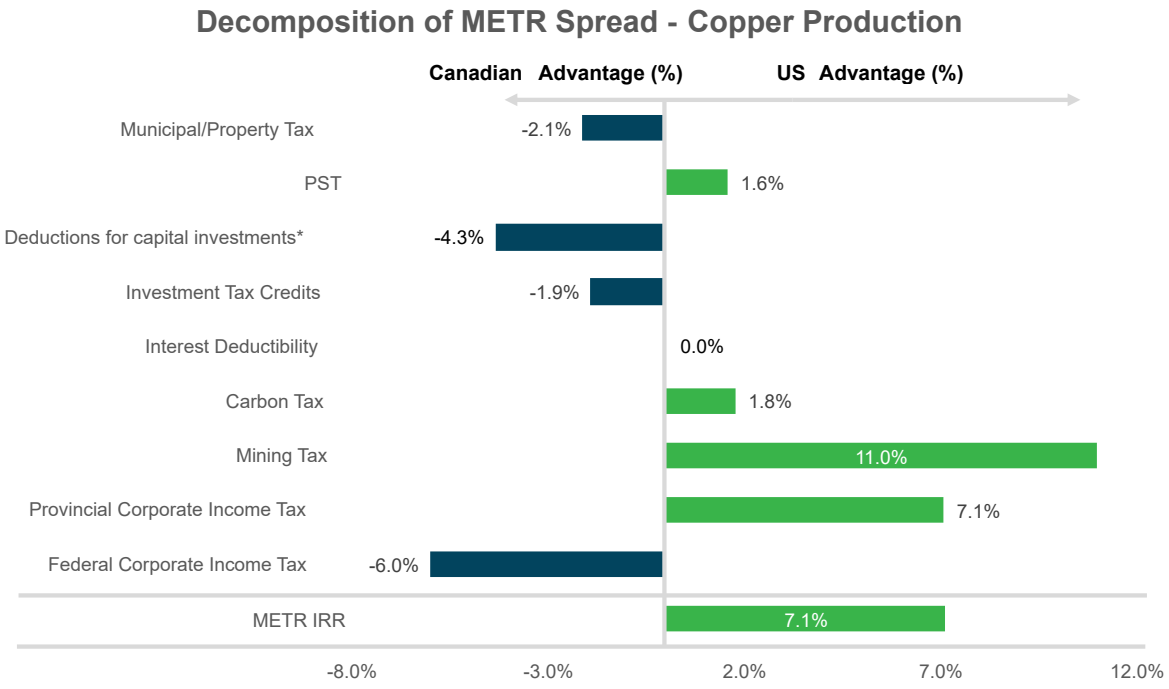
For the purpose of this study, we compared Spences Bridge, British Columbia, with Mitchell Peak, Arizona, because of significant viable copper deposits in these areas.

The charts below show each location's METRs and decomposition by tax component:

Figure 4: Tax competitiveness results for copper mining



69 https://www.energy.gov/articles/department-energy-announces-122-million-regional-initiative-produce-rare-earth-elements-and
70 https://www.energy.gov/articles/doe-awards-19-million-initiatives-produce-rare-earth-elements-and-critical-minerals
71 https://www.energy.gov/articles/doe-awards-20-million-research-rare-earth-elements
72 https://pubs.er.usgs.gov/publication/mcs2021
73 IbisWorld Industry Reports: Copper, Nickel, Lead & Zinc Mining in Canada; Copper, Nickel, Lead & Zinc Mining in the US
74 World Bank Commodity Markets Outlook, October 2021; https://www.worldbank.org/en/research/commodity-markets



For this mining project, the US was found to have a significant tax advantage, driven by a large gap in mining taxes (approximately 3% in Arizona compared to approximately 13% in British Columbia).

Lower provincial/state corporate income tax rates also contribute to the US METR advantage (4.9% and 12% for Arizona and British Columbia, respectively). The gap between the countries' METRs is further widened by provincial sales taxes (PST) that are not recoverable in British Columbia, unlike in the US and other Canadian provinces (i.e. Ontario and Quebec). In addition, British Columbia has imposed a carbon tax, while Arizona did not.

The US tax advantage is somewhat offset by the property taxes in Arizona that are paid on the assessed value of the real property (in this case a processing plant), as well as taxes on mineral properties (i.e. site infrastructure, construction indirect, owner and contingency costs that are assumed to be related to the mineral properties). Assessed value of the real property is the full cash value or net limited value of the property multiplied by the assessed ratio for real property (in this case ratio for class 1 property).

The Tax NPV Ratio for the copper mine project is 1.52, indicating a substantial tax advantage for the US in terms of the project NPV.

Table 6: Tax NPV Ratio and Break-Even Point for copper mining

	TAX NPV ratio	Break-Even Point
Natural resources	1.52	-15.0%

Summary of findings

Our analysis shows that Canada has a small tax advantage in the EV battery manufacturing and vaccine manufacturing projects and a large tax disadvantage in the copper project. Key metrics are presented in the table below.

Table 7: Summary of tax competitiveness results

	METR comparison		TAX NPV Ratio[75]	Break-Even Point
	METR - Canada	METR - US	NPV CAN Tax/ NPV US Tax	Required increase (decrease) in Canadian federal tax rate (in percentage points)
Advanced manufacturing	19.9%	20.5%	0.99	0.25%
Health and biosciences	16.2%	21.4%	0.94	1.40%
Natural resources	29.2%	22.0%	1.52	-15.0%

In the EV battery manufacturing project, the Canadian tax advantage is immaterial, despite inclusion of the planned tax rate cut for zero-emission technologies in Canada and the fact that carbon taxes apply to only a small portion of emissions. As noted above, any change in the stringency limits and other tax policies would affect these results.

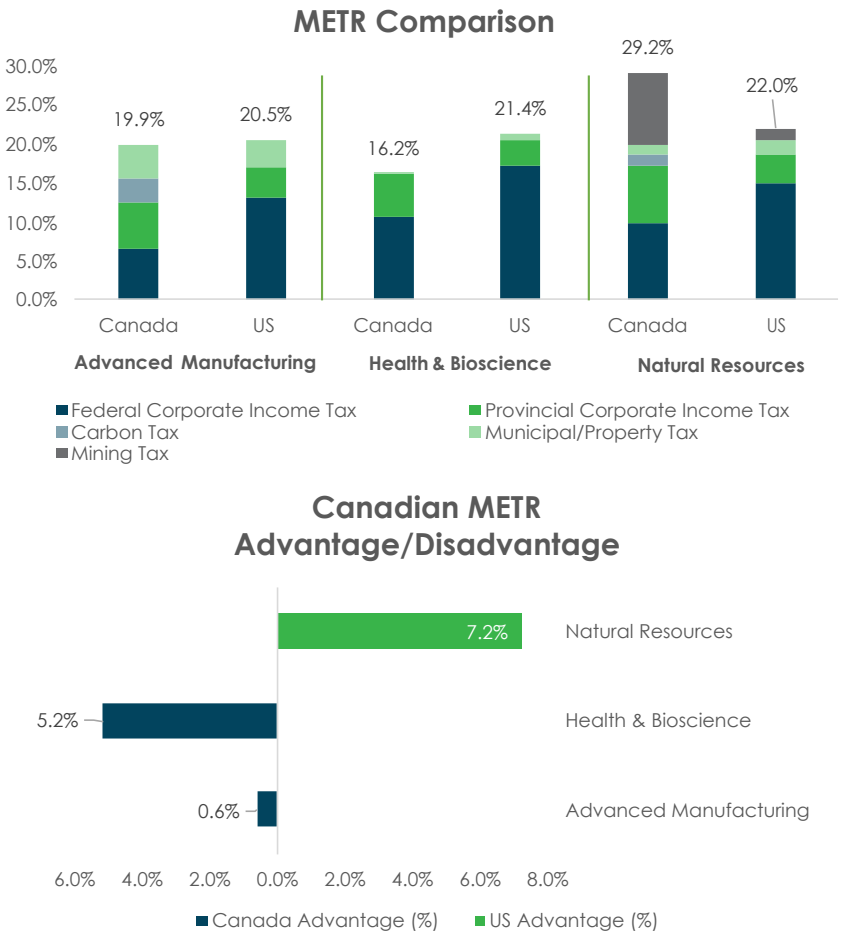
In the vaccine production project, Canada has a higher combined federal/provincial tax rate, which is offset by favourable capital cost allowances and accelerated depreciation. Accelerated depreciation also phases out later in Canada than in the US. A tax holiday for large investment projects provided by Quebec's government further reduces the tax burden for the Canadian operation. Overall, this gives Canada a small tax advantage compared to the US; however, as indicated earlier, this tax advantage incorporates a tax holiday in Quebec and excludes potential tax incentives in North Carolina, which are provided on a case-by-case basis.

Canada's large tax disadvantage in the natural resources sector is driven mainly by high mining taxes in Canada (approximately 13% in British Columbia compared to approximately 3% in Arizona) and higher combined provincial/state corporate income tax rates (12% and 4.9% for British Columbia and Arizona, respectively).

75 NPV of total tax payments by the Canadian project divided by the NPV of total tax payments made by the project in the US.

The charts below show each location's METRs and decomposition by tax component for each sector.

Figure 5: METR for representative projects and locations



Our analysis suggests that the federal government does not have significant room for corporate tax increases if it wishes to maintain its small tax advantage in the EV battery manufacturing and vaccine production subsectors. Our analysis also suggests that copper production in Canada is at a significant tax disadvantage compared to the US.

Potential impact of global tax reforms

In October 2021, OECD and G20 members released details of a two-pillar solution that, among other initiatives, sets a global minimum corporate tax at a rate of 15% to ensure that MNEs pay fair taxes regardless of the place of operations.[76] The introduction of a minimum corporate tax rate could affect the countries' competitiveness, especially in sectors where the METR is expected to be below the proposed floor tax rate.

For the Canadian projects used in this study, we assumed that all revenue and expenses would be earned and incurred in Canada by Canadian corporations with no international operations. Accordingly, the proposed GLoBE and the GILTI provisions in the US would not have had an impact on the results of our study. Similarly, our calculations for the US projects assumed the operations are carried

76 OECD, October 2021. "Two-Pillar Solution to Address the Tax Challenges Arising from the Digitalisation of the Economy".

on by US-resident corporations owned by US-resident shareholders with no operations or sales outside of the US. As such, inclusion of the US GILTI rules, and the OECD Pillar One (expanded jurisdictional taxing rights) and Pillar Two (global minimum tax) regimes would not have had an impact on our calculations.

Appendix A: Tax burden calculations

METR calculation

In calculating the METR, we attempted to emulate the methodology used by the Canadian Department of Finance (DoF) to estimate and compare the Canadian and the US METRs, as described in the 2019 Backgrounder and the competitiveness studies published in the years 1998 and 2005.[77]

In general, a METR analysis provides a more realistic comparison than the statutory corporate income tax rate because the statutory rate does not capture the availability of tax incentives and other taxes that profitable corporations may have to pay (federal taxes, provincial taxes, municipal taxes, sales taxes, capital taxes, etc.).

We followed the calculation approach used by the DoF to analyse the tax competitiveness. This METR approach takes into account taxes, credits and incentives for an investment decision (including investment tax credits and deductions, such as CCAs, etc.). The METRs presented in the DoF analysis capture the following elements of the tax system:

- statutory income tax rates;
- interest deductibility;
- investment tax credits;
- CCAs;
- capital taxes;[78]
- inventory accounting methods;[79]
- retail sales taxes on capital goods.

The METR measures a gross-of-tax rate of return on the capital invested being paid to the government. METR is calculated with the following formula:

$$METR = (Rg - Rn) / Rg$$

Where:

- *Rg* - gross-of-tax return on investment
- *Rn* - net-of-tax return on investment

Carbon pricing and regional and municipal taxes are not factored into the DoF METR calculation. For the purposes of this study, PwC has expanded the METR calculations for Canada and the US by incorporating these elements.

77 Brûlé, A., Mansour, M. McKenzie, K.J. May 1998. "The Calculation of Marginal Effective Tax Rates".; Department of Finance Canada. 2005. "Tax Expenditures and Evaluations"; Department of Finance. "Marginal Effective Tax Rates". 2019 Backgrounder, December, 2020.
78 Capital taxes are no longer relevant.
79 The basis of our financial models was prepared under International Financial Reporting Standards, and as such the inventory accounting methodology is first-in, first-out.

We note that because our calculations were based on particular projects in particular jurisdictions, they differed from those of the DoF. The main differences are summarized below:

	DoF analysis	PwC analysis
Sector composition	METRs estimates were done by the major asset groups and sectors	Results refer to a representative project in a specific jurisdiction
Data sources	Statistics Canada input-output tables and corporate statistics and Revenue Canada T2 and T661 databases	Based on data from public companies making investments similar to the representative projects
Production inputs	Calculated separately by DoF for seven production inputs (structures, machinery, land, inventories, exploration and development, R&D and labour) and aggregated into one METR using the weights calculated separately for each of them	Composition of the investment and the inputs/assets' structure (as a percentage of the total investment) are based on the actual structure of public companies that are active in the subsector that has been selected
Production input weighting	Weights for each one of seven production inputs were estimated separately, using formulas presented in the 1998 study	Analysis based on actual asset structures of public companies making investments similar to the representative projects
Income tax rates	Income tax rates were aggregated into combined federal/provincial statutory income tax rates for 35 industries and two firm sizes (large and small); for example, the average provincial rate structure was generated by weighting the individual provincial rates by the distribution of taxable income across provinces	Estimated the income tax payments using the specific tax rates in the jurisdictions that were selected; companies investing assumed to be large based on the nature of representative projects selected
Capital tax rates	METR calculations reflect a weighted average of firms that pay large corporations tax and those that do not	Capital taxes are no longer relevant
Treatment of investment tax credit (ITC)	Effective ITC rates were calculated for each industry and CCA class by dividing the ITC claim by the cost of additions to CCA pools	For each project, assets were added to various classes or pools and a prescribed rate was applied (generally on a declining balance basis) to each separate class to determine the deduction available
Debt-to-equity ratio	Assumed to be 40%/60%	Assumptions were developed based on the debt-to-equity ratio of publicly traded companies in the selected sectors
Aggregation	METRs are aggregated using sector weights to calculate an economy-wide METR	METRs calculated for three specific projects for each jurisdiction separately

To summarize, the main difference between the DoF's and our approaches is that the DoF's calculations were prepared on a sector level and therefore relied on assumptions and averages across regions, types of companies and subsectors, while our approach refers to a representative project in specific locations. As a result, the findings are not directly comparable, although the approaches are otherwise similar.

Tax NPV ratio

Given that our tax calculations were based on a particular project in a particular jurisdiction, we were able to calculate cash flow specific to the project in the two local jurisdictions selected for each project. We are of the view that the net present value of expected taxes provides a more accurate quantification of the true tax burden than METR.

Appendix B: Main assumptions and tax environment

General assumptions

As noted above, our report focuses only on tax competitiveness and does not take other economic considerations into account. Consequently, all the models were built in US dollars, converting, where applicable, Canadian dollars figures into US dollars using Bank of Canada's forecasted exchange rate. Conversion was made at the purchasing power parity (PPP) rate, which equalizes prices between two countries, thereby holding purchasing power constant. All costs and expenses were escalated using a forecasted inflation rate of 2%.

Our analysis relies on many assumptions; we present below those that are most critical and likely to impact our results:

1. **Cost structure** - for the purposes of this study, we assume that, except for tax, all other elements of the selected projects' costs structure are identical between the respective two selected jurisdictions for each project.

2. **R&D tax credits/grants** - we excluded R&D tax credits because our research suggests there are not significant differences in the level of support between Canada and the US.[80]

3. **Carbon taxes** - we have included the impacts of carbon pricing, where relevant, in the selected jurisdictions.

4. **Tax reduction in Canada for zero-emitting technologies** - we assumed the Government of Canada's future commitment to reduce federal corporate tax rates by 50% for manufacturers of zero-emissions technologies will come into effect on January 1, 2022.

5. **Stringency factor** - we took into account Ontario's carbon tax regulations, which imply the EV battery manufacturing plant would pay carbon taxes on 6% and 8% of its total emissions for the years 2021 and 2022, respectively (referred to as the stringency limits). Since there are no clear guidelines regarding future years, we assumed for the purpose of our study that an EV battery manufacturer in Ontario will pay carbon taxes on only 10% of emissions from 2023 onward.

6. **Accelerated depreciation** - we included the temporary accelerated depreciation available on some US assets, and the temporary enhanced allowance for manufacturing and processing equipment in Canada, taking into account the currently known planned phase-out timelines for both.

7. **Carry-forward losses** - we assumed any carry-forward losses would be used to offset taxes for the same investment rather than transferred to other related corporations. We also assumed the net operating loss would be offset at the rate of 80% of taxable income in the US.[81]

80 OECD data - R&D policy support for business R&D. https://www.oecd.org/sti/rd-tax-stats.htm
81 https://www.irs.gov/newsroom/net-operating-losses

EV battery production project

To develop a financial model for the EV battery production plant, we have reviewed publicly available literature that analyzes the feasibility of EV battery production and collected information on recent investments in the subsector. Our sources are provided in Appendix C: References.

The table below presents the main assumptions used to develop the financial model for the EV battery production plant (values are in US dollars, unless otherwise stated).

Model Category	Assumptions	Supporting Information
Demand	EV battery demand constrained by OEM production quantity	Government of Canada and global goals for zero-emission new vehicle sales[82]
Capital Expenditures (CAPEX)	Approximately US$2,500 million for the plant with the production capacity of 800,000 batteries, which represents an investment of approximately US$60 per kwh[83]	Based on recent investments and total capacity needed for North American market[84]
Production	Maximum production of 800,000 batteries annually	Production follows "ramp up" schedule to meet demand
Battery prices	Sales price of US$8,000/battery for initial years, which decreases to a stabilized price of approximately US$4,000 in operation year 15 onward[85]	Lithium-ion is the main input for EV batteries and the key driver of price. Lithium-ion prices have been decreasing and are forecasted to continue this pattern into the future[86]
Operating Expenditures (OPEX)	Target gross and operating margins when operating at full capacity[87]	Industry reports and actual results of public company comparables used to project expected margins and relevant expenses
PPE	Approximately 50% of initial investment and sustaining CapEx to be used for machinery and equipment	Case studies and public company comparables used to allocate deployed capital between assets

Vaccine production project

To develop a financial model for the vaccine production plant, we have reviewed publicly available literature that analyzes the feasibility of vaccine production and collected information on recent investments in the subsector. Our sources are listed in Appendix C: References.

82 https://www.canada.ca/en/transport-canada/news/2021/06/building-a-green-economy-government-of-canada-to-require-100-of-car-and-passenger-truck-sales-be-zero-emission-by-2035-in-canada.html
83 https://www.forbes.com/sites/samabuelsamid/2021/03/11/lg-chem-commits-45b-to-expand-ev-battery-production-capacity-in-us-by-70-gwh/?sh=3302ca06a026
84 https://pv-magazine-usa.com/2019/12/05/gm-building-billion-dollar-electric-vehicle-battery-factory-in-michigan/
85 https://theicct.org/sites/default/files/publications/EV_cost_2020_2030_20190401.pdf
86 https://www.ida.org/-/media/feature/publications/l/li/lithium-ion-battery-industrial-base-in-the-us-and-abroad/d-11032.ashx
87 https://www.evspecifications.com/en/news/173d14d

The table below presents the main assumptions used to develop the financial model for the vaccine production plant (values are in US dollars, unless otherwise stated):

Model Category	Assumptions	Supporting Information
Demand	Demand will equal production capacity amid COVID-19	100% of production is assumed to be sold at average market price
CAPEX	Approximately US$500 million, based on a case study of COVID-19 vaccine development and data on new vaccine plant construction in Montreal.[88] Capacity was assumed to be 90 million vaccine doses, which represents an investment of US$5.5 per 1 vaccine dos	Global study used to calculate a ratio of CAPEX dollars to vaccines produced. The most recent investments represent an investment ratio of US$5.3 - $5.5 CAPEX dollars to 1 vaccine dose. The capacity of the illustrative plant was estimated considering a future demand for vaccines in North America
Production	Expected production of 90 million vaccine doses at full capacity, based on the case studies listed above and actual capacity of active plants	Based on case study and comparable outputs for public companies
Vaccine prices	Average sales price of 63 vaccines currently being produced in North America. Assumed price increase of 2% per year going forward[89]	It was assumed that 80% of vaccines will be sold at the public average sales price of US$40 and 20% of vaccines at the private average sales price of US$60
Cost of Goods Sold and OPEX	Target margins when operating at full capacity are based on comparable public companies. Cost of goods sold was assumed to be 25% of the vaccine sale price. We assumed the production plant would be a "disposable" facility, leading to higher consumable costs, but less capital charge overtime.[90] Research and Development and Selling, General and Administrative expenses were assumed to be 25% and 30% of revenue, respectively, in the initial year, and assumed an annual cost inflation rate of 2%[91]	OPEX was estimated through a forecast of direct material and labour inputs and overhead costs, using academic research and financial statements of public companies that are active in the vaccine production business[92]
PPE	Approximately 45% of initial CAPEX allocated towards lab equipment and machinery; approximately another 40% to buildings and land	Public company comparables used to allocate deployed capital between assets

88 https://nationalpost.com/news/politics/construction-finished-on-126m-vaccine-plant-in-montreal-but-production-still-months-away
89 https://www.cdc.gov/vaccines/programs/vfc/awardees/vaccine-management/price-list/index.html
90 https://www.who.int/influenza_vaccines_plan/resources/loeillot.pdf
91 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5518734/
92 https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(18)30346-2/fulltext#tables

Copper mining project

To structure a financial model for the copper mine, we have reviewed technical reports for the latest investments in the copper mining industry in North America. For Arizona, this was the Florence copper project because it was an example of a greenfield investment. Our sources are listed in Appendix C: References.

The table below presents the main assumptions used to develop the financial model for the copper mining project (values are in US dollars, unless otherwise stated):

Model Category	Assumptions	Supporting Information
Life of mine	26 years	Based on the 43-101 report for the Florence copper project (Arizona)[93]
CAPEX	Approximately US$216 million	The total investment and the CAPEX structure are based on the 43-101 report for the Florence copper project (Arizona). To confirm the CAPEX structure we also performed a benchmarking analysis, using the actual financial results of public copper mining companies
Production	85-86 million lbs for operation years 3-20	Production profile was based on the 43-101 report for the Florence copper project (Arizona)
Future Prices	The copper prices used in the evaluation are between US$3.30/lb-US$4.00/lb for the first five years of the operation stage, based on analysts' projections. Future pricing assumes an inflation rate of 2%[94]	Sales prices have been applied to assumed production levels. The revenue is the gross value of payable metals sold before transportation charges (Free on Board (FOB) terms)
OPEX	The OPEX structure and profit margins were assumed based on the structure of reference mines	Based on the 43-101 report for the Florence copper project (Arizona)
Transportation	Transportation costs were estimated as a percentage of revenues, based on public company comparables actual results[95]	The copper is assumed to be shipped to buyers in the US market and in the Canadian market, cost of shipping to international markets assumed to be zero since the selling terms are FOB-based

93 "NI 43-101 TECHNICAL REPORT FLORENCE COPPER PROJECT FLORENCE, PINAL COUNTY, ARIZONA". Taseko Mines Limited, February 2017

94 "Commodity Price Watch". IHS Markit, August 2021; ThomsonOne, "Forecast Copper Prices", Jun 30, 2021. *Compilation of the following; Barclays, BMO Capital Markets, Canaccord Genuity, CIBC World Markets, Credit Suisse, Deutsche Bank, HSBC Global Research, Jefferies, JP Morgan, Morgan Stanley, National Bank of Canada, RBC Capital Markets, Scotiabank, Stifel GMP, UBS.*

95 Financial and operational data of the leading players in the copper mining industry.

Tax assumptions - country comparison

The table below presents the main assumptions used to estimate total tax payments for the three representative projects:

Tax Category	Canada	US
Statutory tax rate	• Provincial or territorial taxes apply in addition to federal taxes. • The combined (federal and provincial) income tax rates as of the publication of this report are 25% in Ontario, 26.5% in Quebec and 27% in British Columbia (i.e., 15% net federal income tax rate plus provincial income tax rate of 10% in Ontario[96], 11.5% in Quebec, and 12% in British Columbia). • The federal corporate tax rate is temporarily reduced for zero-emission technology manufacturers (applicable to the EV batteries production model) from 15% to 7.5% in 2022-2028; 9.375% in 2029; 11.25% in 2030 and 13.125% in 2031). Therefore, the combined (federal and provincial) tax rates in Ontario for the EV batteries production model are: - 2022-2028: 17.5% - 2029: 19.375% - 2030: 21.25% - 2031: 23.125% - 2032 onwards: 25% • Mining taxes - In Canada, each province and territory levies separate mining taxes or royalties on mining activities. The British Columbia Mineral Tax Act imposes a two-tier mineral tax on operators of mines in the province, consisting of (i) a 2% net current proceeds tax, and (ii) 13% net revenue tax. The 2% net current proceeds tax is a form of minimum tax, which is fully deductible against the 13% net revenue tax.	• The federal corporate tax rate is 21% as of the publication of this report. • State tax rates are: - Michigan: 6% - North Carolina: 2.5% of income tax plus franchise tax at US$1.50 per US$1,000 of the corporation's net worth - Arizona: 4.9% State taxes are deductible for federal income tax purposes. • Mining taxes - Arizona levies mining severance tax at 2.6% (2.5% Greenlee County and 0.10% Town of Clifton) of the net severance base if the miner of copper is not selling at retail. The net severance base is 50% of the difference between the gross value of production and the production costs.

96 For the purpose of this report, it has been assumed that the lower provincial corporate tax rate of 10% applies to net income as a result of the Ontario manufacturing and processing (M&P) credit that is applicable to mining, manufacturing and processing activities.

Tax Category	Canada	US
Tax depreciation	• The CCA system allows for an income tax deduction for expenditures related to the acquisition of depreciable property. Assets are allocated to classes or pools and a prescribed rate is applied (generally on a declining balance basis) to each separate class to determine the deduction available. • The prescribed annual rates applicable to the capital assets included in our analysis are: - Class 1 - Building: 10%[97] - Class 8 - Furniture and fixtures: 20% - Class 41.2(b) - Mining assets: 25% - Class 43/53 - M&P equipment: 50%/30% - Class 50 - Computer equipment and software: 55% • For certain CCA classes, only half of the additions to a class are eligible for CCA in the year of acquisition. • Under the Accelerated Investment Incentive (AII) measure, certain capital properties are eligible for an increased prescribed CCA rate applied to the net addition to the class for the year. The properties must have been acquired after November 20, 2018, and available for use before 2028. The phase-out of the increased rates will begin for property that becomes available for use after 2023. For the purposes of this report, we assumed that the AII is applicable to the capital assets acquired by the corporations (mainly buildings, mining assets, furniture and fixtures, computer equipment and software systems).	• The Modified Accelerated Cost Recovery System (MACRS) is the current tax depreciation system in the US. The cost of the capital expenditures are recovered using rates as prescribed by the IRS based on the asset's class and when the assets were placed in service.[98] • Bonus depreciation: Bonus depreciation allows taxpayers to deduct a specified percentage of depreciation in the year the qualifying property is placed in service. In order to qualify for bonus depreciation, the taxpayer and the property must be: 1) MACRS property with a recovery period of 20 years or less; 2) depreciable computer software; 3) water utility property; or 4) qualified improvement property. The taxpayer, a predecessor or a related party must not have owned or used the property previously or have acquired it, generally, in a tax-deferred transaction. • The applicable percentages for bonus depreciation are:[99] i. 100% for property placed in service after September 27, 2017 and before January 1, 2023; ii. 80% for property placed in service during calendar year 2023; iii. 60% for property placed in service during calendar year 2024; iv. 40% for property placed in service during calendar year 2025; and v. 20% for property placed in service during calendar year 2026.

97 Generally a CCA rate of 4% is applicable for buildings in Class 1. It was assumed that the buildings met the definition of 'Eligible non-residential buildings' for M&P purposes, and an additional CCA claim of 6% was taken (for a total CCA rate of 10%).
98 https://www.irs.gov/pub/irs-pdf/p946.pdf
99 https://www.law.cornell.edu/uscode/text/26/168

Tax Category	Canada	US
Tax depreciation (continued)	• M&P machinery and equipment acquired after November 20, 2018, and available for use before 2028 are eligible for an enhanced first-year CCA. Assets acquired and available for use before 2023 are allowed a 100% CCA deduction. There is a phase-out of the enhanced CCA deduction for property that becomes available for use after 2023 (75% - 2024 and 2025, 55% - 2026 and 2027).	• Depletion, like depreciation, is a form of cost recovery. For US federal income tax purposes, the owner of an economic interest in a mineral property is allowed a depletion deduction equal to the greater of cost depletion or percentage depletion computed separately for each depletion unit. i. Cost depletion - the costs of the mineral property are deducted ratably as the mineral is produced and sold. To determine the depletable cost per unit, the tax basis of the mineral property is divided by proven, probable and prospective mineral reserves at the beginning of the tax year. ii. Percentage depletion - to calculate the percentage depletion, multiply a certain percentage (15% for gold, silver copper and iron ore) by the gross income from the property during the tax year. The amount of percentage depletion deducted may not exceed 50% of the taxable income from the property.
Tax incentives	• We have analyzed a number of tax incentives available in Canada (both from a federal and a provincial perspective). • Some of the tax incentives that we have considered for the preparation of this report are listed below: - **Tax credit for Investment and Innovation (C3i)** - Quebec tax incentive (vaccine). A non-refundable tax credit was calculated for a portion of the assets in CCA class 43 and 50 at a rate of 20% (for years 2021-2022) and 10% (for years 2023-2025). As only either the C3i or	• Some of the tax incentives that we have considered for the preparation of this report are listed below: - **Michigan (EV):** Michigan does not allow tax credits for: 1. Alternative fuel tax credit, 2. Corporate headquarters, 3. Enterprise Zone credit, 4. Green Credit, 5. Job Creation credit, and 6. Investment tax credit. However, if a business enters into an agreement with the Michigan Economic Growth Authority, there is a possibility to receive tax incentives and grants.

Tax Category	Canada	US
Tax incentives (continued)	tax holiday for large investment projects can be taken, ultimately the C3i credit was not claimed within the model. - **Tax holidays for large investment projects** - Quebec tax incentive (vaccine). We have assumed the investments made by the corporation and the income earned was eligible for the tax holiday for large investment projects. The tax holiday was taken over the maximum allowed 15 years in the vaccine production model. - **Reduced corporate tax rate applicable for zero-emission technology manufacturers** - Federal tax incentive (EV batteries). We have assumed that the income earned was eligible for the reduced corporate tax rate applicable to EV batteries production. - **Refundable BC mining exploration tax credit** - British Columbia mining tax incentive (copper mine). A refundable tax credit was calculated based on the exploration costs incurred at the beginning of the life of the mine (2021 and 2022) at a rate of 20%.	- **North Carolina** does not allow: 1. Alternative fuel tax credit, 2. Corporate headquarters, 3. Enterprise Zone credit, 4. Green Credit, and 5. Job Creation credit. Investment tax credits are only applicable for constructing a railroad intermodal facility. - **Arizona** does not allow: 1. Alternative fuel tax credit, 2. Enterprise Zone credit, and 3. Investment tax credit. Arizona allows a credit for corporate headquarters. The credit is available for tax years beginning January 1, 2013, to December 31, 2022, for expanding or locating a qualified facility in Arizona. However, the amount of the qualified facility tax credit is 10% of the least of the following (in US dollars): 1. the total qualifying investment in the qualified facility (until August 6, 2016, the taxpayer's total capital investment in the qualified facility); or 2. $300,000 for each net new full-time employment position projected by the applicant that has job duties associated with a qualified facility if the total qualifying investment is $2,000 million or more; or 3. $200,000 for each net new full-time employment position at the qualified facility, if the total qualifying investment is less than $2,000 million.

Tax Category	Canada	US
Tax incentives (continued)		This credit has not been computed as we do not have the data available.
Property/ other municipal taxes	• We have calculated property/ municipal taxes for the municipalities in Canada where the projects are located. - **Windsor, ON:** For the purpose of the property tax calculation, the property value was assumed to be the accounting net book value of the land and building. The property tax multiplier[100] used for Windsor, Ontario of 0.052511575 was the average of the 2021 Industrial and Large Industrial rates (0.04737319 and 0.05764996, respectively). This rate was assumed to be applicable across the life of the project. - **Laval, QC:** For the Laval municipal tax calculation, the municipal tax base was assumed to be the accounting net book value of land and building. The municipal tax base was assumed to be applicable for a three-year period (as the municipal tax base is assessed on a triennial basis). The calculation of Laval municipal taxes also included the Water Fund and Public Transportation Fund. Furthermore, the Laval Expansion Program[101] was calculated and applied over five years in the model to reduce the municipal taxes over the applicable years.	• We have calculated property/ municipal taxes for the municipalities in the US where the projects are located. - **Greenlee County, Arizona:** The property tax for Arizona purposes is determined by applying the local tax rate (7.77%) to the assessed value of the property, which is determined by applying the applicable assessment ratio to the value of the property. The value of the property is assumed to be the net book value of the processing plant and net tax basis of the mineral property, which includes costs associated with site infrastructure, construction indirect, owner costs and contingency. The processing plant and mineral property is assumed to be a Class One Property (A.R.S. § 42-12001)[102] and the applicable assessment ratios of class one property are as follows:[103] 1. 17% beginning from and after December 31, 2022 through December 31, 2023. 2. 16.5% beginning from and after December 31, 2023 through December 31, 2024. 3. 16% beginning from and after December 31, 2024. The assessment ratio after 2024 is assumed to be 16%.

100 https://www.citywindsor.ca/cityhall/Taxes--and-Assessment-/Pages/Historical-Tax-Rates.aspx
101 https://lavaleconomique.com/en/tax-credit
102 https://sboe.az.gov/faq#11
103 https://www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/42/15001.htm

Property/ other municipal taxes (continued)	- **Spences Bridge, BC:** We assumed property taxes are not applicable because of our assumption that the land was not owned by the corporation, and was in a remote location in British Columbia.	- **Durham County, North Carolina:** For purposes of the property tax calculation, the fair market property value was assumed to be the accounting book value of land and net book value of building. The County's combined property tax rate is US$1.2739 per US$100 of assessed value, which is assumed to be the fair market property value. - **Detroit, Michigan:** For purposes of the property tax calculation, the fair market property value was assumed to be the accounting book value of land and accounting net book value of building. Detroit's combined property tax rate is 87.6202 mills per US$1,000 of the taxable value, which is 50% of the fair market property value.
Carbon tax	• **Federal Government:**[104] The Greenhouse Gas Pollution Pricing Act was enacted in 2018 to mitigate climate change through the pan-Canadian application of pricing mechanisms to a broad set of greenhouse gas emission sources. The federal pricing system has two parts: a regulatory charge on fossil fuels like gasoline and natural gas, known as the fuel charge, and a performance-based system for industries, known as the Output-Based Pricing System (OBPS). Since 2019, the Government of Canada has established a national minimum price on carbon pollution starting at CA$20 per tonne in 2019, increasing at CA$10 per tonne to CA$50 in 2022. Carbon pollution pricing systems must have a minimum carbon pollution price of at least CA$65 per tonne	• For the jurisdictions chosen for the projects, there are no carbon taxes imposed at either the federal, state or municipal levels. As such, carbon tax calculations were not included in the analysis.

104 https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan.html

Tax Category	Canada	US
Carbon tax (continued)	of greenhouse gas (GHG) emissions calculated in carbon dioxide equivalent (CO2e) in 2023, rising by CA$15 per year to CA$170 per tonne of CO2e in 2030. Cap-and-trade systems must have declining (i.e. increasingly stringent) annual GHG emissions caps from 2023 to at least 2030 that correspond, at a minimum, to the projected emissions levels that would result from the application of the minimum national carbon pollution price that year in explicit price-based systems. The provinces in our models have adopted carbon pricing as follows: • **British Columbia:** British Columbia established a price on GHG emissions beginning at CA$10/tonne in 2008, with planned annual increases, and scheduled to reach CA$50/tonne on April 1, 2022. The carbon tax applies to the purchase and use of fossil fuels. • **Ontario:** On November 29, 2018, Ontario released its Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan. Under the plan, Ontario has committed to reducing its CO2e emissions by 30% below 2005 levels by 2030. This target aligns Ontario with Canada's 2030 target under the Paris Agreement. • The plan proposes, among other things, the Emissions Performance Standards (EPS) program, which aims to reduce GHG emissions from large emitters. The EPS will: - apply to sectors covered by the OBPS based on an emissions threshold of 50,000 tonnes of CO2e (tCO2e) per year (with smaller facilities that emit	

Tax Category	Canada	US
Carbon tax (continued)	between 10,000 and 50,000 tC02e able to voluntarily opt-in to the system over time); - require regulated entities to reduce emissions or purchase compliance units to cover the difference between the regulated entity's total emissions and annual limit imposed by the EPS program; and - set the price of compliance units according to the federal carbon price, starting at CA$20 tCO2e in 2020 and gradually increasing by CA$10 every year to CA$50 tC02e in 2023. • **Quebec:** In 2013, Quebec set up a cap-and-trade system for greenhouse gas emission allowances to fight climate change. In 2014, Québec linked its system to California's as part of the Western Climate Initiative, thereby creating the largest carbon market in North America and the first to be designed and managed by sub-national governments in different countries. • For the purposes of this analysis we have considered the following values (all in Canadian dollars) for the carbon footprint analysis: - Copper Mining model (BC) - $45 per tCO2e in 2021 and remains at $50 per tCO2e for the remaining life of the mine. - EV batteries (Ontario) - The model assumes that the Ontario carbon tax rate is aligned with the Federal rate and is the following amounts: $40 (2021), $50 (2022), $65 (2023), $80 (2024), $95 (2025), $110 (2026), $125 (2027), $140 (2028), $155 (2029), and $170 for 2030 onwards. The model also assumes that as part of the carbon tax calculation,	

Tax Category	Canada	US
Carbon tax (continued)	the stringency factor is 94% and 92% for 2021 and 2022, respectively, and the factor is 90% across the remaining life of the model. For our vaccine production model, the estimated amount of GHG emissions was insignificant and below the threshold. Therefore, we assumed that the carbon tax would not apply.	

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Appendix D: Disclaimer

This report was developed in accordance with our engagement letter dated August 10, 2021, and is subject to the terms and conditions included therein.

Our work was limited to the specific procedures and analysis described herein and was based only on the information made available at the time we prepared the report. Accordingly, changes in circumstances after the date of this report could affect the findings outlined herein. We are providing no opinion, attestation or other form of assurance with respect to our work, and we did not verify or audit any information provided to us.

This information has been prepared solely for the use and benefit of and pursuant to a client relationship exclusively with the Canadian Chamber of Commerce. PwC disclaims any responsibility to others based on its use, and accordingly, this information may not be relied upon by anyone other than the Canadian Chamber of Commerce.

PwC accepts no duty of care, obligation or liability, if any, suffered by any third party that reads our report or any excerpts from our report or statements describing our report. Further, no person or entity, other than the Canadian Chamber of Commerce, shall place any reliance upon the accuracy or completeness of the statements made in our report. In no event shall PwC have any liability for damages, costs or losses suffered by reason of any reliance upon the contents of this report by any person or entity other than the Canadian Chamber of Commerce. This report can be made available to third parties and/or the public on the condition that it is provided in its entirety. Should you wish to publish excerpts of the report or refer to it, you will provide verbatim excerpts and summaries but will not provide any interpretations of our findings. You will add to any such publications a clear link to our entire report.

Limitations on use of this report are found in Appendix E and form an integral part of this report.

Appendix E: Limitations

Reliance on third party data/information: We relied upon the completeness, accuracy and fair presentation of all the information, data, advice, opinion or representations obtained from third parties, public sources and the Canadian Chamber of Commerce, which is detailed under the Scope of review section (collectively, the Information). We have not conducted any audit or review of the Information , nor have we sought external verification of the Information. We accept no responsibility or liability for any losses occasioned by any party as a result of our reliance on the financial and non-financial information that was found in the public domain.

Where the information or data provided is not sufficient to conduct the analysis that has been requested, we have made assumptions, as noted throughout the report.

Receipt of new information: PwC reserves the right at its discretion to withdraw or revise this report should we receive additional information or be made aware of facts existing at the date of the report that were not known to us when we prepared this report. The findings are as of November 2021 and PwC is under no obligation to advise any person of any change or matter brought to its attention after such date, which would affect our findings.

Use limitations: This report has been prepared solely for the use and benefit of, and pursuant to a client relationship exclusively with the Canadian Chamber of Commerce. We understand that the Canadian Chamber of Commerce may share our report with third parties. The Canadian Chamber of Commerce can release this report to third parties only in its entirety and any commentary or interpretation in relation to this report that the Canadian Chamber of Commerce intends to release to the public either requires PwC's written consent or the Canadian Chamber of Commerce is required to add a link to the full report. PwC accepts no duty of care, obligation or liability, if any, suffered by the Canadian Chamber of Commerce or any third party as a result of an interpretation made by the Canadian Chamber of Commerce of this report.

Further, no other person or entity shall place any reliance upon the accuracy or completeness of the statements made herein. In no event shall PwC have any liability for damages, costs or losses suffered by reason of any reliance upon the contents of this report by any person other than the Canadian Chamber of Commerce.

This report and related analysis must be considered as a whole: Selecting only portions of the analysis or the factors considered by us, without considering all factors and analysis together, could create a misleading view of our findings. The preparation of our analysis is a complex process and is not necessarily susceptible to partial analysis or summary description. Any attempt to do so could lead to undue emphasis on any particular factor or analysis.

We note that significant deviations from the above listed major assumptions may result in a significant change to our analysis.